Greencore Pipeline Company LLC Environmental Assessment

BLM

Casper Field Office, Lander Field Office, Buffalo Field Office, Miles City Field Office

Bureau of Land Management
EA No. WY-060-EA11-32

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BLM MISSION STATEMENT

The BLM manages more land – more than 245 million acres – than any other Federal agency. This land, known as the National System of Public Lands, is primarily located in 12 Western states, including Alaska. The Bureau, with a budget of about $1 billion, also administers 700 million acres of sub-surface mineral estate throughout the nation. The BLM's multiple-use mission is to sustain the health and productivity of the public lands for the use and enjoyment of present and future generations. The Bureau accomplishes this by managing such activities as outdoor recreation, livestock grazing, mineral development, and energy production, and by conserving natural, historical, cultural, and other resources on public lands.

Acronyms

µ	microns
µg/m^3	micrograms per cubic meter
°C	degrees Celsius
°F	degrees Fahrenheit
ACEC	area of critical environmental concern
ACHP	Advisory Council on Historic Preservation
amsl	above mean sea level
ANSI	American National Standards Institute
APE	area of potential effect
ARS	artificial nesting structure
ATWS	additional temporary work space
AUM	animal unit month
BEA	Bureau of Economic Analysis
BLM	Bureau of Land Management
BMP	Best Management Practice
CBNG	coal bed natural gas
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
Denbury	Denbury Resources, Inc.
DEQ	Department of Environmental Quality
DNRC	Department of Natural Resources and Conservation

DOE	Department of Energy
EA	environmental assessment
EI	Environmental Inspector
EO	Executive Order
EOR	enhanced oil recovery
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FHA	Federal Highway Administration
FLPMA	Federal Land Policy and Management Act
FO	Field Office
FR	Federal Register
GHG	greenhouse gas
GIS	Geographic Information System
GLO	General Land Office
Greencore	Greencore Pipeline Company LLC
HDD	horizontal directional drill
HUC	Hydrologic Unit Code
I	Interstate
IM	Instruction Memorandum
IPCC	Intergovernmental Panel on Climate Change
MBTA	Migratory Bird Treaty Act
MCA	Montana Code Annotated
MDEQ	Montana Department of Environmental Quality
MDT	Montana Department of Transportation
MEPA	Montana Environmental Policy Act
MFWP	Montana Fish, Wildlife, and Parks
mg/L	milligrams per liter

MLRA	Major Land Resource Area
MMSCFD	million standard cubic feet per day
MOU	Memorandum of Understanding
MP	milepost
MPDES	Montana Pollution Discharge Elimination System
mph	miles per hour
MSDS	Material Safety Data Sheet
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSO	No Surface Occupancy
NTP	Notice to Proceed
NWI	National Wetland Inventory
O_3	ozone
OHV	off-highway vehicle
ORV	off-road vehicle
OSHA	Occupational Safety and Health Administration
OTI	open trench inventory
PA	Programmatic Agreement
PEM	palustrine emergent
PFYC	Potential Fossil Yield Classification
PHMSA	Pipeline and Hazardous Materials Safety Administration

PIC	Planning Information Corporation
PIF	Partners in Flight
PL	Public Law
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
POD	plan of development
ppm	parts per million
PRPA	Paleontological Resources Preservation Act
psi	pound per square inch
PUP	Pesticide Use Proposal
RMP	resource management plan
RMA	recreation management area
ROW	right of way
RV	recreational vehicle
SCADA	Supervisory Control and Data Acquisition
SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
SSURGO	Soil Survey Geographic
SWPPP	Storm Water Pollution Prevention Plan
TCP	traditional cultural property
TSS	total suspended solids
U.S.	United States
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USEPA	United States Environmental Protection Agency
USDA	United States Department of Agriculture
USDOI	United States Department of the Interior

USDOT	United States Department of Transportation
USGS	United Stated Geological Survey
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
VRM	visual resource management
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WRCC	Western Regional Climate Center
WSA	wilderness study area
WSEO	Wyoming State Engineer's Office
WSGS	Wyoming State Geological Survey
WUS	Waters of the U.S.
WWEC	West-Wide Energy Corridor

Contents

Acronyms and Abbreviations **AA-1**

1.0 Introduction and Background **1-1**

1.1 Introduction 1-1

1.2 Purpose for the Proposed Action 1-2

1.3 Need for the Proposed Action 1-2

1.4 Decision to be Made 1-2

1.5 Location of the Proposed Action 1-3

1.6 Authorizing Actions 1-3

1.7 Conformance with Land Use Plans 1-7

1.8 Project Interrelationships 1-7

1.8.1 Interrelated Projects 1-7

1.8.2 Special Management Areas 1-8

1.9 Public Involvement, Scoping, and Issues 1-8

2.0 Description of the Proposed Action and Alternatives **2-1**

2.1 Introduction 2-1

2.2 Proposed Action 2-2

2.2.1 Description of Facilities 2-2

2.2.2 Environmental Protection Measures as Design Features of the Proposed Action 2-13

2.2.3 Construction 2-15

2.2.4 Operation 2-23

2.2.5 Abandonment 2-23

2.3 No Action Alternative 2-23

2.4 Alternatives Considered but Eliminated From Detailed Analysis 2-23

2.4.1 Truck Transportation of CO_2 2-23

2.4.2 Northern Alternative 2-24

3.0 Affected Environment **3-1**

3.1 Climate and Air Quality 3-1

3.1.1 Climate 3-1

3.1.2 Climate Change 3-2

3.1.3 Air Quality 3-3

3.2 Geology and Soils 3-3

3.2.1 Geology 3-3

3.2.2 Soils 3-7

3.3 Mineral and Paleontological Resources 3-9

3.3.1 Mineral Resources 3-9

3.3.2 Paleontological Resources 3-11
3.3.3 Study Area 3-11
3.3.4 Regulatory Structure 3-11
3.3.5 Potential Fossil Yield Classification 3-11
3.3.6 Fossil Potential 3-13

3.4 Water Resources 3-14
3.4.1 Surface Water 3-14
3.4.2 Groundwater 3-18

3.5 Vegetation, Wetlands, Agriculture, and Range Resources 3-18
3.5.1 Vegetation and Wetlands 3-18
3.5.1 Noxious Weeds 3-21
3.5.2 Agriculture and Range Resources 3-22
3.5.3 Threatened, Endangered, Candidate, and Sensitive Plant Species 3-22

3.6 Wildlife Resources 3-29
3.6.1 Recreationally and Economically Important Species and Nongame Wildlife 3-29
3.6.2 Threatened, Endangered, Candidate, and Sensitive Wildlife Species 3-32

3.7 Aquatic Resources 3-36
3.7.1 Habitat 3-36
3.7.2 Aquatic Communities 3-37
3.7.3 Threatened, Endangered, and Sensitive Species 3-37

3.8 Land Use and Recreation 3-38
3.8.1 Land Use 3-38
3.8.2 Recreation 3-38

3.9 Wilderness 3-39

3.10 Visual Resources and Noise 3-39
3.10.1 Visual Resources 3-39
3.10.2 Noise 3-42

3.11 Socioeconomics 3-42
3.11.1 Population 3-42
3.11.2 Economic Conditions 3-42
3.11.3 Income 3-56
3.11.4 Employment 3-57
3.11.5 Housing 3-57
3.11.6 Local Government Facilities and Services 3-58
3.11.7 Local Fiscal Conditions 3-58

3.12 Environmental Justice 3-58
3.12.1 Minority Populations 3-58
3.12.2 Low-Income Populations 3-60

3.13 Transportation 3-60

3.14 Cultural Resources/Native American Concerns 3-61
3.14.1 Cultural Resources 3-61
3.14.2 Eligibility Criteria for Listing Cultural Resources on the NRHP 3-62
3.14.3 Area of Potential Effect 3-62
3.14.4 Native American Concerns 3-65

4.0 Environmental Consequences 4-1

4.1 Climate and Air Quality 4-1
4.1.1 Climate 4-1
4.1.2 Air Quality 4-1

4.2 Geology and Soils 4-3
4.2.1 Geology 4-3
4.2.2 Soils 4-4

4.3 Mineral and Paleontological Resources 4-6
4.3.1 Mineral Resources 4-6
4.3.2 Paleontological Resources 4-6

4.4 Water Resources 4-7
4.4.1 Surface Water 4-7
4.4.2 Groundwater 4-8

4.5 Vegetation, Wetlands, Agriculture, and Range Resources 4-8
4.5.1 Vegetation and Wetlands 4-8
4.5.2 Noxious Weeds 4-9
4.5.3 Agriculture and Range Resources 4-10
4.5.4 Threatened, Endangered, Candidate, and Sensitive Plant Species 4-13

4.6 Wildlife Resources 4-15
4.6.1 Recreationally and Economically Important Species and Nongame Wildlife 4-16
4.6.2 Threatened, Endangered, Candidate and Sensitive Wildlife Species 4-19

4.7 Aquatic Resources 4-23

4.8 Land Use and Recreation 4-25

4.9 Wilderness 4-26

4.10 Visual Resources and Noise 4-26
4.10.1 Visual Resources 4-26
4.10.2 Noise 4-28

4.11 Socioeconomics 4-29

4.12 Environmental Justice 4-30

4.13 Transportation 4-31

4.14 Cultural Resources/Native American Concerns 4-32
4.14.1 Cultural Resources 4-32
4.14.2 Native American Concerns 4-34

4.15 No Action Alternative 4-35

5.0 Residual and Cumulative Impacts 5-1

5.1 Commitment of Resources 5-1

5.2 Short-term, Long-term, and Residual Impacts 5-2

5.3 Cumulative Impacts 5-3
5.3.1 Cumulative Impacts for Vegetation and Sensitive Plants 5-4
5.3.2 Cumulative Impacts for Wildlife 5-4

6.0 Consultation and Coordination 6-1
6.1 Public Involvement and Scoping Process 6-1
6.2 Coordination 6-1
6.3 Team Organization 6-2
6.4 EA Preparers 6-2

7.0 References 7-1

List of Appendices

Appendix A – Additional Temporary Work Space Required for Construction of the Greencore Project

Appendix B – Programmatic Agreement *[Pending Finalization by the BLM]*

Appendix C – Sensitive Soils along the Greencore Project Route

Appendix D – Greencore Project Waterbody and Wetland Crossings

Appendix E – Special Status Species Identified for the Greencore Project

Appendix F – Visual Contrast Rating Forms

List of Tables

Table 1-1 Federal, State, and Local Permits, Approvals, and Reviews Required for Construction and Operation of the Greencore Project ... 1-3
Table 1-2 Summary of Oil Production in the Bell Creek Oil Field ... 1-7
Table 2-1 Acres Disturbed, Removed, and Reclaimed by the Greencore Project ... 2-1
Table 2-2 Location of SCADA and Manual Valves for the Greencore Project ... 2-10
Table 2-3 Summary of Environmental Protection Measures for the Greencore Project ... 2-13
Table 2-4 Highway and Railroad Crossings for the Greencore Project ... 2-20
Table 3-1 Climatological Measurements at Stations Near the Greencore Project ... 3-1
Table 3-2 Background Concentrations of Air Pollutants ... 3-3
Table 3-3 Geologic Formation and Deposits ... 3-4
Table 3-4 Oil and Gas Fields Crossed by the Greencore Project ... 3-9
Table 3-5 Potential Fossil Yield Classification ... 3-12
Table 3-6 Paleontological Resources Potential ... 3-13
Table 3-7 Hydrologic Units Crossed by the Greencore Project ... 3-14
Table 3-8 Perennial Streams Crossed One or More Times by the Greencore Project ... 3-16
Table 3-9 Count of Waterbodies Crossed by the Greencore Project ... 3-17
Table 3-10 Vegetation Cover Types within the Greencore Project Area ... 3-19
Table 3-11 Grazing Allotments within the Greencore Project Area ... 3-23
Table 3-12 Range Improvements within the Greencore Project Area ... 3-27
Table 3-13 Special Status Plant Species Potentially Occurring within the Greencore Project Area ... 3-29
Table 3-14 Big Game Ranges Crossed by the Greencore Project ... 3-30
Table 3-15 Fremont County Economic/Demographic Profile for the Greencore Project ... 3-48
Table 3-16 Natrona County Economic/Demographic Profile for the Greencore Project ... 3-50
Table 3-17 Johnson County Economic/Demographic Profile for the Greencore Project ... 3-52
Table 3-18 Campbell County Economic/Demographic Profile for the Greencore Project ... 3-54
Table 3-19 Average Weekly Wage for Counties Crossed by the Greencore Project ... 3-56
Table 3-20 Temporary Housing Accommodations for the Greencore Project ... 3-57
Table 3-21 Race and Poverty Characteristics of Affected Counties in the Greencore Project Area ... 3-59
Table 3-22 Traffic Levels for Major Highways Crossed by the Greencore Project, 2008 ... 3-61
Table 3-23 Summary of Site Types and Eligibility ... 3-63
Table 3-24 NRHP-Eligible Sites Located Within the Project APE ... 3-63
Table 4-1 Applicable Ambient Air Quality Standards ... 4-1
Table 4-2 Construction Emissions Estimates ... 4-3
Table 4-3 Summary of Temporary and Permanent Impacts per Vegetation Cover Type Within the Project Area ... 4-9

Table 4-4 Carrying Capacity Impacts by Allotment Within the Greencore Project Area 4-11
Table 4-5 Summary of Range Improvements Potentially Impacted Within the Greencore Project Area 4-13
Table 4-6 Constraint Periods for Big Game Crucial Winter/Yearlong Range Crossed by the Greencore Project 4-17
Table 4-7 Prairie Dog Colonies Impacted by the Greencore Project 4-19
Table 4-8 Greater Sage-grouse Breeding Habitat Impacted by the Greencore Project..... 4-21
Table 4-9 Suitable Mountain Plover Nesting Habitat Impacted by the Greencore Project 4-23
Table 4-10 Contribution to Tax Base for the Greencore Project 4-31
Table 4-11 Management Recommendations for Eligible Sites Located Within the Project APE..... 4-33
Table 5-1 Resource Commitments Identified for the Greencore Project 5-1
Table 5-2 Existing and Proposed Long-term Disturbance Calculations within the Greater Sage-grouse Cumulative Impacts Analysis Area 5-6
Table 5-3 Number of Energy Production and Transmission Structures within the Greater Sage-grouse Cumulative Impacts Analysis Area 5-8
Table 6-1 BLM Team 6-2
Table 6-2 AECOM EA Team (Third-party Consultant) 6-3

List of Figures

Figure 1-1 Proposed Greencore CO_2 Pipeline Route 1-5
Figure 2-1 Proposed Route (Maps 1 through 7) 2-3
Figure 2-2 Facility Location Requirements 2-12
Figure 2-3 Typical Rural Construction Spread 2-17
Figure 3-1 Physiographic Provinces of Wyoming 3-5
Figure 3-2 Structural Elements of Wyoming. Source: Wyoming State Geological Survey 2010a 3-6
Figure 3-3 Hydrologic Unit Subbasins in the Project Vicinity 3-15
Figure 3-4 Wilderness Study Areas (WSA) in the Project Vicinity 3-40
Figure 3-5 VRM Classes and Key Observation Point Locations 3-43
Figure 3-6 View northeast from KOP-1 along South Bighorn Backcountry Byway 3-44
Figure 3-7 View north from KOP-2 along U.S. 20 3-44
Figure 3-8 View east from KOP-3 along I-25 3-45
Figure 3-9 View northwest from KOP-4 along SH 192 3-45
Figure 3-10 View southwest from KOP-5 along Bozeman Trail 3-46
Figure 3-11 View northeast from KOP-6 along I-90 3-46
Figure 3-12 View northeast from KOP-7 along U.S. 14/16 3-47
Figure 3-13 View west from KOP-8 along SH 59 3-47

1.0 Introduction and Background

1.1 Introduction

Greencore Pipeline Company, LLC (Greencore), a wholly owned subsidiary of Denbury Resources, Inc. (Denbury), based in Plano, Texas, proposes to construct and operate approximately 231.1 miles of 20-inch-diameter liquid (dense phase) carbon dioxide (CO_2) steel pipeline (the Project) from the ConocoPhillips Lost Cabin Gas Plant in Fremont County, Wyoming, to a point in the Bell Creek oil field in Powder River County, Montana. The CO_2 transported by the pipeline would be used for enhanced oil recovery (EOR) at the existing Bell Creek oil field.

This Environmental Assessment (EA) has been prepared under the direction of the Bureau of Land Management (BLM), serving as the lead agency in compliance with the National Environmental Policy Act of 1969 (NEPA). This document follows the guidelines promulgated by the Council on Environmental Quality (CEQ) for implementing the procedural provisions of NEPA (40 Code of Federal Regulations [CFR] 1500-1508) and BLM's NEPA Handbook (H-1790-1). The Project would be designed, constructed, and operated in accordance with CFR 49 Part 195, Transportation of Hazardous Liquids by Pipeline. These regulations are administered by the United States (U.S.) Department of Transportation (USDOT) Pipeline and Hazardous Materials Safety Administration (PHMSA).

This chapter presents the purpose and need for the Project, including a general discussion of EOR and an overview of CO_2 use in the EOR process. In addition, it also describes the Project location and identifies other authorizing actions necessary for the Project to be constructed. A complete description of the proposed action is provided in Chapter 2.0.

The source of the CO_2 that would be captured and transported by the Project is the Lost Cabin Gas Plant. Currently vented CO_2 would be captured, compressed, and transported to the Bell Creek Field for use in a CO_2 flood. By capturing CO_2 that would otherwise be released into the atmosphere, the Project would reduce CO_2 emissions by approximately 1 million metric tons each year.

The Project would be designed to flow initial start up volumes of 50 million standard cubic feet per day (MMSCFD) of CO_2 and future potential volumes up to 775 MMSCFD with the addition of pump station horsepower along the Project route and additional supply sources of CO_2. Implementation of the EOR Project at the Bell Creek field would result in increased incremental production of oil that would not be recoverable by existing operations. This incremental production would extend the economic life of the fields and benefit both state and local economies.

CO_2 is a common, ordinary compound usually thought of as a gas, although it is quite easily converted to a solid or liquid. In its gaseous state, CO_2 is approximately 1.5 times heavier than air at standard conditions. The following hazards can be associated with CO_2. Frostbite may result from contact with dry ice or liquid CO_2. CO_2 also can act as a simple asphyxiant. Concentrations of 10 percent (100,000 parts per million [ppm]) can produce unconsciousness from oxygen deficiency. A concentration of 5 percent (50,000 ppm) may produce shortness of breath and headaches. Continuous exposure to 1.5 percent (15,000 ppm) may cause changes in some physiological processes (Sittig 1981).

As an oil field ages, the natural oil reservoir pressure declines; thus, pumping becomes less efficient. To recover some of the remaining oil, it becomes necessary to employ enhanced methods of oil recovery such as waterflooding. Waterflooding consists of injecting water into wells and forcing it into the oil reservoir. As the water spreads out from the injection site, it pushes some of the remaining oil towards producing wells. Waterflooding is relatively inexpensive to employ, is effective in displacing oil and increasing the pressure in the reservoir, and increases oil recovery from approximately 15 to 25 percent. Even after these secondary methods have been completed, as much as 60 percent or more of the original oil is left in the ground.

At this point, other tertiary or enhanced recovery methods become necessary to liberate some of the remaining reserves. Injection of CO_2 to increase oil recovery was first patented in 1952. Large-scale commercial CO_2 flooding occurs in Utah, Texas, Mississippi, Colorado, New Mexico, Oklahoma, Louisiana, and Wyoming. The first commercial application of CO_2 flooding in Wyoming was Amoco's Bairoil Project, which began injection of CO_2 in October 1986 (BLM 1989).

CO_2 works to increase the volume of recoverable oil in several ways. In most reservoirs, CO_2 is easily miscible with the oil and can be thoroughly mixed at relatively low pressures. Once mixed, it is highly soluble. As it dissolves, it swells the oil, yielding a 10 to 30 percent increase in volume (Miller and Jones 1981). This swelling forces more oil out of the reservoir pores, making it available for recovery. In addition, CO_2 decreases the viscosity of oil, allowing it to flow more freely. CO_2 also aids recovery by solution gas drive. Just as CO_2 goes into solution with an increase in reservoir pressure, gas will come out of solution and continue to drive oil into the wellbore. Finally, the slightly acidic nature of the CO_2-water mixture promotes certain injectivity changes. Clays are stabilized due to a reduction in pH, and injectivity is improved in carbonates by increased permeability.

The CO_2 flooding technique is similar to waterflooding except that the CO_2 gas acts as a solvent to reduce the viscosity of oil, rendering it more mobile, while maintaining pressure in the reservoir. According to the Department of Energy (DOE), EOR with CO_2 could add 89 billion barrels to the recoverable oil resources of the U.S. (Techline 2006). It is estimated that the CO_2 injected via the Project would increase oil production of existing wells by as much as 5-fold. Consequently, the Project would access known reserves and supply the growing national need for domestic energy supplies. Wyoming and Montana, states that are largely dependent on the energy industry, can benefit from the development of CO_2 for EOR because vast CO_2 reserves are available and there are many depleted oil reservoirs that are prime candidates for EOR (Ogg et al. 2006).

1.2 Purpose for the Proposed Action

The primary purpose of the Project is to transport currently vented CO_2 from the existing Lost Cabin Natural Gas Plant located near Lost Cabin, Wyoming to the Bell Creek Oil Field located in southeastern Montana for EOR processing of existing oil reserves. The result of the CO_2 EOR would more fully develop and produce the remaining oil reserves in an existing oil field under the rights granted by existing federal, state and local authorities, including federal oil and gas lease(s), as required in 43 CFR 3160, all Onshore Orders, and the Mineral Leasing Act, as amended and supplemented (30 United States Code [U.S.C.] 181 *et seq.*). The increased production would extend the economic life of the field, help to prevent unavoidable loss of oil reserves, as well as reduce CO_2 venting at the plant. The Project would be designed to flow initial start up volumes of 50 MMSCFD of CO_2 and future potential volumes up to 775 MMSCFD with the addition of pump station 27 horsepower along the route and additional supply sources of CO_2. The secondary purpose of the Project is to allow for greater capacity with the pipeline for future CO_2 transportation needs and EOR processing opportunities.

1.3 Need for the Proposed Action

The need for the action is the requirement to grant approval for the construction, operation, maintenance, and termination of a pipeline for the purpose of oil and gas recovery on public lands managed by the BLM under the authority of the Mineral Leasing Act, as amended and supplemented, (30 U.S.C. 181 *et seq.*) and prescribed in 43 CFR Parts 2880 and 3160.

1.4 Decision to be Made

The BLM would decide whether or not to approve the pipeline for transportation of CO_2, and if so, under what terms and conditions.

1.5 Location of the Proposed Action

The Project proposed by Greencore would be located in four Wyoming counties (Fremont, Natrona, Johnson, and Campbell); one Montana county (Powder River); and four BLM field office (FO) areas (Lander, Casper, Buffalo, and Miles City). A map showing the location of the proposed pipeline route is presented in **Figure 1-1**.

1.6 Authorizing Actions

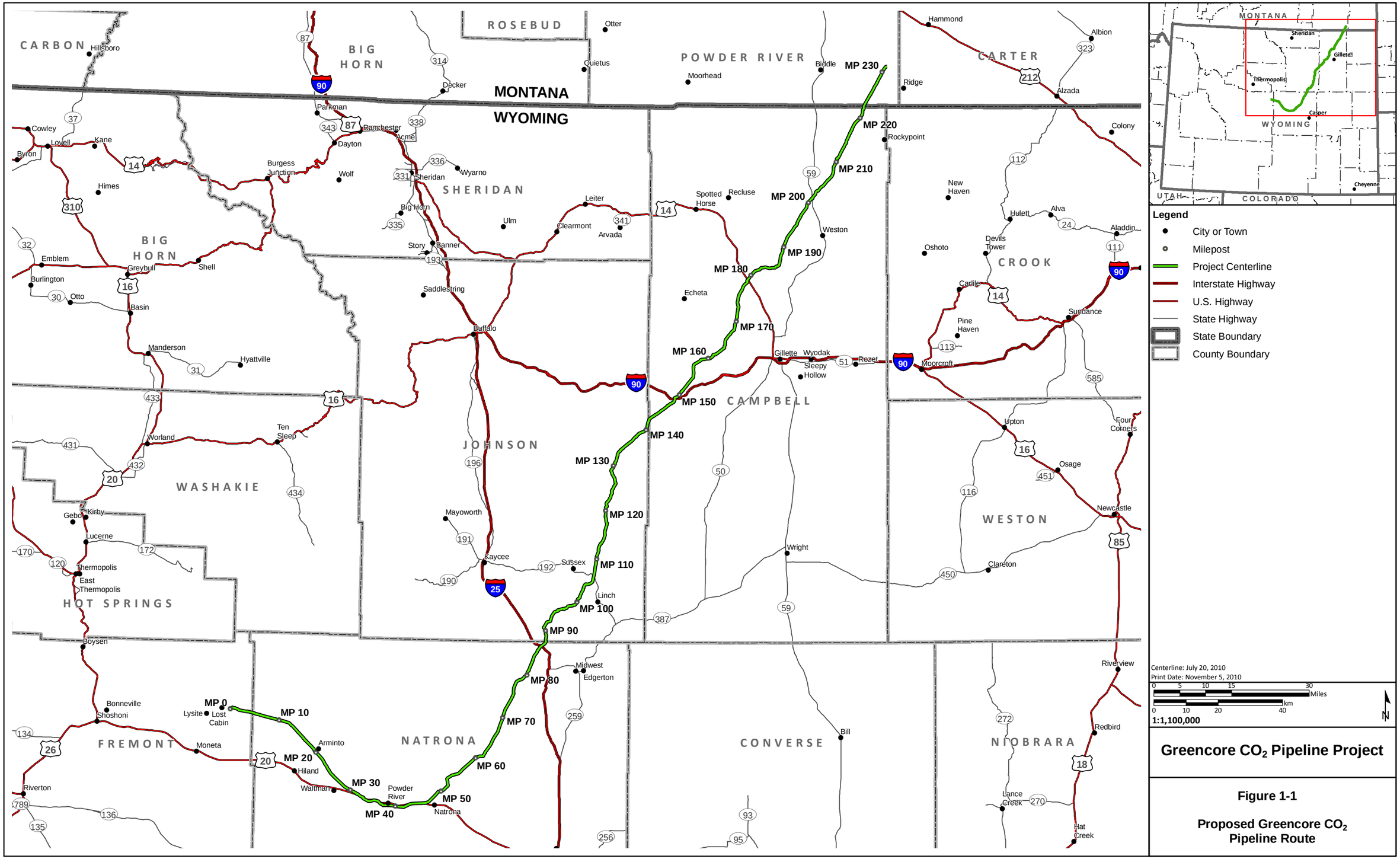
The Project would require federal, state, and local authorizations for many aspects of construction, operation, maintenance, and abandonment. It is the applicant's intent to fulfill all requirements of any applicable statutes, regulations, and policies. **Table 1-1** lists permits, approvals, and reviews necessary for implementation of the Project.

Table 1-1 Federal, State, and Local Permits, Approvals, and Reviews Required for Construction and Operation of the Greencore Project

Agency	Nature of Action	Authority
Federal Permits, Approvals, and Reviews		
U.S. Department of the Interior (USDOI), BLM	Grant rights-of-way (ROWs) and issue temporary use permits	Section 28 of the Mineral Leasing Act of 1920
	Issue materials sales contracts	Materials Act of 1947, as amended; 30 U.S.C. 601, 602; 43 CFR 3600
	Issue cultural resource permit to excavate or remove cultural resources on federal lands	Archaeological Resources Protection Act of 1979, 16 U.S.C. Section 470aa-47011; 43 CFR Part 3
	Approve pesticide use proposal	BLM Manual 9011.1, Guidelines for Conducting Chemical Pest Control Program
U.S. Fish and Wildlife Service (USFWS)	Section 7 Consultation process for endangered or threatened species	Endangered Species Act (ESA) of 1973; 16 U.S.C. 1531 et seq.
USDOT Federal Highway Administration (FHA)	Issue permits to cross federal-aid highways	23 U.S.C. Sections 116, 123, 23 CFR Part 645 Subpart B
U.S. Army Corps of Engineers (USACE)	Issue Section 404 permit for placement of dredged or filled material in Waters of the U.S. (WUS)	Section 404 of the Clean Water Act of 1972 (40 CFR 122-123); 33 U.S.C. Section 1344; 33 CFR Parts 323, 325
	Issue Section 10 permit for crossing navigable water in the U.S.	Section 10 of the Rivers and Harbors Act of 1899, 33 U.S.C. 401-413
U.S. Department of the Treasury Bureau of Alcohol, Tobacco and Firearms	Issue permits to purchase, store, and use explosives	Section 1102(a) of the Organized Crime Control Act of 1970, 18 U.S.C. Section 841-848; 27 CFR Part 181
Advisory Council on Historic Preservation (ACHP)	Review and compliance activities related to cultural resources	Section 106 National Historic Preservation Act (NHPA) (16 U.S.C. 470) (36 CFR Part 80)
State of Wyoming		
Department of Environmental Quality (DEQ) – Water Quality Division	Issue National Pollutant Discharge Elimination System (NPDES) Permit for discharges; approves Storm Water Pollution Prevention Plan	Wyoming Environmental Quality Act, W.S. 35-11-301

Table 1-1 Federal, State, and Local Permits, Approvals, and Reviews Required for Construction and Operation of the Greencore Project

Agency	Nature of Action	Authority
Wyoming Highway Department	Issue permits for oversize and overweight loads	Chapters 17 and 20 of the Wyoming Highway Department Rules and Regulations
	Issue encroachment permits	Chapter 12 of the Wyoming Highway Department Rules and Regulations
State Land Board	Issue easements to cross state lands	W.S. 35-20 and 36-20
Wyoming State Engineer's Office	Grant permit to appropriate water for hydrostatic testing, dust control, and other uses	W.S.41-121 through 147
State Historic Preservation Office (SHPO)	Review compliance activities related to cultural resources	Section 106 NHPA (16 U.S.C. 470) (36 CFR Part 80)
Wyoming Public Service Commission	Issue certificate of public convenience and necessity	W.S. 1977 and Wyoming Administrative Procedures Act
County Commissioners	Road crossing permits, land use permits, and licenses	County zoning regulations
County Health Departments	Temporary sanitation facilities	County sanitation requirements
State of Montana		
DEQ – Director's Office	Review and comment on environmental activities; review and use federal EA to meet Montana Environmental Policy Act (MEPA) requirements	MEPA
DEQ – Permitting and Compliance Division - Water Protection Bureau	Issue Montana Pollution Discharge Elimination System (MPDES) Permit for discharges; approve Storm Water Pollution Prevention Plan; 318 Authorization (short-term water quality standard for turbidity); Section 401 Water Quality Certification	Montana Water Quality Act Montana Code Annotated (MCA) 75-5-101
Department of Natural Resources and Conservation (DNRC) – Water Resources Division	Issue Water Appropriation Permits (Beneficial Water Use Permit) and/or Water Wells Drilling/Alteration for hydrostatic testing and dust control	Montana Water Use Act of 1973
DNRC – Trust Land Management Division	Review and process applications for ROWs and easements across state-administered surface lands and navigable waterways	MCA 77-1-130
DNRC – Conservation Districts Bureau; and Floodplain Management Section	Issue 310 Permits to physically alter or modify bed or banks of perennial streams; Floodplain Development Permits for new construction within a designated 100 year floodplain	Montana Natural Streambed and Land Preservation Act; Montana Floodplain and Floodway Management Act
Department of Fish, Wildlife and Parks	SPA124 permit issuance; comment on the Project and effects on natural resources and sensitive species	Montana Stream Protection Act
Montana Department of Transportation (MDT)	Issue permits for state highway crossing permits and permits for oversize and overweight loads	MDT Rules and Regulations
	Issue encroachment permits	MDT Rules and Regulations
SHPO	Review and compliance activities related to cultural resources	Section 106 NHPA (16 U.S.C. 470) (36 CFR Part 80)
Counties	Issue road crossing permits, land use permits, licenses, and authorization for temporary sanitation facilities	County zoning and sanitation regulations



Greencore CO_2 Pipeline Project

Figure 1-1

Proposed Greencore CO_2 Pipeline Route

In order to obtain a ROW grant from federal land management agencies or easements across private land, several steps must be taken. For federally administered lands, an applicant must submit a ROW application to the appropriate federal agency along with a fee to cover the costs of processing the application and granting and administering the ROW. The agency then prepares an environmental document (such as this EA) as required under NEPA to determine potential impacts on all lands (regardless of ownership) that may occur as a result of implementing the Proposed Action.

Protective measures to avoid and minimize adverse impacts are proposed by the applicant and referenced throughout this document as design features. In addition to these commitments, the agency requires standard protective measures on federal lands.

After the EA is prepared and the agency preferred alternative is selected, the BLM prepares a Decision Record. The Decision Record documents and provides the legal record for any decisions made regarding the requested ROW on federal lands.

Before the ROW can be granted, Greencore must prepare a Plan of Development (POD) detailing construction of all Project facilities on federal land. This POD must be submitted to the authorizing agencies for approval. POD approval is concurrent with the ROW approval. The POD contains Project information and site-specific procedures for the following:

- Fire protection;
- Erosion control, revegetation, and reclamation;
- Water resources protection;
- Transportation;
- Communications;
- Cultural resources protection;
- Threatened or endangered species protection;
- Wildlife protection;
- Blasting;
- Dust control;
- Weed control;
- Health and safety;
- Construction schedule;
- Construction facilities and housing;
- Pipeline testing;
- Construction monitoring;
- Operations and maintenance; and
- Abandonment.

Prior to construction, the applicant would be required to conduct site-specific surveys on the proposed ROW, additional temporary work space (ATWS), and ancillary facilities for sensitive plants and animals, including threatened and endangered species and federally protected raptors; jurisdictional waters of the U.S.; cultural, historical, and paleontological resources and noxious weeds. The BLM then applies stipulations to protect site-specific resources. When possible, these stipulations are incorporated into the POD.

The process used by pipeline companies to obtain easements across private lands is different from that used for state or federal lands. The company's ROW agent first contacts the landowner for permission to determine the proposed pipeline's centerline across the owner's property. At the same time, the ROW agent seeks the landowner's permission to conduct the same surveys required to obtain permits to cross federal and state lands (such as cultural and wildlife surveys).

A plat is prepared after the surveyor obtains the necessary data for locating the pipeline. This plat shows the relationship of the planned pipeline to the property boundaries. The ROW agent meets with the landowner to initiate negotiations for an easement across the property.

Across federal, state, and private lands, Greencore has requested a 50-foot-wide permanent easement and an additional 50-foot-wide temporary construction easement on level terrain. ATWS (**Appendix A**), typically 50 feet by 200 feet on both sides of the construction ROW, would be required at most road, railroad, arroyo, and water crossings, as well as vehicle turn-around areas. Construction techniques and reclamation procedures would be the same on private and public lands, or as specified by the landowner.

1.7 Conformance with Land Use Plans

The Project would be located within the BLM's Lander, Casper, Buffalo, and Miles City FO areas, each of which has an approved Resource Management Plan (RMP) (BLM 2010a,b,c, 2007a, 2001a, 2000a, 1987, 1985a). The Proposed Action is in conformance with these plans. In addition, the Project would be within designated utility corridors along greater than 90 percent of the route. None of the Project disturbance areas would be located within areas where ROWs are prohibited. The RMPs do identify restrictions on ROW placement (e.g., Interstate 25 [I-25] and I-90 segments). However, linear projects are allowed to cross I-25 and I-90. Specific land use plan and applicable statutory/regulatory information is provided in Chapter 3.0.

1.8 Project Interrelationships

1.8.1 Interrelated Projects

Development of the Project would be related to EOR activities at the Bell Creek and other potential oil fields (see **Figure 1-1**). EOR in the Bell Creek oil field would be initiated subsequent to construction of the Project, and NEPA analysis for that action and in any other fields would be subject to approval under separate granted ROW. Initially, Denbury would be the only operator to implement EOR activities at their wells in the Bell Creek field. A summary of recent production in the Bell Creek field is provided in **Table 1-2**.

Table 1-2 Summary of Oil Production in the Bell Creek Oil Field

Oil Production Information	Bell Creek Field
Number of Producing Wells in 2010	104
Production Initiated (Year)	1967
Barrels of Oil Produced in 2008	405,624
Barrels of Oil Produced Since Inception	134,524,927

Source: http://bogc.dnrc.state.mt.us/PDF/AnnualReview/AR_2008.pdf.

Denbury would upgrade the Bell Creek Field infrastructure to handle higher water injection and production volumes, to facilitate injection and production of CO_2, and to re-inject produced water and CO_2 streams. Denbury would attempt to reactivate or use existing wells in the field and possibly drill additional wells as required. The types of changes that would occur in the Bell Creek field as a result of the Project and subsequent upgrades to the Bell Creek field include the following:

- Aboveground pipeline connection to the CO_2 source;
- New buried injection lines;
- New buried gathering lines;
- New CO_2 or recycling facility; and
- Field meter/manifold sites.

Trenching would be required for the injection and gathering lines, with the depth of approximately 4 to 6 feet and a width of 4 feet.

Since the EOR activities would occur at existing active wells, limited new development would occur.

Greencore also would construct processing and pumping facilities at the Lost Cabin Gas Plant to liquefy the CO_2 and to pump it through the pipeline to the Bell Creek field.

Other facilities to support future system supply and delivery capacities include:

1. Future Natrona Hub – (an approximate 10-acre site at Milepost [MP] 39.5) – future southern extension interconnect and pump station. This future site would be designed to support future CO_2 supplies and deliveries.
2. Future Mid-Point pump station (an approximate 5-acre site at MP 144.0).
3. Future Bell Creek end point pump station and delivery site (an approximate 5-acre site at MP 231.1).

1.8.2 Special Management Areas

The Project would not cross any Wilderness Study Areas (WSAs) or Areas of Critical Environmental Concern (ACECs). However, the Project would cross the Wind River Management Area near Waltman, Wyoming, and would pass within 5 miles of the Salt Creek Management Area near Midwest, Wyoming. See Chapters 3.0 and 4.0, Land Use and Recreation, for additional discussion of these special management areas.

1.9 Public Involvement, Scoping, and Issues

As part of Section 106 compliance, BLM notified all federally recognized Native American groups residing in or with cultural ties to the Project area (see Chapter 3.0, Section 3.14.4).

Greencore Public Relations representatives met with individuals and groups between October 5 and 10, 2009, to introduce the Project, provide public awareness, and assess public sentiment regarding the Project. The vast majority of individuals and groups were positive and supportive of the Project.

Formal scoping meetings have not been conducted as part of the NEPA process. However, Greencore engineers, lands specialists, and consultants have interacted with agencies and land owners extensively to develop a preferred layout that would avoid or minimize impacts to the environment.

2.0 Description of the Proposed Action and Alternatives

2.1 Introduction

The Proposed Action analyzed in this EA consists of the construction of the Project from the Lost Cabin Gas Plant to the Bell Creek Field. Construction of the Project would require approximately 3,228.1 acres; an estimated 3,178.3 acres would be reclaimed immediately following construction. Modifications may be required on some of the access roads. Following construction completion, roadways would be returned to preconstruction conditions. **Table 2-1** provides information on land requirements for both the pipeline and temporary work areas, as part of the Proposed Action. All disturbances, with the exception of permanent access roads, pump stations, block and take-off valves, and the measurements facilities, would be reclaimed after construction.

Table 2-1 Acres Disturbed, Removed, and Reclaimed by the Greencore Project

Component/Facility	Acres Disturbed	Acres Removed	Acres Reclaimed[1]
CO_2 Pipeline, 231.1 miles[2]	2,801.2	0.0	2,801.2
Lost Cabin (MP 0.0) – 6.1 acres Future Natrona Hub (MP 39.5) – 10.0 acres Future Interconnect Station (MP 87.2) – 0.4 acre Future Mid Point Pump Station (MP 144.0) – 5.0 acres Launcher/Receiver Facility (MP 200.4) – 0.4 acre Bell Creek Pump Station and Delivery Point (MP 231.1) – 5.0 acres	26.9	26.9	0.0
Block Valves and Take-off Valves, 20 at 0.2 acre[3]	0.0	4.0	0.0
Measurement Facilities with Scraper Traps, 2 at 0.3 acre; Interconnect Station at 0.8 acre	1.4	1.4	0.0
Casper Pipeyard	21.5	0.0	0.0
Upton Pipeyard[4]	14.9	0.0	0.0
Additional Temporary Work Space	377.1	0.0	377.1
Overall Total[4]	**3,228.1**	**32.3**	**3,178.3**

[1] These are acres that would be reclaimed immediately following the Project construction; all areas would be reclaimed after abandonment.

[2] Assumes nominal construction disturbance width of 100 feet: disturbance may be slightly wider on sidehill locations and narrower on flat ground using disturbance minimization techniques. Acreage for ATWS is provided in a separate entry.

[3] Valves would be installed within the permanent ROW; therefore, disturbance is already accounted for within the pipeline disturbance acreage.

[4] Upton pipeyard is located within an industrial area that is 100 percent previously disturbed ground; therefore the acreage was not added to the total.

Construction of the Project would be scheduled to begin upon receipt of BLM's Notice to Proceed (NTP). Construction of the second and third spreads is anticipated to extend from August 1 through December 31, 2011, and would be from MP 64 to MP 178. Construction of the first and fourth spreads is anticipated to extend from August 1 through December 31, 2012. The first spread would be from MP 0 to MP 64, and the fourth spread would be from MP 178 to MP 231.1. Construction is anticipated to take approximately 15 to 20 weeks to complete in each year of construction. This does not account for weather delays, holidays, or seasonal construction restrictions that may occur during this period. The in-service date is anticipated to be December 31, 2012. Additional reclamation activities lasting approximately 4 weeks would

be required after the pipeline has been placed into service. Each spread would require an average of approximately 163 workers. Most of the unskilled laborers (approximately 25 percent of the total work force) would be hired locally. The limited level of local workers is mainly due to demand for coal bed methane and other oil and gas field-related activities. Skilled laborers, such as pipeline welders, would be hired locally or brought in from outside the area, depending on availability.

Transportation to the ROW is expected to be provided by the pipeline contractor from Casper and Gillette with appropriately sized vehicles. Local resident workers from other parts of the Project area would be expected to supply their own transportation to the work site; they would not be expected to report to Casper or Gillette. It is assumed that up to 61 percent of the workers would drive personal vehicles or work vehicles (e.g., welding truck, foreman's pickups) to the work site. There would be an estimated 101 vehicle trips per spread during the morning and afternoon peak hours.

2.2 Proposed Action

2.2.1 Description of Facilities

Greencore proposes to construct approximately 231.1 miles of 20-inch-diameter CO_2 pipeline from a point in Township 38 North (T38N), Range 90 West (R90W), Section 11 at the Lost Cabin Gas Plant to a point in the Bell Creek Field (T8S, R54E, Section 27). The Project would transport CO_2 as a dense-phase fluid to the Bell Creek Field for a future EOR project and, potentially, to other delivery points when markets develop. Major components of the Project include:

- CO_2 pipeline;
- One future interconnect and pump station (Natrona Hub);
- One future interconnect (Interconnect Station);
- One future pump station (Mid Point Pump Station);
- Scraper traps (launcher and receiver vessel installed per USDOT 195 requirements for pigging the pipeline), block valves, Supervisory Control and Data Acquisition (SCADA) control buildings and satellite communications, and takeoff valves;
- Cathodic protection facilities and CO_2 measurement facilities;
- Denbury Lost Cabin CO_2 compression/pump station facilities; and
- Denbury gathering facilities at Bell Creek.

All facilities in this system would be designed, constructed, operated, and maintained in accordance with USDOT Title 49 CFR Part 195, Transportation of Hazardous Liquids by Pipeline, and American National Standards Institute (ANSI) B31.4, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols.

2.2.1.1 CO_2 Pipeline

The Project route would parallel other pipelines, electric power transmission and distribution lines, or roads for approximately 210 miles (91 percent) of the total pipeline length. The Project would traverse private, state, and federal lands. Approximately 66 percent of the route would be on private lands, 5.5 percent on state lands, and 28.5 percent on federal lands. An overview of the Project route is presented in **Figure 1-1**. Maps of the Project route shown at a scale of 1 to 250,000 are provided in **Figure 2-1** (maps 1 through 7).

The CO_2 would be delivered to Bell Creek at a pressure ranging from 1,200 to 2,220 pounds per square inch (psi). The transported gas would be no less than 97 percent CO_2, contain no more than 30 pounds of water per 1,000,000 standard cubic feet (3 percent), and contain no more than 40 ppm (by volume) hydrogen sulfide, and 1,500 ppm carbonyl sulfide (less than 1 percent).

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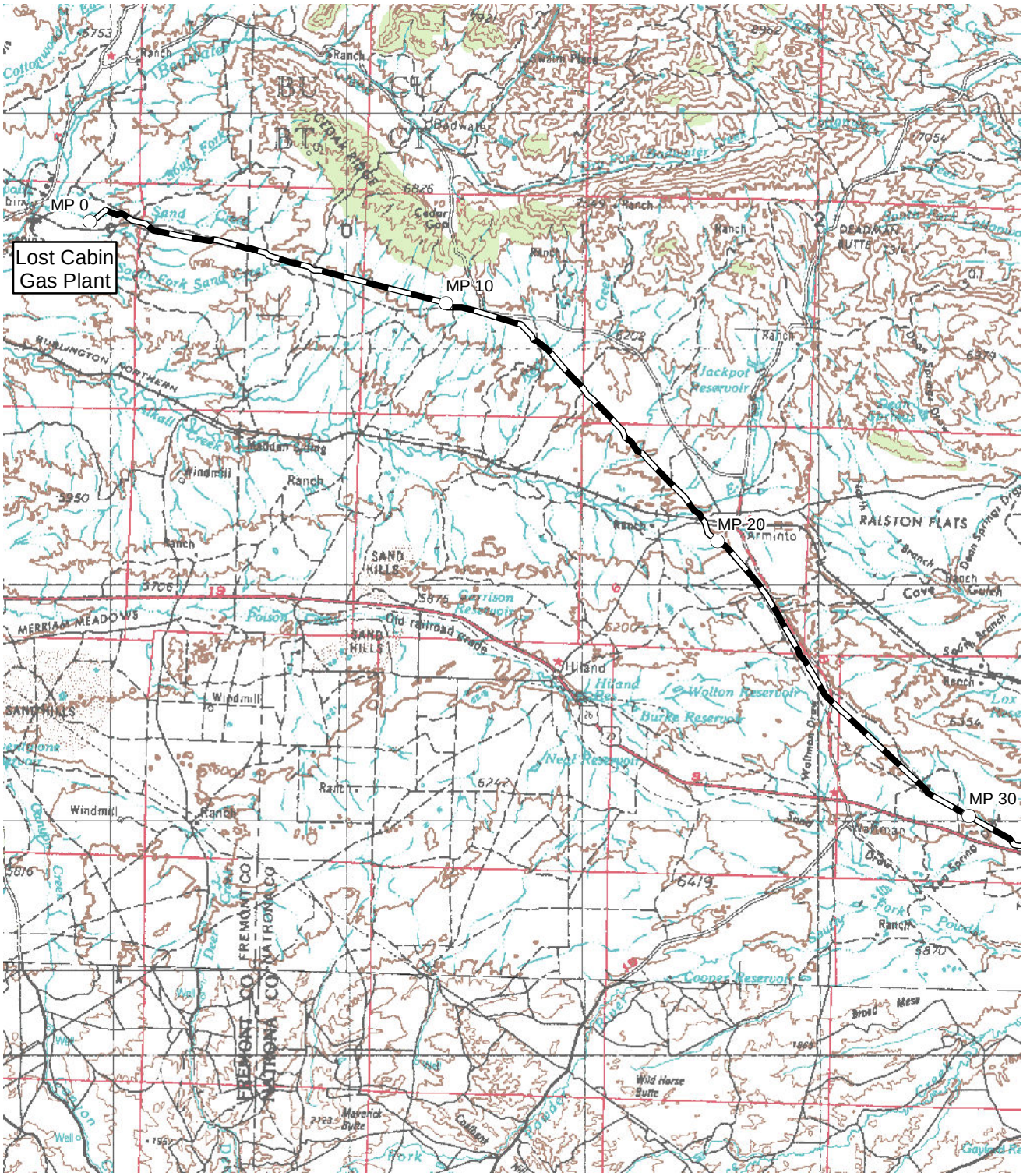
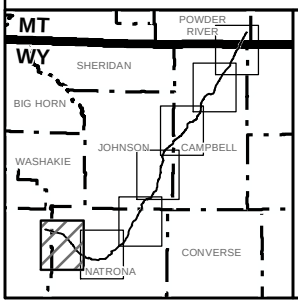




Legend

- Milepost
- Proposed Pipeline Route

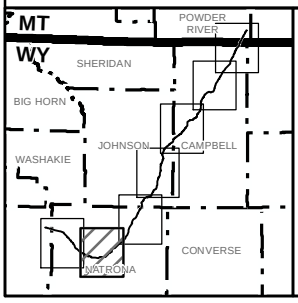
Greencore
CO_2 Pipeline Project

Figure 2-1
Proposed Route

MAP 1 OF 7

0 1 2 4 Miles
0 1 2 4 Kilometers
1:250,000

N



Legend

- Milepost
- Proposed Pipeline Route

Greencore
CO_2 Pipeline Project

Figure 2-1
Proposed Route

MAP 2 OF 7

0 1 2 4 Miles
0 1 2 4 Kilometers
1:250,000

N

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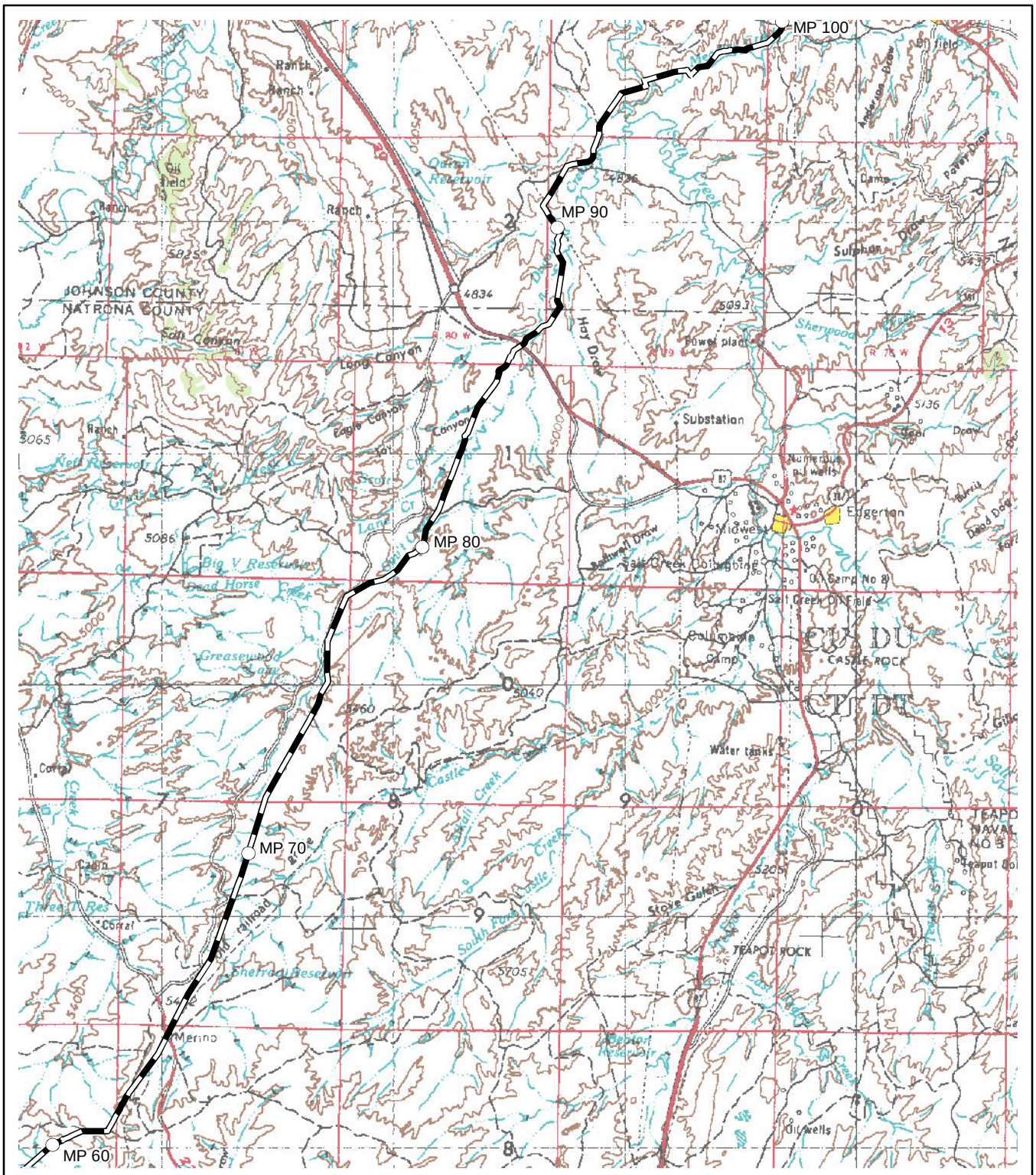

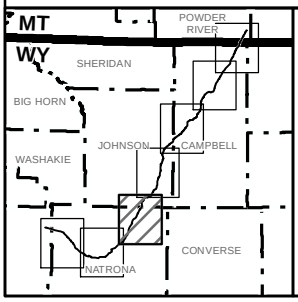

Legend

- Milepost
- Proposed Pipeline Route

Greencore
CO_2 Pipeline Project

Figure 2-1
Proposed Route

MAP 3 OF 7

0 1 2 4 Miles
0 1 2 4 Kilometers
1:250,000
N

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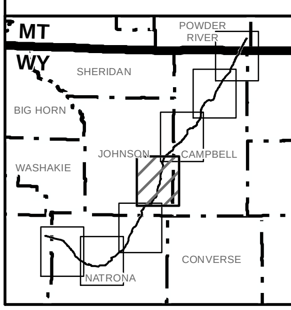

Legend

○ Milepost

Proposed Pipeline Route

Greencore
CO_2 Pipeline Project

Figure 2-1
Proposed Route

MAP 4 OF 7

0 1 2 4 Miles
0 1 2 4 Kilometers
1:250,000

N

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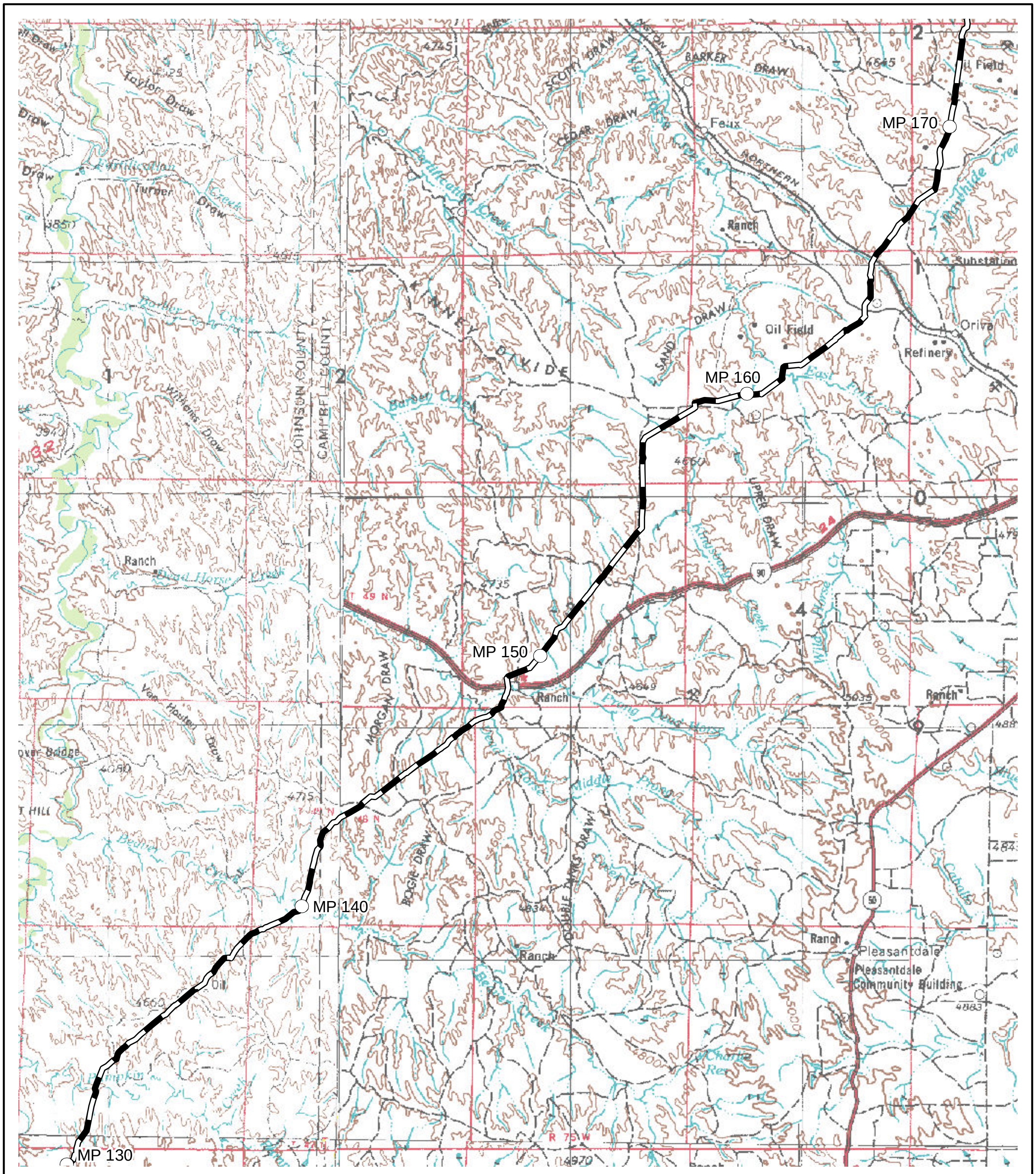

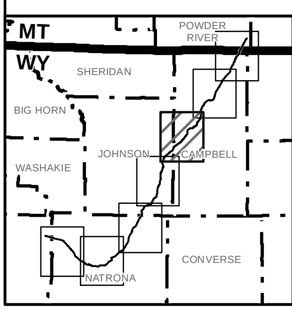

Legend

○ Milepost

Proposed Pipeline Route

Greencore
CO_2 Pipeline Project

Figure 2-1
Proposed Route

MAP 5 OF 7

0 1 2 4 Miles

0 1 2 4 Kilometers

1:250,000

N

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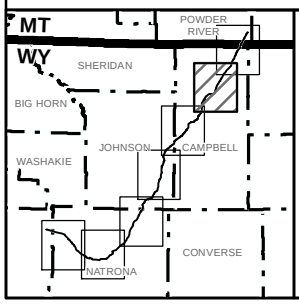

Legend

- Milepost
- Proposed Pipeline Route

Greencore
CO_2 Pipeline Project

Figure 2-1
Proposed Route

MAP 6 OF 7

0 1 2 4 Miles
0 1 2 4 Kilometers
1:250,000

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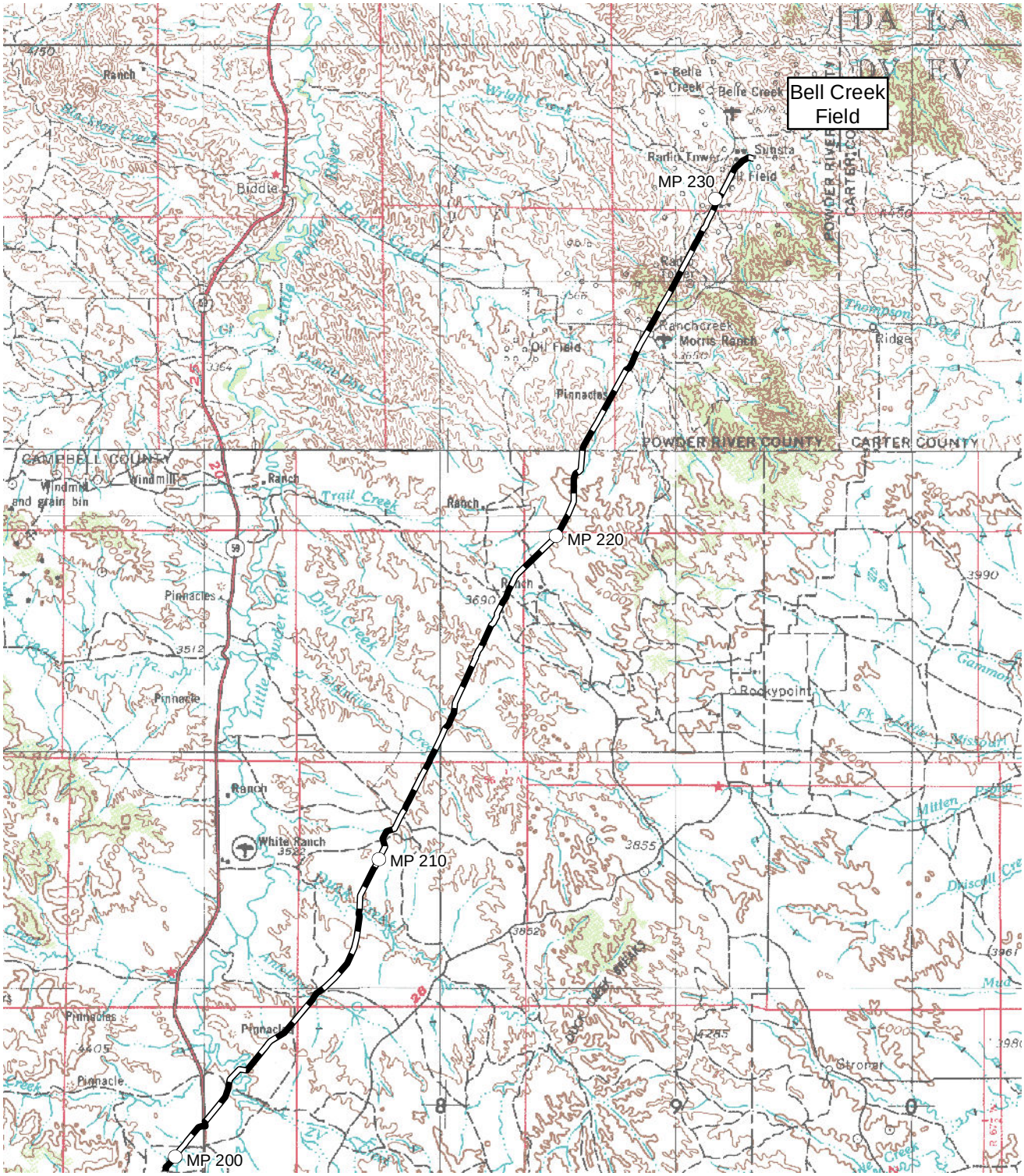
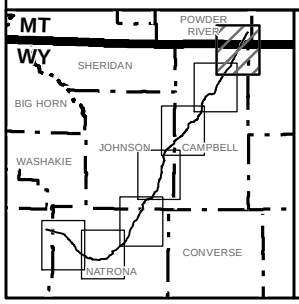




Legend

- Milepost
- Proposed Pipeline Route

Greencore
CO_2 Pipeline Project

Figure 2-1
Proposed Route

MAP 7 OF 7

0 1 2 4 Miles
0 1 2 4 Kilometers
1:250,000

N

X:\0Projects\12603_003_GreencoreCO2PipelineEA\Figures\DocumentFigures\EA_2_DRAFT_201008\FIG_2_1_PROJ_LOC_TOPOBACK_10.mxd

Initially, approximately 50 MMSCFD would be transported through the buried pipeline. Pipeline route markers would be installed at county road crossings, railroads, state and interstate highway crossings, water crossings, property boundaries, and other pipeline crossings in locations where such markers would not interfere with existing land uses. Aerial markers would be installed at intervals along the route and at turning points, where possible, to facilitate periodic aerial patrol of the pipeline.

Based on an analysis of gradient and flow requirements for transporting the CO_2 product, Greencore determined that pumping facilities would not be required for the initial 50 MMSCFD. A hydraulics model was used in this analysis.

Two pipe yard work areas would be used to store pipe prior to transport to the ROW. The pipe storage yards would be located near Casper and Gillette, Wyoming. Pipe would be transferred to the yard via the Burlington Northern Railroad or truck. After pipe unloading from rail cars, the pipe would be transported to the ROW by truck. The estimated number of trucks per day for pipe transport would be 5 to 6 during a 2-month period.

2.2.1.2 Future Pump Station Locations

At approximate MPs 39.5, 144.0, and 231.1, Greencore would purchase land for future pump stations. At these locations, Greencore would install branch tees at mainline block valves to facilitate the future tie-in of these stations. These pump stations would be constructed when product volumes exceed 150 MMSCFD and would include valve manifolds, pumps, pigging equipment, power distribution, and control buildings. Each station would be within an approximate 3- to 10-acre fenced area.

2.2.1.3 Scraper Traps and Block Valves

Scraper traps, which include block valves, would be installed at the following locations: one at Lost Cabin (MP 0.0), two at the future Natrona Hub (MP 39.5), two at the future Interconnect Station (MP 87.2), two at the future Mid Point Pump Station (MP 144.0), two at MP 200.4, and one at Bell Creek (MP 231.1). Block valves would be installed at approximately 15- to 20-mile intervals along the entire length of the pipeline with exception of additional block valves installed at major interstate and state highways for emergency response. The additional tees and valves would be installed at potential future delivery/receipt locations. Scraper traps and block valves would be located as shown in **Table 2-2**. Each scraper trap and block valve area would be graveled and enclosed using a chain link fence, and the disturbance acreage is listed in **Table 2-1**. Access would be year-round, depending upon winter weather.

Table 2-2 Location of SCADA and Manual Valves for the Greencore Project

Type	MP	Location
Lost Cabin – meter run and Block Valve	0.0	T38N, R90W, Section 11
Block Valve	19.7	T37N, R87W, Section 15
Block Valve	32.8	T36N, R85W, Section 36
Future Natrona Hub – Scraper Receipt Trap/Launcher Trap, Tee Block Valve	39.5	T35N, R84W, Sections 1, 12
Block Valve	45.1	T35N, R84W, Section 1
Block Valve	64.6	T37N, R81W, Section 5
Block Valve	83.0	T40N, R80W, Section 28
Future Interconnect – Scraper Receipt Trap/Launcher Trap, Tee and Block Valve	87.2	T41N, R79W, Section 30
Block Valve	100.5	T42N, R78W, Section 18

Table 2-2 Location of SCADA and Manual Valves for the Greencore Project

Type	MP	Location
Block Valve	117.6	T45N, R78W, Section 36
Block Valve	138.5	T47N, R76W, Section 6
Future Mid Point Pump Station – Block Valve, Scraper Receipt Trap/Launcher Trap, Tee Block Valve	144.0	T48N, R76W, Section 15
Block Valve	148.6	T49N, R75W, Section 32
Block Valve	149.3	T49N, R75W, Section 32
Block Valve	158.5	T50N, R74W, Section 30
Block Valve	178.4	T52N, R73W, Section 10
Block Valve	178.9	T52N, R73W, Section 3
Pigging station – Block Valve, Scraper Receipt Trap/Launcher Trap, Tee	200.4	T55N, R71W, Section 22
Block Valve	203.5	T57N, R70W, Section 11
Block Valve	217.9	T57N, R70W, Section 12
Bell Creek Delivery/Terminus Point – Block valve, Scraper Receipt Trap, Tee and meter run	231.1	T8S, R54E, Section 27

2.2.1.4 Bell Creek Delivery Facility

The Bell Creek Delivery Facility would be constructed on an approximately 5-acre site located at the terminus of the pipeline. The site would consist of a meter building (35 feet wide by 75 feet long by 24 feet high), receiving scraper trap, flow control valve, communications and satellite dish, CO_2 vent, and an electric service pole with a pad-mounted transformer. A 72-inch-high, brown, plastic-coated, chain-link security fence would be installed around the facility.

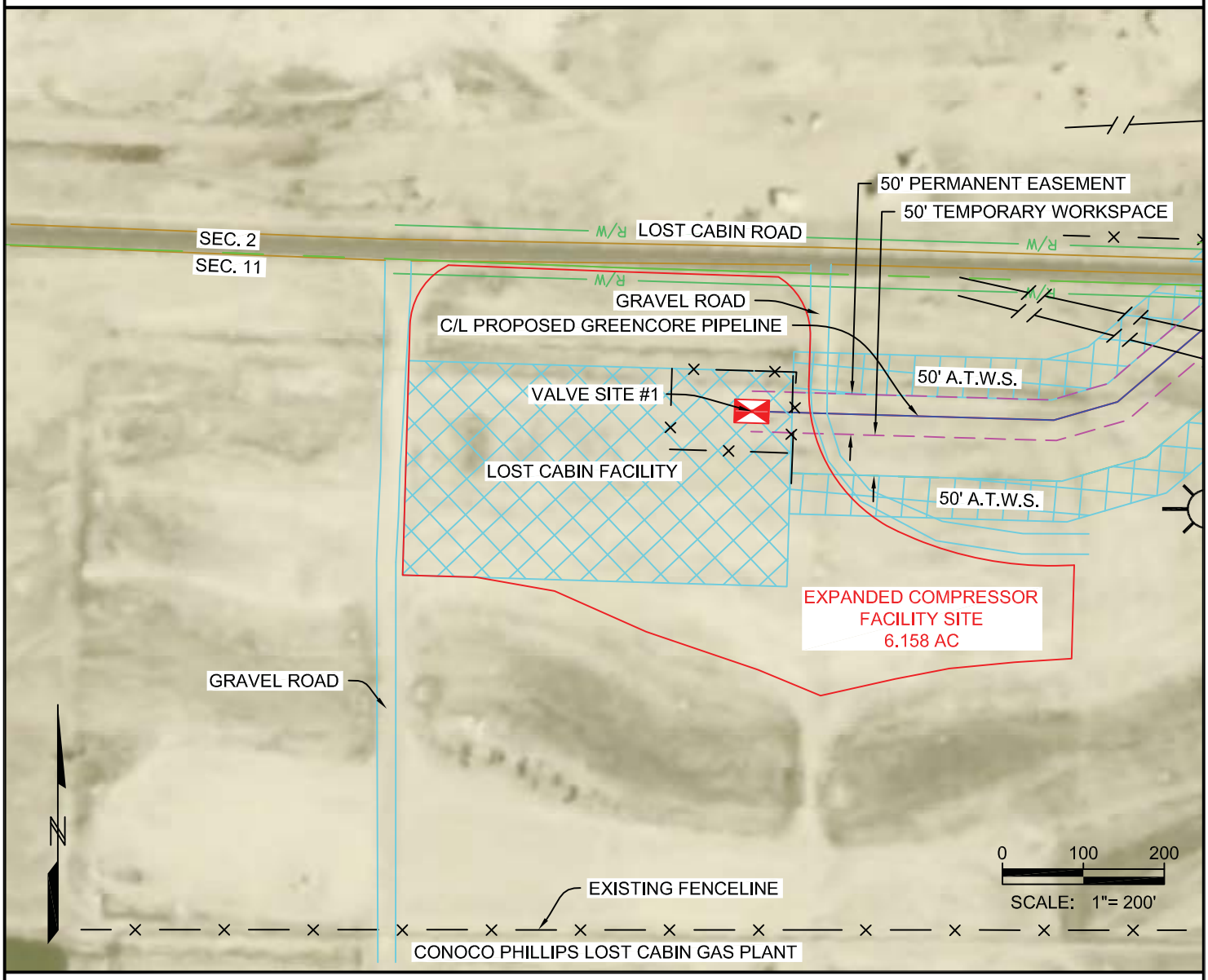
2.2.1.5 Measurement Facilities and Supervisory Control and Data Acquisition (SCADA) System

Measurement facilities would be installed initially at Lost Cabin and Bell Creek, and later at future intermediate receipt and delivery points as they are developed. The Lost Cabin measurement facility is shown in **Figure 2-2**. Each measurement facility area would be graveled and enclosed with a chain-link security fence. Access to these sites would be conducted at 1-week intervals (year-round).

2.2.1.6 Corrosion Protection

The pipeline would be cathodically protected by the coating, rectifiers, and anodes. Rectifiers would be located near valve sites with power distribution available in close proximity and mounted on a pole adjacent to the ROW; associated anodes would be buried. The exact locations of these cathodic protection devices would be determined during the design phase of the Project. If possible, the rectifiers would be placed at the existing planned facility sites. Test leads would be attached to the pipeline at fence lines, other pipeline crossings, roads, and highways to monitor the cathodic protection system. Each set of test leads would be brought to the junction box mounted nearby on a short post. The post and junction box would be installed where it would not interfere with existing land uses.

A PORTION OF SECTION 11,
TOWNSHIP 38 NORTH, RANGE 90 WEST,
FREMONT COUNTY, WYOMING



NOTES:

1. THE PROPERTY LINES DEPICTED HEREON ARE APPROXIMATE. THEY WERE CONSTRUCTED FROM COUNTY ASSESSOR MAPS AND ARE NOT BASED ON FIELD SURVEY DATA.

2. ALL DISTANCES SHOWN HEREON ARE APPROXIMATE AND ARE NOT BASED ON FIELD SURVEY DATA.

A.T.W.S. = ADDITIONAL TEMPORARY WORKSPACE

PREPARED BY: CH2MHILL

CLIENT: GREENCORE PIPELINE COMPANY LLC

REVISIONS

NO.	DATE	BY	DESCRIPTION
A	11/23/10	JTS	ISSUED FOR REVIEW
B	12/2/10	JTS	ADDED EXPANDED COMPRESSOR FACILITY SITE

GREENCORE PIPELINE COMPANY LLC
FACILITY LOCATION REQUIREMENTS

DRAWN BY:	DRAWN DATE:	CHECK'D BY:	PLOT DATE:
JTS	11/23/10	CLJ	11/23/10

APN:

Figure 2-2 LOST CABIN

B
REV.

2.2.2 Environmental Protection Measures as Design Features of the Proposed Action

Greencore has committed to specific environmental protection measures as part of the Project design to minimize potential impacts to natural resources during construction and operation. These protection measures are summarized by resource in **Table 2-3**. For some of the resources (i.e., wetlands, cultural resources, sage grouse, etc.), additional field verifications would be conducted, as needed, to determine the appropriate resource protection measures.

Table 2-3 Summary of Environmental Protection Measures for the Greencore Project

Resource	Environmental Protection Measures As Design Features
Air Quality	• Water or chemical soil binders and best management practices (BMPs) would be used to control dust along the ROW and access roads during construction in accordance with federal, state, and local requirements. • Water for dust control would be obtained from federal, state, and local permitting processes, or purchased through contracts with owners with valid, existing water rights.
Geology and Soils	• Soil erosion would be minimized by implementing procedures described in BMPs, the Storm Water Pollution Prevention Plan (SWPPP) (POD, Appendix E), and the Reclamation Plan (POD, Appendix J). • If construction is planned during a storm event, vehicle traffic and equipment would be restricted to prevent rutting in excess of approximately 4 inches deep.
Water Resources and Wetlands	• The SWPPP and BMPs would be implemented to minimize storm water transport of sediment from disturbed areas to streams and wetlands. All Project-related storm water and hydrostatic test water discharges would be in compliance with a NPDES permit. • Greencore has committed to not constructing aboveground facilities and staging areas within wetlands, riparian areas, or other waters of the U.S. • Greencore has committed to locating ATWSs a minimum of 50 feet outside wetland boundaries. • No refueling or lubricating would occur within 100 feet of wetlands and other waterbodies or drainages. Hazardous materials, chemicals, fuels, etc. would not be stored within 100 feet of wetlands or waters of the U.S. • Application of herbicides or pesticides within the vicinity of wetlands and waterbodies would follow pesticide use protocol and restrictions outlined in the Noxious Weed Management Plan (POD, Appendix K). • Topsoil within the trench line would be segregated from subsoil in wetland and riparian areas for use in reclamation as specified in the Project Reclamation Plan. • Biologists familiar with wetland and riparian identification would post signs at the edges of the wetland/waterbody features prior to construction. • Where crossings of riparian or wetland areas cannot be reasonably avoided, the construction ROW width would be reduced to approximately 75 feet and measures would be taken to limit impacts as described in the POD. • The horizontal directional drill crossing method would be used at the Horse Creek, Wild Horse Creek (extended wetland), Little Powder River, and Donner Reservoir crossings, which would avoid in-stream impacts and reduce erosion along the banks of these waterbodies.
Vegetation, Agriculture, and Range	• Revegetation seed mixes would be developed in coordination with the BLM and private landowners. The Project Reclamation Plan would outline the procedures to be followed to return the land to pre-existing vegetative cover and land uses. • The Project's Noxious Weed Management Plan (POD, Appendix K) would be implemented to minimize the spread of noxious weeds. A Draft Pesticide Use Proposal (PUP) would be included in the Noxious Weed Management Plan. • Woody (tree) species removed during construction in riparian and/or wetland areas would be replanted from nursery stock or cuttings, as outlined in the Project's Reclamation Plan. • Any range improvements such as fences, gates, cattle guards, and developed water sources located within disturbance or access routes would be repaired to the satisfaction of the BLM or

Table 2-3 Summary of Environmental Protection Measures for the Greencore Project

Resource	Environmental Protection Measures As Design Features
	private landowner. • As determined by the Environmental Inspector (EI), soft plugs would be installed at well established livestock trails to allow livestock crossing of the trench. Ramps also would be installed, as needed, to allow livestock that enter the trench a way to exit. If construction would disturb or destroy a natural barrier used for livestock control, the opening would be temporarily closed during construction and permanently closed following construction, as required by the BLM or private landowner. • If threatened, endangered, candidate, or sensitive plant species are identified prior to construction, Greencore would coordinate with the BLM and USFWS to determine appropriate protection measures.
Wildlife and Fisheries	• For the measures below that include seasonal stipulations, Greencore would coordinate with the BLM to determine the applicability of specific dates and areas where those stipulations would be implemented. Greencore would coordinate with the BLM Field Offices to determine if additional surveys would be required prior to the initiation of construction. • Appropriate wildlife and fisheries protection measures would be implemented during all phases of construction in coordination with BLM, USFWS, and other jurisdictional agencies. • Prior to the initiation of construction, applicable biological surveys would be conducted through areas of suitable habitat for specific species during the appropriate season, as determined by the jurisdictional agencies (e.g., BLM and USFWS) and survey results reported in compliance with Section 7 of the ESA. • To prevent adverse impacts to pronghorn, a seasonal construction constraint (November 15 – April 30) would be implemented in areas of crucial winter range. • Greencore has committed to not disturbing migratory bird habitat on currently undisturbed lands between April 15 and July 31 to comply with the Migratory Bird Treaty Act (MBTA). • To avoid direct impacts to breeding raptors, Greencore has committed to implement a construction schedule that would avoid the raptor nesting period (February 1 – July 31). • Greencore has committed to conducting two additional aerial surveys during the winter of 2010/2011 to identify bald eagle winter roosts. Appropriate site specific protection measures (i.e., buffers and timing constraints from November 1 – March 31) would be implemented at bald eagle winter roosts identified during aerial surveys. • Greencore has committed to conducting pre-construction pedestrian nesting burrowing owl surveys through areas of potentially suitable habitat (i.e., prairie dog colonies) to avoid direct impacts to breeding burrowing owls. • Greencore has committed to conducting two additional aerial surveys during the winter of 2010/2011 to determine greater sage-grouse winter concentration areas. Appropriate protection measures (i.e., buffers and timing constraints from November 15 – March 14) would be implemented on a site specific basis. • To avoid potential impacts to breeding greater sage-grouse, Greencore would implement a permanent 0.6 mile No Surface Occupancy (NSO) buffer around occupied leks in Core Areas and a 0.25 mile NSO lek buffer in Non-core Areas. Any site specific modifications to NSO buffers would require authorization by the BLM. • Greencore has committed to not constructing during the greater sage-grouse breeding season (March 15 – June 30). • Mountain plover nest surveys would be conducted if construction occurs during the mountain plover breeding season (March 15 – July 31). If the mountain plover were listed as a federally threatened species, prior to, or during construction, Greencore would consult with the BLM and USFWS to determine appropriate protection measures. • Pipeline markers would not be placed near greater sage-grouse leks or in mountain plover habitat to reduce predation opportunities. • Greencore would coordinate with the BLM to determine appropriate protection measures for black-tailed and white-tailed prairie dog colonies that would be directly disturbed by the Project.

Table 2-3 Summary of Environmental Protection Measures for the Greencore Project

Resource	Environmental Protection Measures As Design Features
	• Measures for protection of water resources that would reduce potential impacts to fish and their habitat are included in Appendix E of the POD. • In perennial sections of streams containing substrate for spawning trout, trenched construction would be avoided during the spawning periods, or the horizontal directional drill (HDD) method would be used to cross the streams.
Recreation and Visual Resources	• Measures would be implemented to minimize the visual effects of construction on high value road, river, and trail crossings as identified by the BLM. • To prevent unauthorized use of the ROW by off-road vehicles (ORVs) and subsequent potential impacts to soil, vegetation, and wildlife resources, access would be blocked at locations specified by BLM representatives or private landowners.
Socioeconomics and Transportation	• All major highway crossings would be bored to limit traffic interruptions. • For minor roads that would be trenched, temporary alternate access would be maintained such that delays would be limited to no more than 10 minutes per hour.
Cultural and Paleontological Resources	• Prior to the Project construction, cultural resource inventories would be conducted on all previously uninventoried lands in proposed disturbance areas, in accordance with the Programmatic Agreement (PA) in **Appendix B**. • Impacts to the Texas and Bozeman trails would be minimized in accordance with the PA and as determined by the BLM and SHPO. • Construction monitoring during ROW preparation would be conducted where the pipeline route crosses prehistoric sites. Cultural materials discovered during monitoring would be handled according to the procedures detailed in the PA. • Open trench inventory (OTI) would be conducted in accordance with the provisions of the PA • Construction would be halted within 328 feet of discovery of human remains, and the find reported to the BLM Authorized Officer immediately. The discovery would be evaluated and treated in accordance with appropriate state laws and the provisions of the PA. • Paleontological surveys would be conducted prior to and during construction. A final Paleontological Technical Report would be prepared and submitted to the BLM following completion of construction. The final report would contain the results of the work conducted, including an accession list of fossil specimens collected and listed by locality. • In areas where the potential for occurrence is high, a paleontologist would monitor the trench excavation and salvage potentially significant fossiliferous deposits. Measures would be taken to identify and preserve the fossils as detailed in the Project Paleontological Assessment Report. • To minimize indirect impacts to cultural and paleontological resources, Greencore would educate Project-related personnel as to the sensitive nature of the resources; a strict policy of prohibiting collecting of these resources would be implemented.

2.2.3 Construction

As part of the EA process, Greencore has developed a detailed POD, which would become part of the ROW Grant approved by the BLM. The POD addresses the specific details regarding pipeline construction, reclamation, BMPs, and site-specific environmental protection measures on federally owned and private lands. EIs would be present during construction of the line to ensure that these measures are implemented. The Project's Emergency Response Plan (POD, Appendix L) describes the fire prevention and suppression techniques that would be implemented to reduce the potential for a construction-related fire, which could potentially impact vegetation, agricultural resources, and wildlife.

The following is a list of major construction activities in order of occurrence along the spread:

- ROW clearing and grading;
- Topsoil salvage;
- Trenching;
- Stringing;
- Welding, and radiographic examination;
- Joint coating and repair;
- Lowering in;
- Trench back-filling;
- Hydrostatic testing and final tie-ins; and
- Cleanup and reclamation.

These operations are described in more detail in the POD. **Figure 2-3** illustrates the components of a typical spread. Appendix G of the POD provides the typical ROW configuration for the Project (locations of topsoil, trench spoil piles, etc.). Typical construction equipment for this type of project includes pickup trucks, loaders, various sized dozers, shovels and backhoes, side booms, generators, and bending machines. Most of the equipment that would be used during ROW reclamation consists of dozers, blades, and trackhoes. Construction workers would live in permanent residences, local motels, rented houses or lodging, personal trailers, or pickup campers. Crew transports and privately owned vehicles would be used to transport workers to the construction site.

Temporary headquarters for construction personnel, weld fabrication, and equipment storage yards likely would be located at or near Casper and Gillette, Wyoming. Temporary headquarters would consist of an office trailer, one or more warehouse trailers (or suitable rented space, if available), and the contractor yards.

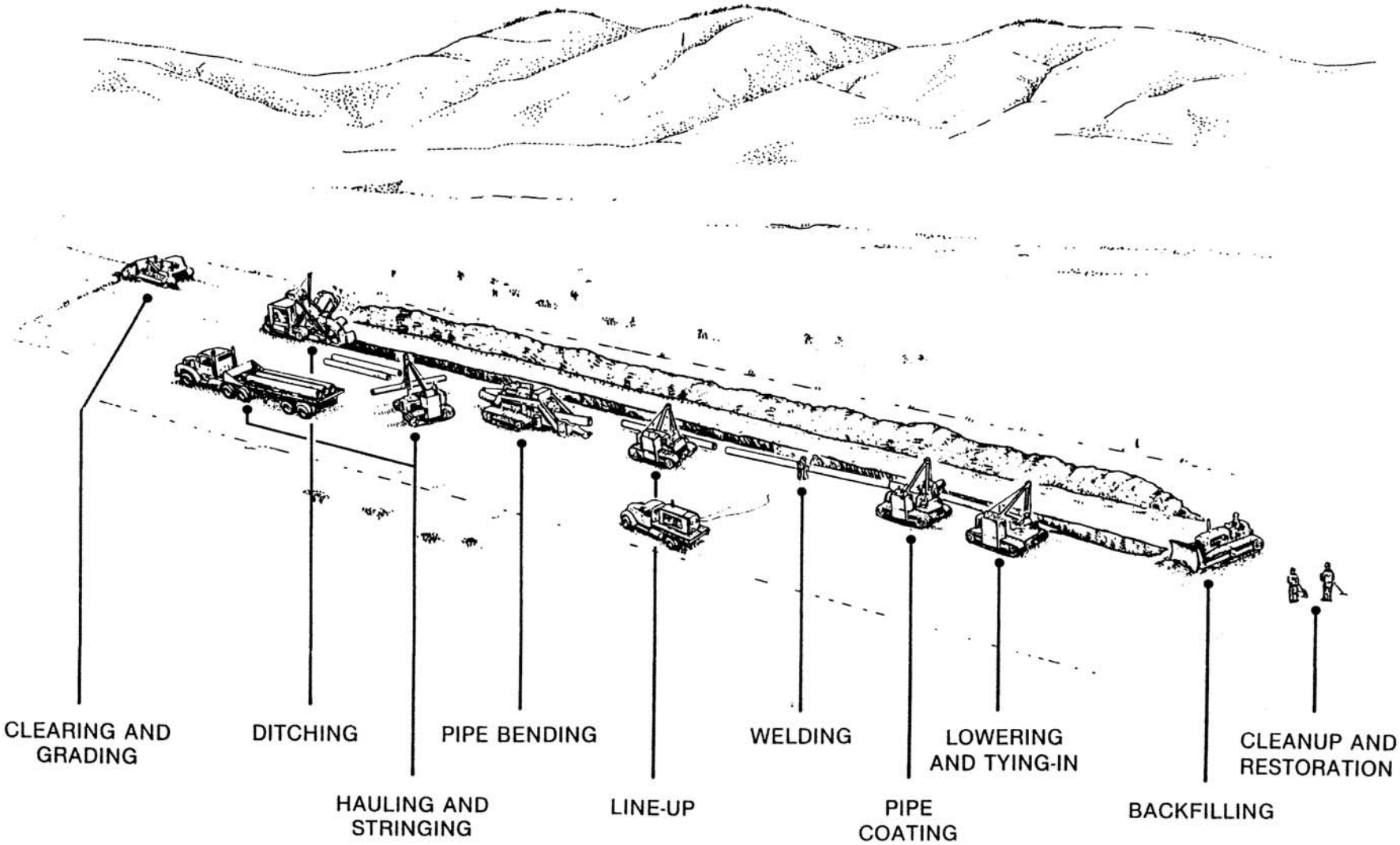
The pipe and equipment would be shipped to an area northwest of Casper and near Gillette via trucks and/or railroad. Approximately 57,900 metric tons of 20-inch-diameter by 0.441-inch (average) wall thickness pipe would be required for the Project. Distribution of pipe to construction sites would require an average of 15 to 20 truckloads per day during the period of peak activity. The use of signs and markers on light-duty and heavy-duty roads would follow current BLM standards. Prior to construction, company and contractor employees would be instructed to use only designated access roads (identified in Appendix D of the POD), and as approved in the ROW grant for access. All off-road driving would be prohibited.

ATWSs would be required for jurisdictional water crossings, difficult terrain, select wetland crossings, and federal, state, and county road crossings. The location and estimated area for the ATWSs are provided in Appendix C of the POD.

During construction of the Project, Greencore would comply with existing federal, state, county, and private requirements developed to protect road networks. Load limit restrictions would be observed at all times to prevent damage to the road surface. Any special permits would be obtained for oversized and heavy loads from the appropriate agency.

2.2.3.1 Pre-Construction

All biological and cultural resources permit requirements, impacts, and any designated avoidance areas and seasonal restrictions would be identified prior to construction. Constraint areas would be included on the alignment sheets. The permits required for construction of the Project are listed in **Table 1-1**.



GREENCORE PIPELINE COMPANY LLC

Figure 2-3
Typical Rural
Construction Spread

Civil engineering surveys would identify the centerline of the Project route and the boundaries of both sides of the approved working limits before construction activities commence. EIs would be responsible for verifying that the limits of authorized construction work areas are staked prior to construction. Flagged or painted lath would be set at 200-foot intervals (maximum), or as required to maintain line of sight along the centerline. All ATWSs would be marked in a similar fashion, and corners of each ATWS would be marked. Staking would clearly show the boundary of the area that can be used or accessed by construction personnel.

Prior to earth moving activities, BMPs incorporated into the Project POD would be implemented to limit sediment transport and erosion. BMPs are usually site-specific and depend on current site and weather conditions. The EIs also would be responsible for designating areas that should utilize BMPs or make adjustments to BMPs as needed and as approved by the BLM. The SWPPP (POD, Appendix E) contains specific BMP information and serves as a reference throughout the Project to ensure proper sediment and erosion control.

2.2.3.2 ROW Clearing and Grading

A nominal working width of 100 feet would be required for construction. The width of the ROW may be reduced while crossing wetlands and waterbodies if they are not bored or drilled. All construction equipment would work off of timber mats in waterbodies and wetlands that are saturated to the surface. BMPs would be utilized at each crossing to reduce direct and indirect effects associated with sedimentation, erosion, and soil compaction, which in turn reduces the affects to the vegetation and habitat for wildlife. Construction schematics (typicals) for crossing these areas are included in Appendix F of the POD. The EI would be consulted prior to each of these crossings to ensure permit compliance.

Vegetation would be cleared and trees would be cut with a chain saw and/or mechanical shears and brush would be generally cut with a hydro-axe or brush-hog. Trees and brush would be cut as close to the ground as possible. On private and public lands, brush and other materials cleared from the ROW typically would be incorporated into the reclamation of the ROW. Private landowners may have other stipulations for disposing of these materials. Stumps would be left in place except over the trenchline or as necessary to create a safe and level workspace. Greencore proposes to use an EI to coordinate with the appropriate agency or landowner to locate areas for stump disposal, if required.

Where grading is needed to create a safe, level, working area, approximately 4 to 6 inches of topsoil would be stripped from the full construction ROW prior to grading operations. There may be some areas where the contractor would not need to grade and topsoil. For example, level fields or pastures may not need to be graded for construction. In these cases, the contractor can avoid topsoiling, except over the trenchline, which would preserve the root system and increase reclamation success.

In areas where the Project would parallel an existing pipeline, the new line would be kept at a distance of 25 to 40 feet away. A 5- to 10-foot-wide safety zone (where possible) would be established next to the existing pipeline to protect it from construction activities.

Functional use of all livestock facilities and other public improvements would be maintained at all times. Fences would be adequately braced along both sides of the ROW before wires are cut and gates are installed. Permanent gates may be installed, with landowner permission, to provide access to the pipeline ROW. If a natural barrier used for livestock control were damaged during construction, the area would be adequately fenced to prevent the escape of livestock. No gates on established roads over public lands would be locked or blocked. Any cattle guards or gates damaged during construction would be repaired or replaced.

<u>Survey Monuments</u>

All survey monuments found within the ROW would be protected. If any survey monuments found within the ROW or temporary use areas are disturbed or obliterated during the course of the Project, the Contractor would immediately report it to Greencore. Greencore would report the incident in writing to the Authorized Officer and the respective installing authority (if identified).

2.2.3.3 Trenching

Trenching would be used for all sections of the ROW except for areas identified for slick boring or HDD as outlined in the POD. Trenching operations would be timed so that the trench is backfilled as soon as practical. Construction methods used to excavate a trench would vary depending on soils, rock, terrain, and related factors.

Excavated subsoil would be stored separately from windrowed topsoil piles. Like topsoil, subsoil would not be stored in flowing waterbodies, dry drainages or washes that cross the ROW. Gaps would be left periodically in the subsoil piles to avoid ponding and excess diversion of natural runoff during storm events, where necessary.

Measures would be taken to ensure that access is provided for private landowners or tenants to move vehicles, equipment, and livestock across the ditch where necessary. Adequate precautions also would be taken to ensure that livestock are not prevented from reaching water sources because of the open ditch. Measures to be taken include contacting livestock operators and providing adequate crossing locations.

The Contractor would keep wildlife and livestock trails open and passable by adding soft plugs (areas where the trench is excavated and replaced with minimal compaction) during the construction phase, as determined by the EI. Soft plugs with ramps on either side would be left at all well-defined livestock and wildlife trails to allow access across the trench and provide a means of escape for livestock and wildlife that may fall into the trench. These well-defined trails would be identified on the construction alignment sheets, and soft plug installation would be verified by the EIs.

The depth and width of the ditch would vary depending upon soil types. A typical ditch would be excavated approximately 4 feet wide at the bottom and the sides would be sloped to Occupational Safety and Health Administration (OSHA) specifications (up to approximately 8 feet wide). The depth of the ditch would vary approximately 5 feet (standard trench) to approximately 7 feet through drainages, road crossings, from agricultural land, and waterways.

Paved roads would be bored to avoid disrupting traffic in accordance with governing agency and permit requirements. Pipeline crossings of un-surfaced or lightly traveled roads would be made with a mechanical ditching machine or a trackhoe (unless a permitting agency requires a bore). Installation at these locations, including cleanup and reclamation of road surfaces, would usually be completed within 1 day. In such cases, provisions would be made to detour or control passage of traffic during construction. Signage and traffic control flaggers may be required.

2.2.3.4 Trench Backfilling

Once the pipe has been strung, welded, and lowered in, backfilling would occur as soon as possible after the pipe has been lowered into the trench. Backfill may be compacted to increase stability and prevent air pockets and future non-uniform settling. Segregated topsoil would be returned to the trench after the subsoil is replaced. After the pipe is lowered in, the ditch would be backfilled, with any segregated topsoil going in last, returning it to its original position.

Trench breakers would then be installed on slopes, as identified in the POD. Prior to backfilling the trench, the equipment operator would check the trench for wildlife and/or livestock to ensure any wildlife or livestock found in the trench are removed before backfilling begins.

The Contractor would place a crown over the trench approximately 0.5 feet in height to account for subsidence (except at road crossings where compaction would be adequate to keep the roadway flat). Written authorization from the private landowner is required to eliminate the crown.

2.2.3.5 Blasting

Where rock is encountered, tractor-mounted mechanical rippers or rock trenching equipment may be used to facilitate excavation. In areas where rippers or trenchers are not practical or sufficient, blasting may be employed. However, no blasting is anticipated for the Project. Should blasting be required, a site specific plan would be developed in accordance with all federal, state, and local regulations and requirements. All necessary authorizations would be obtained and safety precautions observed. The Contractor is responsible for obtaining permits to store blasting materials.

2.2.3.6 Highway, Railroad, and Road Crossings

At major paved highway and railroad crossings (**Table 2-4**), the pipeline would be dry (slick) bored or directionally drilled to conform to requirements of the Wyoming Highway Department and/or Montana Department of Transportation. Current plans are to bore all established paved roads. Boring activities would not be conducted within the road ROW limits. Greencore would keep all road surfaces free of dirt, rock, or other debris that could be a hazard to the public.

Table 2-4 Highway and Railroad Crossings for the Greencore Project

Highway or Railroad	MP	Type of Surface	Road/Railroad ROW Width	Crossing Method
Burlington Northern Railroad	19.1	Tracks	240	Bore
Highway 20/26	33.1	Asphalt	576	Bore
Highway 20/26	45.4	Asphalt	360	Bore
Burlington Northern Railroad	46.0	Tracks	300	Bore
I-25 and Service Road	86.9	Asphalt	910	Bore
Highway 192 /Sussex Road	107.0	Asphalt	360	Bore
I-90	149.8	Asphalt	960	Bore
Burlington Northern Railroad	166.0	Tracks	1020	Bore
Highway 14/16	178.9	Asphalt	240	Bore
Highway 59	201.2	Asphalt	300	Bore

Notes: All unidentified dirt roads would be open cut.

2.2.3.7 Stream and Wetland Crossings

Plans and procedures for typical wetland and waterbody crossings are provided in Appendix F of the POD. Greencore has aligned waterbody crossings as close to 90 degrees as possible to minimize impacts to riparian vegetation. Vegetation would be cleared on each stream bank only as needed to provide sufficient work space and spoil storage.

All waterbodies would be crossed via open cut construction method except for Horse Creek, Wild Horse Creek (extended wetland), Little Powder River, and Donner Reservoir, which would be crossed by HDD. The HDD construction method is described in Section 3.8.1 of the Project POD. Only drilling fluid containing bentonite (no additives) would be used during HDD. In the event of a “frac-out” at a waterbody crossing, steps would be taken as outlined in the Frac-Out Contingency Plan (POD, Appendix H).

Standard equipment would be operated on timber mats in saturated wetlands. ATWSs would be located a minimum of 50 feet outside wetland and waterbody boundaries, and sediment barriers would be installed

immediately upslope of the wetland boundary to minimize effects on any adjacent wetlands. Woody vegetation in wetlands would be cleared using the least disruptive method. Grass or herbaceous vegetation would not be removed except immediately over the trench line. The salvaged topsoil, which would contain seeds and propagules from wetland species, would be reapplied to the areas from which it was stripped to maximize reclamation success.

If standing water and unstable soils interfere with construction, the trench may be dewatered by pumping. Trench water would be discharged from the trench in accordance with the Wyoming Department of Environmental Quality (WDEQ) and Montana Department of Environmental Quality (MDEQ) regulations.

In hilly areas, depending on the pipeline gradient, sack breakers (sacks filled with sand or smooth soil) would then be placed in the trench as barriers, perpendicular to the pipe at regularly spaced intervals to prevent water from running down the trench during rain storms and from washing out the backfill. When these preparations are completed, the areas between and over the sack breakers would be backfilled with spoil and topsoil excavated from the trench.

2.2.3.8 Water Withdrawals for Hydrostatic Testing, Directional Drilling, and Dust Abatement

Once the pipe is in place, the system would be tested with pressurized water to locate any leaks or weak spots. The entire pipeline would be hydrostatically tested to at least 125 percent of maximum operating pressure. It currently is estimated that approximately 18,300,000 gallons of water would be required for hydrostatic testing and that seven pipe sections would be tested concurrently. The test water would be obtained from a permitted source through a Water Use Agreement with the State Engineer and negotiations with water rights owners. Test water would be reused in testing each section of the pipeline if possible. The test water would be shunted from section to section of the pipeline for testing and eventually disposed of in accordance with federal, state, and local agency requirements. Hydrostatic test water would be discharged through straw bale structures and then released to a permitted discharge location as described in the Project Hydrostatic Testing Plan (POD, Appendix I). Consumptive water use would be required for directional drilling and dust abatement. Approximately 370,680 gallons (1.1 acre-feet) would be obtained from a permitted source for mixing with bentonite during directional drilling at the HDD crossings. Additional water would be obtained from permitted sources (irrigation companies or municipal sources) for dust abatement.

2.2.3.9 Cleanup and Reclamation

Where the side hill slopes are gentle, the material graded from the working width would be replaced, contoured, and reclaimed as nearly as practical to preconstruction conditions. Water bars would be constructed in steeper areas to prevent erosion.

Greencore would implement conditions found in the Reclamation Plan (POD, Appendix J) for erosion control, revegetation, and reclamation to be approved by the BLM. Reclamation procedures would be developed on a site-specific basis in that plan.

After backfilling and cleanup are complete, the soil would be chiseled with suitable equipment to ameliorate compaction and improve soil permeability. A firm and friable seed bed suitable for the establishment of vegetation would be provided. The seed bed also would be disked prior to planting. Mulch or other stabilizing materials would be placed on the disturbed area for erosion control, as needed.

Revegetation of lands disturbed by construction would be in accordance with the Project Reclamation Plan. Species and seeding rates effective in controlling erosion would be used to revegetate the disturbed areas. Species would be selected after consideration of climatic adaptation, species adaptation to soil texture, possible adverse conditions such as drought or saline soils, palatability to wildlife, and shrub cover for wildlife. Generally, commercially available native species, as approved by the landowner or surface management agency, would be used.

Suitable mulches and other soil stabilizing practices would be used where necessary to protect bare soil from wind and water erosion and to improve water infiltration. Cultivation and land preparation operations on steeply sloping areas would be performed along the contour to minimize erosion.

Disturbed and reseeded areas would be inspected periodically to monitor the success of erosion control measures and revegetation programs. The monitoring program would help identify problem areas and corrective measures to ensure vegetation cover and erosion control. In addition, a weed control program would be developed for disturbed areas as part of the Noxious Weed Management Plan (POD, Appendix K). A BLM approved PUP would be developed prior to the use of herbicides and pesticides. A draft PUP is included as Appendix B of the Noxious Weed Management Plan.

2.2.3.10 Special Construction Areas

The Project was studied for sensitive areas that would require more extensive reclamation and construction efforts. Additionally, the reclamation efforts of the adjacent pipelines (e.g., Anadarko/Howell Pipeline) were studied for application to the Project. These special construction areas are discussed below.

Close Proximity to Collocated Utilities

The Project is collocated with existing utilities for approximately 91 percent of the pipeline route. When the situation occurs that the Project is within 25 feet of the utility, Greencore would take added precautions to support pipeline construction. As discussed in the POD, adjacent utilities would be staked via the One-Call System for existing utility locations.

Surface Slumping

The Project ROW would be reviewed for surface slumping in the detailed engineering design phase of the Project. If the problem is shallow surface slumping, no action is planned if outside the construction ROW as it would pose no threat to the Project. If the problem is more severe than shallow surface slumping, a design would be developed to address future surface slumping.

Bank Erosion

Waterbody crossings would be reviewed during the detailed design phase to ensure all potential bank erosion issues are addressed. Crossing approaches would be tapered to gradual slopes and water bars installed, if required, to eliminate small abrupt changes in elevation. The new gradual slope would taper to match the undisturbed terrain. BMPs would be initiated as described in the SWPPP to reduce erosion and limit sediment transport (POD, Appendix E).

Highly Eroded Areas

The Project would be reviewed for any areas of potential eroded terrain with steep banks. If the soil has limited cohesion making reclamation to original contours difficult, the pipeline ROW would be graded to blend into the adjacent terrain.

Active Faults

Active faults along the pipeline ROW would be studied during the detailed engineering phase of the Project. A design would be developed at that time which would mitigate the effects from fault movement.

2.2.3.11 Hazardous Materials/Wastes

Hazardous materials would be used and maintained per the Material Safety Data Sheet (MSDS) and disposed of accordingly. All hazardous materials/wastes disposal would be in accordance with federal, state, and local requirements.

2.2.4 Operation

The SCADA System located at the measurement facilities would provide continuous operating data. Pressure, temperature, flow rate, totalizing flow, pressure alarms, and status alarms would be transmitted via satellite to the control center.

A Project SCADA control center would be utilized at the Lost Cabin supply station, mainline valve sites, and Bell Creek meter stations, which would communicate data and status information back to the main control center. Future potential pump stations also would have unit control centers that communicate data and control status back to the existing SCADA control center.

The ROW would be periodically inspected by an aerial patrol. Surface traffic would be limited to workers performing pipeline and valve maintenance, periodic monitoring and inspection, and emergency repairs to the pipeline or associated equipment.

The permanent work force for pipeline operation would be an incremental increase of eight full time positions, probably stationed at Casper or Gillette. Pipeline maintenance, as required, would be done with local contractors specializing in this type of work. The annual cost of pipeline operation and maintenance is expected to be approximately $3.75 to $4.5 million per year, depending upon delivery volumes.

No hazardous materials or wastes would be used or produced as part of the Project operation.

2.2.4.1 Transmission Lines

Transmission lines necessary to provide electricity for aboveground facilities would be permitted, constructed, and operated by local utility providers.

2.2.4.2 Rupture Scenario Monitoring

Pinhole leaks during operation of the pipeline could occur but would not be expected to be serious. The leak would probably cause a high-pitched sound made by the escaping gas and would form a white frost spot on the ground. Periodic inspection would identify such leaks, which would be repaired.

2.2.5 Abandonment

BLM standard stipulations would be followed as part of the abandonment process, as discussed in the POD. At the Project termination, all surface facilities would be removed, and the disturbed acreage would be reclaimed. The areas would be reshaped to blend into adjoining areas to the extent permitted by existing conditions. All disturbed areas would be seeded with the appropriate seed mixture to ensure that an acceptable stand of vegetation is established.

2.3 No Action Alternative

The No Action Alternative would be the denial of the requested ROW. This means that the Project would not be authorized across federal lands. Neither the benefits nor the impacts outlined in this EA would be realized.

2.4 Alternatives Considered but Eliminated From Detailed Analysis

2.4.1 Truck Transportation of CO_2

Truck transportation of CO_2 from the Lost Cabin Gas Plant or other sources would require approximately 105 to 450 trucks each day. Many of the existing roads could not accommodate the increased traffic volume and would need to be expanded. Transportation of CO_2 by truck would not provide a reasonable alternative to the Proposed Action. The large numbers of trucks, long distances involved, and the much greater costs inherent in this alternative would not offer reduced environmental or socioeconomic impacts nor offer other advantages.

2.4.2 Northern Alternative

The Northern alternative originally was examined via helicopter in an attempt to shorten the length of the pipeline. This alternative would deviate from the proposed route in the vicinity of MP 10, and would proceed east and northward to rejoin the proposed route in the vicinity of MP 83 (just south of the proposed I-25 crossing). This alternative would have shortened the Project length by approximately 17 miles.

Constructing the 20-inch-diameter pipeline segment along this route would result in several significant constructability concerns. The alternative route does not follow any existing utilities and is not within a designated utility corridor. The terrain along this alternative route is extremely rugged and would require special construction techniques for much of its length. The rugged terrain would be extremely difficult to reclaim/revegetate and would be prone to ongoing erosion.

3.0 Affected Environment

This chapter describes the environmental baseline conditions in the area potentially affected by the Project. The BLM's NEPA Handbook (H-1790-1) requires that all EAs address certain Critical Elements of the Human Environment. These critical elements are presented in Chapters 3.0 and 4.0 where the element is discussed. The following elements do not occur within the Project area or would not be affected and therefore are not discussed further in the EA.

- ACECs;
- Hazardous or Solid Wastes;
- Prime or Unique Farmlands; and
- Wild and Scenic Rivers.

3.1 Climate and Air Quality

3.1.1 Climate

The climate in the Project area is characterized by large annual variations in temperature, low precipitation, and high winds. The Project crosses two ecological climate sub-regions as defined by the U.S. Department of Agriculture (USDA) Forest Service (USFS): the Great Plains-Palouse Steppe and the Intermountain Semi-Desert Provinces (McNab and Avers 1994). Roughly, the southwestern portion of the Project is within the Intermountain Semi-Desert Province and crosses into the Great Plains-Palouse Province at about MP 35. At MP 35, the Project descends from 6,000 feet above mean sea level (amsl) and into the plains. The two climate sub-regions have fairly similar climate, described as "cold continental with dry winters and warm summers. Temperature averages 39 to 45°Fahrenheit (F) (4 to 7°Celsius [C]). The growing season lasts 120 to 140 days." On average, the Great Plains-Palouse Province has slightly more precipitation than the Intermountain Semi-Desert Province (USFS 2008).

Climatological summaries of temperature and precipitation were examined for five stations near the Project area (listed from southwest to northeast): Jeffrey City, Casper, Midwest, Reno, and Weston (Western Regional Climate Center [WRCC] 2010). Comparative statistics are presented for all five stations in **Table 3-1**. Generally, temperature is more extreme at lower elevations, but the quantity and form of precipitation varies widely and does not follow any identifiable trend. Normals, means, and extremes in temperature, precipitation, and winds were examined for Casper, which is located southeast of the southern-most point of the Project route. The annual average maximum temperature is approximately 59 degrees Fahrenheit (°F), and the annual average minimum temperature is approximately 32°F. The record high temperature at Casper was 104°F in July 1954. The record low at Casper was -41°F in December 1990. The annual average total precipitation (water equivalent) is approximately 12 inches. Annual average snowfall at Casper is approximately 77 inches. The maximum monthly total of snow, ice pellets, and hail at Casper was 62.8 inches in December 1982. The mean wind speed at Casper was 12.8 miles per hour (mph), and the prevailing direction was from the southwest. The peak gust was 67 mph from the southwest and was recorded in January 1990.

Table 3-1 Climatological Measurements at Stations Near the Greencore Project

Station Name	Station Elevation (feet amsl)	Annual Average Precipitation (inches)	Annual Average Snowfall (inches)	Maximum Temperature (˚F)	Minimum Temperature (˚F)
Jeffrey City	6,340	10	57	98	-39
Casper	5,340	12	77	104	-41

Table 3-1 Climatological Measurements at Stations Near the Greencore Project

Station Name	Station Elevation (feet amsl)	Annual Average Precipitation (inches)	Annual Average Snowfall (inches)	Maximum Temperature (˚F)	Minimum Temperature (˚F)
Midwest	4,820	13	53	106	-40
Reno	5,080	11	22	103	-34
Weston	3,530	13	38	108	-47

3.1.2 Climate Change

3.1.2.1 Global Changes

Ongoing scientific research has identified the potential impacts of anthropogenic (man-made) greenhouse gas (GHG) emissions and changes in biological carbon sequestration due to land management activities on global climate. Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused CO_2 equivalents (CO_2e) concentrations to increase dramatically and are likely to contribute to overall global climatic changes. The Intergovernmental Panel on Climate Change (IPCC) recently concluded that “warming of the climate system is unequivocal” and “most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentration” (IPCC 2007).

Global mean surface temperatures have increased nearly 1.8°F from 1890 to 2006. Models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Northern latitudes (above 24°N) have exhibited temperature increases of nearly 2.1°F since 1900, with nearly a 1.8°F increase since 1970 alone. Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of GHGs are likely to accelerate the rate of climate change.

In 2001, the IPCC indicated that by the year 2100, the global average surface temperatures would increase 2.5 to 10.4°F above 1990 levels. The National Academy of Sciences has confirmed these findings, but also has indicated there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature would not be equally distributed, but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than increases in daily maximum temperatures. Increases in temperatures would increase water vapor in the atmosphere, and reduce soil moisture, increasing generalized drought conditions, while at the same time enhancing heavy storm events. Although large-scale spatial shifts in precipitation distribution may occur, these changes are more uncertain and difficult to predict.

As with any field of scientific study, there are uncertainties associated with the science of climate change. This does not imply that scientists do not have confidence in many aspects of climate change science. Some aspects of the science are known with virtual certainty, because they are based on well-known physical laws and documents trends (U.S. Environmental Protection Agency [USEPA] 2008).

Several activities contribute to the phenomenon of climate change, including emissions of GHGs (especially carbon dioxide and methane) from fossil fuel development, large wildfires, and activities using combustion engines; changes to the natural carbon cycle; and changes to radiative forces and reflectivity (albedo). It is important to note that GHGs would have a sustained climatic impact over different temporal scales. For example, recent emissions of carbon dioxide can influence climate for 100 years.

It may be difficult to discern whether global climate change is already affecting resources, let alone the study area. In most cases there is more information about potential or projected effects of global climate change on

resources. It is important to note that projected changes are likely to occur over several decades to a century. Therefore, many of the projected changes associated with climate change may not be measurably discernable within the reasonably foreseeable future.

3.1.3 Air Quality

All counties through which the Project would cross (Campbell, Johnson, Natrona, and Fremont in Wyoming and Powder River in Montana) are classified as attainment (meeting air quality standards) for all pollutants. The Primary and Secondary National Ambient Air Quality Standards for inhalable particulate matter with an aerodynamic diameter of 10 microns (µ) or less (PM_{10}) are 150 micrograms/cubic meter (µg/m^3) over a 24-hour period and 50 µg/m^3 over a year, respectively. Campbell, Natrona, and Fremont counties currently have PM_{10} monitors. There are no monitoring sites in Johnson County. Annual average PM_{10} concentrations in these counties vary from approximately 17.5 µg/m^3 to approximately 33 µg/m^3 compared to the annual standard of 50 µg/m^3. The maximum 24-hour PM_{10} concentration measured in these counties since 1994 was 112 µg/m^3 in 1995 in Campbell County. This compares favorably with the 24-hour PM_{10} standard of 150 µg/m^3. Background concentrations of criteria pollutants that potentially would be released as a result of the Project are listed in **Table 3-2**.

Table 3-2 Background Concentrations of Air Pollutants[1]

Pollutant and Averaging Period	Background Concentration	Source[2]
Carbon monoxide (CO) 1-hour	3,336	A
CO 8-hour	1,381	A
Nitrogen dioxide (NO_2) annual	3.4	B
Ozone (O_3) 8-hour	147	C
PM_{10} 24-hour	51	D
PM_{10} annual	21	D
Particulate matter with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$) 24-hour	30	D
$PM_{2.5}$ annual	8	D
Sulfur dioxide (SO_2) 3-hour	93	E
SO_2 24-hour	32	E
SO_2 annual	4	E

[1] Devon Bairoil to Beaver Creek CO_2 Pipeline Project Environmental Assessment (BLM 2007b).

[2] A = Data collected by Amoco at Ryckman Creek for an 8 month period during 1978-1979, summarized in the Riley Ridge EIS (BLM 1983). B = Data collected at Green River Basin Visibility Study site during the period January – December 2001 (ARS 2002). C = Data collected at Green River Basin Visibility Study site during the period June 10, 1998 - December 31, 2001 (ARS 2001). Data represents the top tenth percentile maximum 1-hour value. D = Data collected by the WDEQ at Lander, Wyoming, 2005 (personal communication with WDEQ, February 13, 2007). Data may be affected by the use of woodstoves. E = Data collected at Lost Cabin Gas Plant (preconstruction monitoring) Fremont County, Wyoming;1986-1987 LaBarge Study Area at the Northwest Pipeline Craven Creek site, 1982-1983 (WDEQ). All short-term data are second-maximum values unless otherwise specified. Annual data represent averages.

3.2 Geology and Soils

3.2.1 Geology

3.2.1.1 Topography and Physiography

The Project is located in two physiographic provinces. From west to east along the Project route are the Wyoming Basins province and the Unglaciated Missouri Plateau section of the Great Plains province

(Wyoming State Geological Survey [WSGS] 2010a,b,c). The Wyoming Basin province is characterized by plateaus and isolated mountain ranges and generally occupies the southwestern third of Wyoming (**Figure 3-1**). The Unglaciated Missouri Plateau consists of plateaus, terraces, badlands, and isolated mountain ranges. The proposed pipeline route begins in the Wyoming Basins province and enters the Unglaciated Missouri Plateau section in the vicinity of Arminto, Wyoming. Elevations along the proposed route range from 5,000 to 6,300 feet amsl from Lost Cabin to around Waltman, Wyoming. From Waltman to north of Gillette, Wyoming, elevations generally range from 5,500 feet to 4,000 feet amsl, with much variation as the route crosses corrugated and rolling hill topography. East of U.S. Highway 14 north of Gillette, the elevations drop below 4,000 feet amsl and where the Project terminates at Bell Creek, Montana, the elevation is about 3,680 feet amsl.

3.2.1.2 Stratigraphy

The bedrock geology consists of upper Cretaceous and lower Tertiary rocks along the length of the Project. **Table 3-3** lists the formations and deposits crossed by the proposed route.

Table 3-3 Geologic Formation and Deposits

Formation-Unit/Symbol	Period	Description
Alluvium, terrace, wind-blown deposits	Recent	Unconsolidated clay, silt sand, and gravels.
Wind River Formation	Lower Tertiary – Eocene	Poorly sorted sandstones and conglomerates with red to gray mudstones.
Mesaverde Formation	Upper Cretaceous	A highly variable unit consisting of lenticular sands, shale, siltstone, and coals.
Cody Shale	Upper Cretaceous	Dark gray shale with sandstone lenses in the lower part and fossiliferous beds in the upper part.
Fox Hills Sandstone	Upper Cretaceous	Light-colored fine to course-grained sandstone with interbedded siltstone and shale.
Lewis Shale	Upper Cretaceous	Dark gray marine shale becoming sandy at the top with interbedded carbonaceous shale and coal.
Fort Union Formation – Tullock Member	Lower Tertiary – Paleocene	Sandstone, mudstone, and coals.
Fort Union Formation – Lebo Member	Lower Tertiary – Paleocene	Shale with interbedded sandstone.
Wasatch Formation	Lower Tertiary - Paleocene	Interbedded sandstone and shale, claystone, and siltstone, carbonaceous shale, and coals.
Lance – Hell Creek Formations	Upper Cretaceous	Sandstones, carbonaceous shale, and coal. The Lance and Hell Creek Formations are equivalent; Hell Creek is used in the northeast Powder River Basin in Montana.

Sources: Love and Christiansen (1985); Watson (1980); Vuke et al. (2001); Winterfeld (2010).

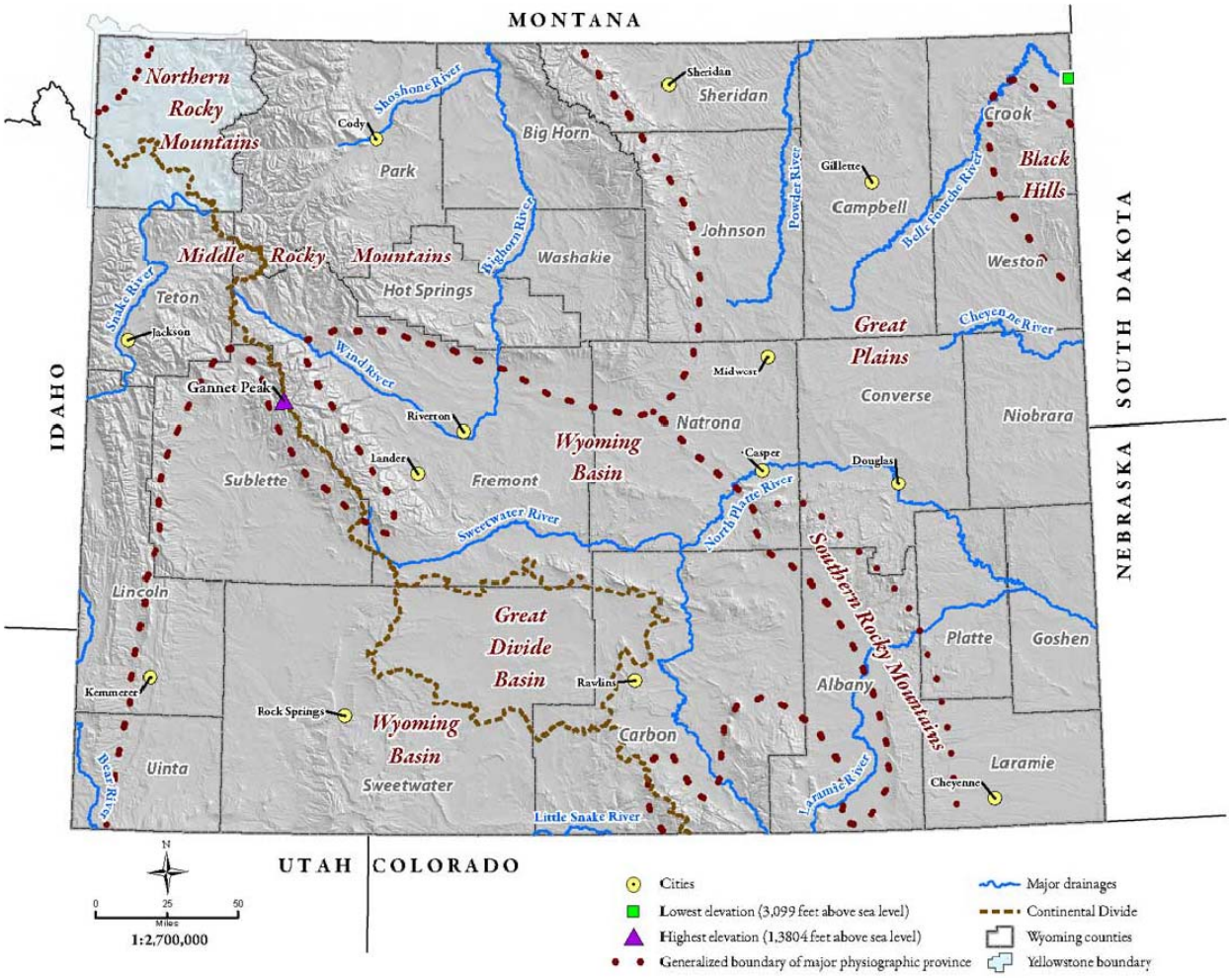


Figure 3-1 Physiographic Provinces of Wyoming

The Project lies in three structural domains: the Wind River Basin, the Casper Arch, and the Powder River Basin. The Wind River and Powder River Basins were created during the Laramide Orogeny that occurred at the end of Cretaceous time (**Figure 3-2**). The basins are asymmetric and contain thousands of feet of sedimentary rocks of varying lithologies and ages. At Lost Cabin, the Wind River Basin is near its deepest point and the sedimentary rock section is about 25,000 to 30,000 feet thick (Kent 1972). The Project crosses the Casper Arch between Waltman to just south of Sussex. The Casper Arch is an anticline-type of structural flexure that separates the Wind River Basin from the Powder River Basin and is a low-relief continuum between the north end of the Laramie Mountains that terminates at Casper, Wyoming, and the southern end of the Big Horn Mountains, 100 miles north of Casper. In the Powder River Basin, there is over 17,000 feet of sedimentary rock. In both the Wind River and Powder River Basins, the sedimentary rocks and deposits range in age from Cambrian to recent (Love et al. 1993).

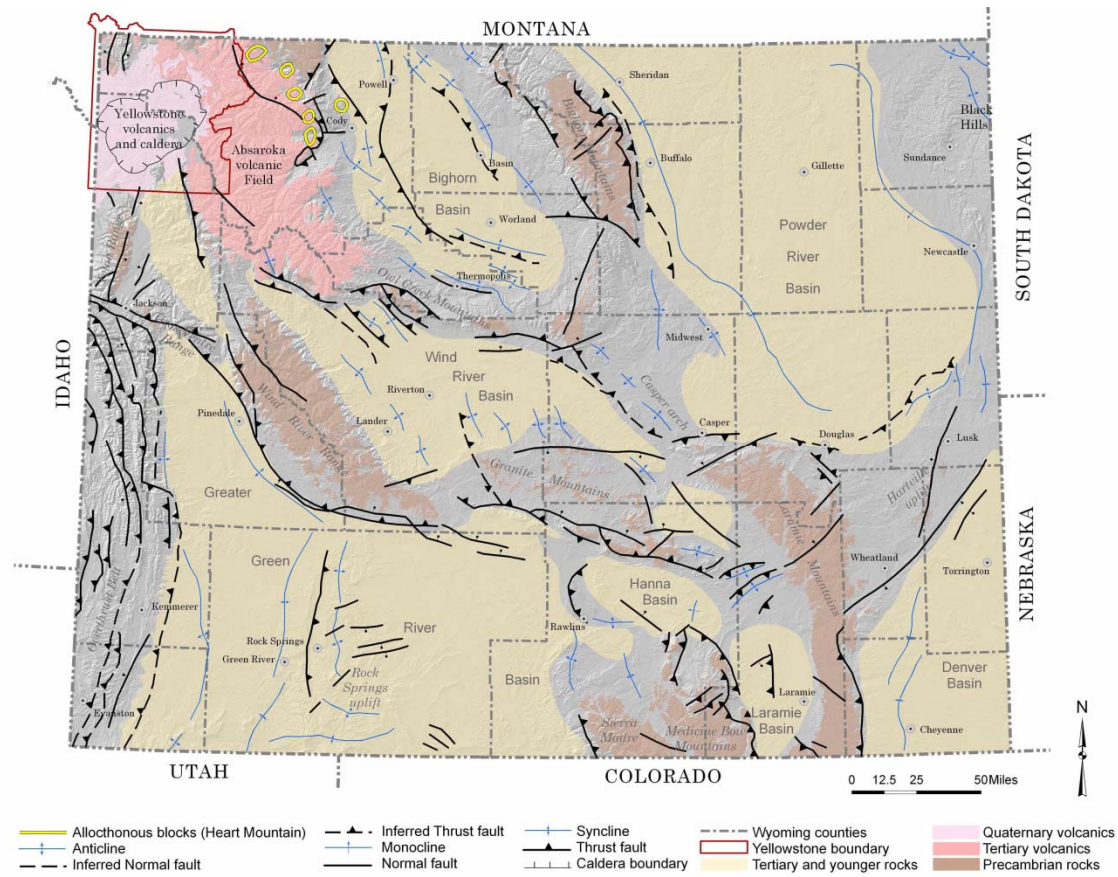


Figure 3-2 Structural Elements of Wyoming. Source: Wyoming State Geological Survey 2010a

Along the boundary between the Wind River Basin and the Casper arch is a series of deep reverse faults, while along the east boundary of the Casper Arch there is much less deformation (**Figure 3-2**). Reverse faults may be present at depth as the sedimentary strata dip down into the Powder River Basin.

3.2.1.3 Geological Hazards

Active Faults and Earthquakes

Faults are dislocations in the earth's crust and movement along faults is a primary cause of earthquakes. Faults have been mapped in geologic units of all ages, but many of the faults are not active. An active fault is defined as a fault that has had movement within the last 11,000 years (Holocene or Recent). There is an active fault called the Stagner Creek Fault to the west of Lost Cabin (Machette 1999). The Stagner Creek Fault trends northwest for about 18 miles, beginning just west of Lost Cabin. There is evidence for Holocene movement that consists of a 2-mile-wide area of surface displacement along the fault. There are no active faults along the Project and it does not cross the Stagner Creek Fault zone. The Project crosses the deep reverse faults along the west side of the Casper Arch, but these faults are not considered to be active.

The Project is in an area that is relatively quiet for earthquakes. A search of the U.S. Geological Survey (USGS) earthquake catalogue (1973 to present) showed 106 events in a circular area centered on MP 140 with a 162-mile radius. These earthquakes were mainly small magnitude events, but the strongest was a magnitude 5.5 (Richter Scale) that was recorded in 1984 in the north end of the Laramie Mountains, about 60 miles southeast of MP 50.

The USGS seismic hazard mapping indicates that ground motion in the Project area from a maximum credible earthquake would be less than 10 percent of the acceleration of gravity, with a 10 percent probability of exceedance in 50 years (Petersen et al. 2008).

Landslides

The Project crosses areas that may be susceptible to landslides (WSGS 2010b). There are numerous landslides in the area crossed by the Project in northeastern Campbell County. Most are small (several acres), but can be up to 40 acres and are generally block slides involving bedrock and unconsolidated materials on the slopes of buttes or drainages where the bedrock is the Fort Union Formation. The Project itself, however, does not cross documented landslides.

Subsidence

Ground subsidence may be caused by the dissolution of certain kinds of strata that result in subsurface voids that propagate to the surface or from the withdrawal of fluids such as groundwater or oil and gas. No subsidence hazards due to dissolution have been documented in the Project area (National Atlas 2009). Although large amounts of groundwater have been withdrawn for coal bed natural gas production, no surface subsidence effects have been documented in the Powder River Basin (WSGS 2010c)

3.2.2 Soils

The Project is located within the following 4 Major Land Resource Areas (MLRAs) of soil resources (USDA 2006):

- MLRA 32 – Northern Intermountain Desertic Basins;
- MLRA 34A – Cool Central Desertic Basins and Plateaus;
- MLRA 58A – Northern Rolling High Plains, Northern Part; and
- MLRA 58B – Northern Rolling High Plains, Southern Part.

The Northern Intermountain Desertic Basins MLRA is located from approximately MP 0.0 to MP 5.1 and MP 7.2 to MP 7.9. The soils generally are shallow to very deep, well drained, and loamy. The MLRA is in a syncline between anticlinal mountain ranges with elevations ranging from 3,900 to 5,900 feet. The average

annual precipitation in most parts of the basins is 6 to 12 inches, but can reach 22 inches in the higher areas within the basins. The freeze-free season ranges from 110 to 180 days.

The Cool Central Desertic Basins and Plateaus MLRA is located from approximately MP 5.1 to MP 7.2 and MP 7.9 to MP 45.4. The soils formed in slope alluvium or residuum derived from shale or sandstone. Soils that formed in stream- or river-deposited alluvium are near the major waterways. Generally, the soils are well drained and are calcareous. This area is bounded on most sides by mountains with elevations ranging from 5,200 feet to 7,500 feet. The average annual precipitation generally is 7 to 12 inches, but it ranges from 7 to 32 inches with a freeze-free season of 45 to 160 days.

The Northern Rolling High Plains (Northern Part) MLRA is located from approximately MP 220.3 to MP 231.1. The soils are generally shallow to very deep, well drained, and clayey or loamy. This area consists of gently rolling to steep eroded plateaus and terraces underlain by shale, siltstone, and sandstone, including areas of steep badlands bordering major streams and intermittent drainageways. Elevations range from approximately 2,950 to 3,280 feet, with an average annual precipitation of 8 to 22 inches, and a frost-free season of about 115 to 190 days.

The Northern Rolling High Plains (Southern Part) MLRA is located from approximately MP 45.4 to MP 220.3. The soils are generally shallow to very deep, well drained, and clayey or loamy. This area consists of gently rolling to steep eroded plateaus and terraces underlain by shale, siltstone, and sandstone, including areas of steep badlands bordering major streams and intermittent drainageways. Elevations range from approximately 2,950 to 5,900 feet, with an average annual precipitation of 9 to 27 inches, and a frost-free season of about 115 to 70 days.

Baseline information used to characterize soils was derived from Soil Survey Geographic (SSURGO) database review and analyses. SSURGO is the most detailed level of soil mapping done by the Natural Resources Conservation Service (NRCS) (Soil Survey Staff 2010). The data for North Johnson County are draft, and have not been correlated. The various soil map units within the Project area were combined into generalized groups of soils to evaluate potential impacts and to determine effective erosion control measures, reclamation, and revegetation potential in the area. Soils that are particularly susceptible to impacts and that may be disturbed during construction are considered “fragile” soils. Delineation of fragile soils was based on the following BLM criteria (BLM 2001):

- Shallow over bedrock (less than 20 inches);
- Underlain by lithic (hard) bedrock;
- Sand, loamy sand, or clay-textured surface and subsoil layers;
- Soils containing more than 35 percent coarse fragments by volume;
- Permeability less than 0.6 inch per hour;
- Water table less than 72 inches;
- Soil pH greater than 8.5, salinity more than 16 millimhos in the upper 40 inches; and
- Occupying slopes steeper than 15 percent.

While the potential for having a slope limitation is indicated by the soil map unit, actual steep slope locations also were identified (from 1:24,000 topographic maps) by MP locations along the Project route. Only significant areas of steep slopes (i.e., areas of at least 0.1 mile long) were identified. A list of sensitive soils is provided in **Appendix C**.

NRCS Order 3 soil surveys for Fremont, Natrona, Johnson, Campbell, and Powder River counties were used to characterize the types of soils crossed by the Project. In general, soils along the ROW in Fremont County are prone to water and wind erosion and range from loamy sand to clay loam textures. Depth to paralithic (soft) bedrock is variable and no shallow lithic bedrock is encountered in Fremont County. Depth to water is generally deep with the exception of the locations listed in **Appendix C**. Soils in Natrona county are generally

prone to water erosion and moderately erodible by wind. Soil textures range from clay to loamy sand. Depth to paralithic bedrock is variable and no shallow lithic bedrock is encountered by the Project. Depth to water is generally deep with the exception of the locations listed in **Appendix C**. In Johnson County, soils are generally erodible by water and moderately erodible by wind. Depth to paralithic bedrock is variable and only one location encountered shallow lithic bedrock along the ROW between MP 118.3 and MP 118.7. Depth to water is generally deep with the exception of the locations listed in **Appendix C**. Soil textures range from silty clay to loamy sand. Soils along the Project in southern Campbell county are slightly to highly erodible by wind and water and range from clay loam to loamy sand. Depth to paralithic (soft) bedrock is variable and no shallow lithic bedrock is encountered. Depth to water is generally deep with the exception of the locations listed in **Appendix C**. Soils along the Project in northern Campbell County generally are highly erodible by water and slightly to moderately erodible by wind. Soil textures range from clay loam to fine sandy loam. Depth to paralithic (soft) bedrock is variable and no shallow lithic bedrock is encountered. Depth to water is generally deep with the exception of the locations listed in **Appendix C**. Soils along the route in Powder River County are generally highly erodible by water and slightly to moderately erodible by wind. Soil textures range from silty clay loam to fine sandy loam. Depth to paralithic (soft) bedrock is variable and no shallow lithic bedrock is encountered. Depth to water is generally deep.

Soil limitations as they relate to pipeline operation and/or construction (limitations such as a high erosion potential or shallow depth to bedrock) are discussed in Chapter 4.0.

3.3 Mineral and Paleontological Resources

3.3.1 Mineral Resources

The major mineral resources in the vicinity of the Project are oil and gas (including coal bed natural gas [CBNG]), coal, uranium, bentonite, and aggregates (sand and gravel and clinker) (BLM 2009a,b, 2004).

3.3.1.1 Oil and Gas Resources

The Wind River Basin and the Powder River Basin are both prolific oil and gas producing areas. Cumulatively, the Wind River and Powder River basins have produced about 3.7 billion barrels of oil and 12.4 trillion cubic feet of gas (Dolton and Fox 1995; Fox and Dolton 1995; Wyoming Oil and Gas Conservation Commission 2010). **Table 3-4** provides a list of oil and gas fields crossed by the proposed route.

Table 3-4 Oil and Gas Fields Crossed by the Greencore Project

Approximate Milepost	Primary Product	Field Name
0.0 to 1.1	Gas	Lost Cabin
1.1 to 3.2	Gas	Madden – Lost Cabin
3.3 to 5.2	Gas	Cedar Gap
23.2 to 26.1	Gas	Waltman
39.6 to 39.6	Oil	Clark Ranch
79.6 to 80.2	Oil	Smokey Gap
100.2 to 101.3	Oil	Sussex
105.0 to 190.0	Gas	Powder River Basin Cbng
116.8 to 120.3	Oil	Jepson Draw, Nipple
143.9 to 144.6	Shut-In	Bugher Draw
148.5 to 149.3	Oil	Barber Creek, Dead Horse Creek South
161.2 to 163.8	Gas	Kingsbury Creek

Table 3-4 Oil and Gas Fields Crossed by the Greencore Project

Approximate Milepost	Primary Product	Field Name
170.1 to 176.3	Oil	Kitty
187.4 to 188.4	Shut-In	Squaw Creek, Gas Draw
225.0 to 230.0	Oil	Bell Creek

Sources: De Bruin (2002); Montana Board of Oil and Gas; Wyoming Oil and Gas Conservation Commission (2010).

3.3.1.2 Coal

The Project crosses outcrops containing coal in the Fort Union, Wasatch, and Mesaverde Formations. Both the Wind River and Powder River basins contain coal resources, but the Powder River Basin produces large amounts of coal. The Powder River Basin produced 446.5 million tons of coal in 2008, which accounted for 97 percent of Wyoming's coal production (BLM 2009a). The Tongue River and Lebo Members of the Fort Union Formation contain most of the coal reserves. Wasatch Formation coals are thinner and of lesser quality. The Project crosses areas of high development potential for coal north of Gillette from MP 175.0 to MP 190.0 (BLM 2009a). However, the Project does not cross active coal leases and mining areas. The Project also crosses coal-bearing rocks east of Waltman in the Fort Union and Mesaverde formations, but these coals are thin and have low mineable potential (BLM 2009b).

3.3.1.3 Uranium

Uranium also is a valuable mineral resource in the Wind River and Powder River Basins. The Powder River Basin hosts the only recently active in-situ uranium mining project in Wyoming – Smith Ranch. In-situ mining of uranium involves injecting solutions into deposits containing high values of uranium, leaching the deposit of the uranium, and pumping the uranium-laden solutions to the surface for processing. The Smith Ranch in-situ uranium project is located in Converse County and has produced over 28.9 million pounds of uranium (Wyoming Department of Revenue 2010a). There are no active uranium mines in the Wind River Basin. With the increase in demand and prices for uranium, a number of uranium exploration permits have been issued and some operators have applied for uranium recovery licenses from the U.S. Nuclear Regulatory Commission. The Project does not cross uranium exploration areas or areas of uranium development potential, although it skirts the west boundary of the Pumpkin Buttes Uranium District and the proposed Christen Ranch – Irigaray in situ recovery uranium project (COGEMA Mining, Inc.).

3.3.1.4 Bentonite

Bentonite is a clay mineral that results from the alteration of volcanic ash (BLM 2009a, 2004). Bentonite is an industrial mineral that has a number of uses, the most common as a main ingredient in drilling fluids. Bentonite is common in the Cretaceous rocks of Wyoming and is mined in several areas including the Powder River Basin. Bentonite is mined in southwestern Johnson County, but the Project, while crossing upper Cretaceous rocks that may contain bentonite, does not cross bentonite mining permit areas.

3.3.1.5 Aggregate

Sand and gravel deposits are found in alluvium associated with the major drainages (BLM 2009a,b, 2004). Clinker is rock adjacent to coal beds that has been altered when the coal has burned. Clinker is used as a road base and landscaping material (BLM 2009a). Clinker is common in the Powder River Basin and is especially prevalent along the coal outcrop in eastern Campbell County. There are no federally permitted gravel (mineral material) pits within 200 feet of the Project (BLM 2010d).

3.3.2 Paleontological Resources

3.3.3 Study Area

The study area for paleontological resources consists of the Project ROW (**Figure 1-1**), the access roads, ATWS, and ancillary facilities.

3.3.4 Regulatory Structure

Federal legislative protection for paleontological resources stems from the Antiquities Act of 1906 (Public Law [PL] 59-209; 16 U.S.C. 431 et seq.; 34 Stat. 225), which calls for protection of historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest on federally administered lands. Federal protection for scientifically important paleontological resources would apply to construction or other related impacts that would occur on federally owned or managed lands. Another federal law regulating paleontological resources is the Archaeological and Paleontological Salvage Act (23 U.S.C. 305). The act provides for funding for mitigation of paleontological resources discovered during Federal aid highway projects, provided that "excavated objects and information are to be used for public purposes without private gain to any individual or organization". In addition to the foregoing, the National Registry of Natural Landmarks provides protection to paleontological resources.

The BLM manages paleontological resources (fossils) on federal lands under the following statutes and regulations (BLM 2010e):

- Federal Land Policy and Management Act of 1976 (PL 94-579);
- National Environmental Policy Act of 1969 (PL 91-190);
- Various sections of BLM's regulations found in CFR Title 43 that address the collection of invertebrate fossils and, by administrative extension, fossil plants; and
- A recently enacted statute, the Paleontological Resources Preservation Act (PRPA), was passed in March 2009. The law authorizes the BLM and USFS to manage and provide protection to fossil resources using "scientific principles and expertise" (BLM 2010e).

In addition to the statutes and regulations listed above, fossils on public lands are managed through the use of internal BLM guidance and manuals. Included among these are the BLM Manual 8270 and the BLM Handbook H-8270-1 (BLM 2010e). Various internal instructional memoranda have been issued to provide guidance to the BLM in implementing management and protection to fossil resources.

3.3.5 Potential Fossil Yield Classification

Recently, the BLM has adopted the Potential Fossil Yield Classification (PFYC) system to identify and classify fossil resources on federal lands (BLM 2007c). Paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them. The probability for finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. Therefore, geologic mapping can be used for assessing the potential for the occurrence of paleontological resources.

The PFYC system is a way of classifying geologic units based on the relative abundance of vertebrate fossils or scientifically significant fossils (plants and invertebrates) and their sensitivity to adverse impacts. A higher class number indicates higher potential. The PFYC is not intended to be applied to specific paleontological localities or small areas within units. Although significant localities may occasionally occur in a geologic unit, a few widely scattered important fossils or localities do not necessarily indicate a higher class; instead, the relative abundance of significant localities is intended to be the major determinant for the class assignment.

The PFYC system is meant to provide baseline guidance for predicting, assessing, and mitigating paleontological resources. The classification should be considered at an intermediate point in the analysis, and should be used to assist in determining the need for further mitigation assessment or actions. The BLM intends

for the PFYC System to be used as a guideline as opposed to rigorous definitions. Descriptions of the potential fossil yield classes are summarized in **Table 3-5**.

Table 3-5 Potential Fossil Yield Classification

Class	Description	Basis	Comments
1	Igneous and metamorphic (tuffs are excluded from this category) geologic units or units representing heavily disturbed preservation environments that are not likely to contain recognizable fossil remains.	Fossils of any kind known not to occur except in the rarest of circumstances. Igneous or metamorphic origin. Landslides and glacial deposits.	The land manager's concern for paleontological resources on Class 1 acres is negligible. Ground disturbing activities would not require mitigation except in rare circumstances.
2	Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant invertebrate fossils.	Vertebrate fossils known to occur very rarely or not at all. Age greater than Devonian. Age younger than 10,000 years before present. Deep marine origin. Aeolian origin. Digenetic alteration.	The land manager's concern for paleontological resources on Class 2 acres is low. Ground disturbing activities are not likely to require mitigation.
3	Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence. Also sedimentary units of unknown fossil potential.	Units with sporadic known occurrences of vertebrate fossils. Vertebrate fossils and significant invertebrate fossils known to occur inconsistently; predictability known to be low. Poorly studied and/or poorly documented. Potential yield cannot be assigned without ground reconnaissance.	The land manager's concern for paleontological resources on Class 3 acres may extend across the entire range of management. Ground disturbing activities would require sufficient mitigation to determine whether significant paleontological resources occur in the area of a proposed action. Mitigation beyond initial findings would range from no further mitigation necessary to full and continuous monitoring of significant localities during the action.
4	Class 4 geologic units are Class 5 units (see below) that have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation.	Significant soil/vegetative cover; outcrop is not likely to be impacted. Areas of any exposed outcrop are smaller than two contiguous acres. Outcrop forms cliffs of sufficient height and slope that most is out of reach by normal means. Other characteristics that lower the vulnerability of both known and unidentified fossil localities.	The land manager's concern for paleontological resources on Class 4 acres is toward management and away from unregulated access. Proposed ground disturbing activities would require assessment to determine whether significant paleontological resources occur in the area of a proposed action and whether the action would impact the paleontological resources. Mitigation beyond initial findings would range from no further mitigation necessary to full and continuous monitoring of significant localities during the action.

Table 3-5 Potential Fossil Yield Classification

Class	Description	Basis	Comments
5	Highly fossiliferous geologic units that regularly and predictably produce invertebrate fossils and/or scientifically significant invertebrate fossils, and that are at risk of natural degradation and/or human-caused adverse impacts.	Vertebrate fossils and/or scientifically significant invertebrate fossils are known and documented to occur consistently, predictably, and/or abundantly. Unit is exposed; little or no soil/vegetative cover. Outcrop areas are extensive; discontinuous areas are larger than 2 contiguous acres. Outcrop erodes readily; may form badlands. Easy access to extensive outcrop in remote areas. Other characteristics that increase the sensitivity of both known and unidentified fossil localities.	The land manager's highest concern for paleontological resources should focus on Class 5 acres. Mitigation of ground disturbing activities is required and may be intense. Areas of special interest and concern should be designated and intensely managed.

Sources: BLM 2008, 2007c.

3.3.6 Fossil Potential

The bedrock formations crossed by the Project all have moderate to high fossil potential except for Recent unconsolidated deposits that have low potential. The fossil potential is summarized in **Table 3-6**.

Table 3-6 Paleontological Resources Potential

Formation-Deposit	Period	PFYC Rating	Fossil Types
Alluvium, terrace, wind-blown deposits	Recent	1 to 2	Not determined.
Wind River Formation	Lower Tertiary – Eocene	4 to 5	Vertebrates, invertebrates, and plants.
Mesaverde Formation	Upper Cretaceous	3	Vertebrates, invertebrates, and plants, and trace fossils.
Cody Shale	Upper Cretaceous	3	Vertebrates, invertebrates, and trace fossils.
Fox Hills Sandstone	Upper Cretaceous	3	Vertebrates, invertebrates, and trace fossils.
Lewis Shale	Upper Cretaceous	3	Vertebrates, invertebrates, and trace fossils.

Table 3-6 Paleontological Resources Potential

Formation-Deposit	Period	PFYC Rating	Fossil Types
Fort Union Formation – Tullock Member	Lower Tertiary – Paleocene	3	Vertebrates, invertebrates, plants, and trace fossils.
Fort Union Formation - Lebo Member	Lower Tertiary – Paleocene	3	Vertebrates, invertebrates, plants, and trace fossils.
Wasatch Formation	Lower Tertiary – Paleocene	4 to 5	Vertebrates, invertebrates, plants, and trace fossils.
Fort Union – Tongue River and Lebo Members	Lower Tertiary – Paleocene	3	Vertebrates, invertebrates, plants, and trace fossils.
Lance - Hell Creek Formations	Upper Cretaceous	4 to 5	Vertebrates, invertebrates, plants, and trace fossils.

Sources: Love and Christiansen 1985; Vuke et al. 2001; Winterfeld 2010.

3.4 Water Resources

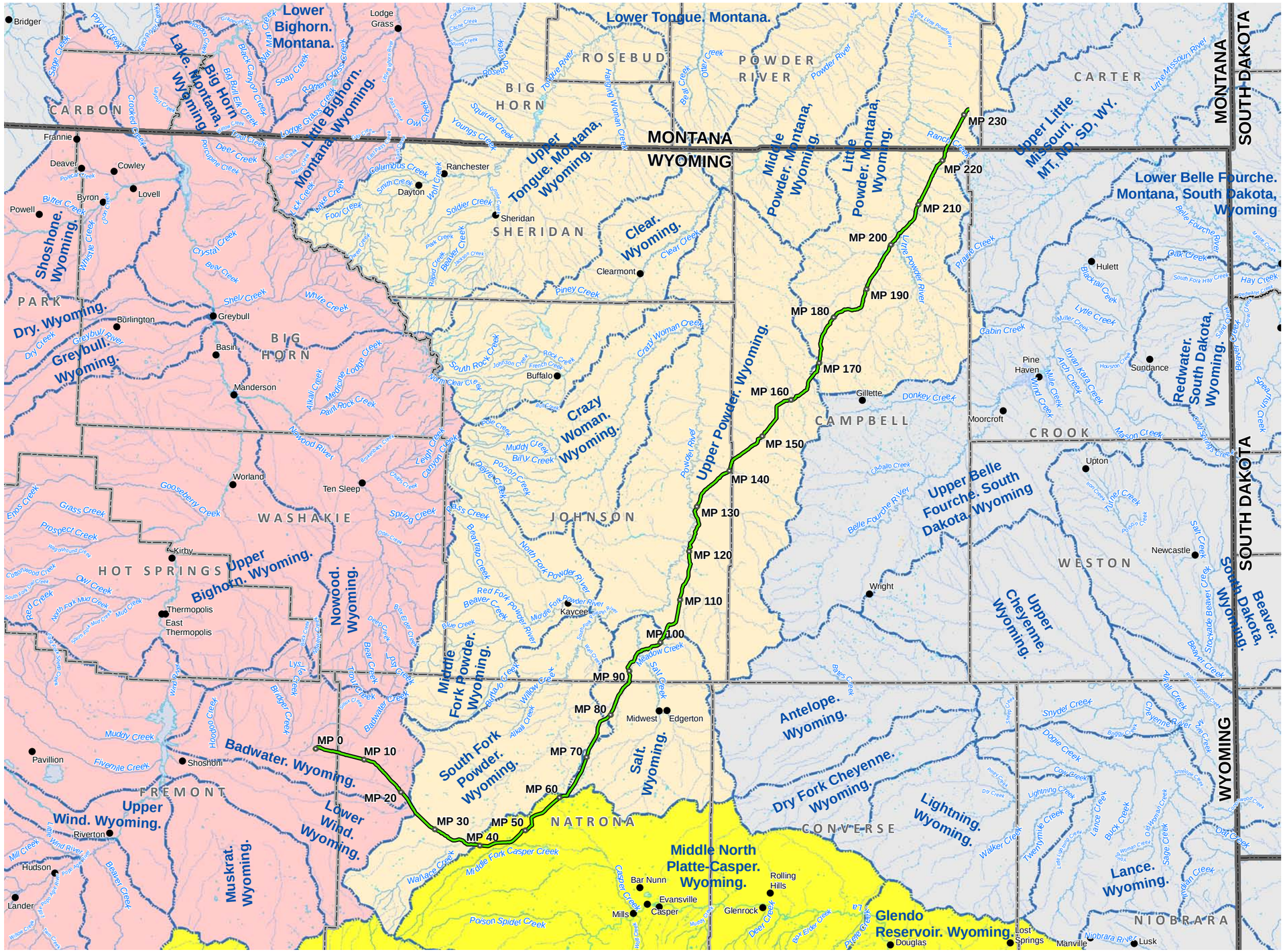
3.4.1 Surface Water

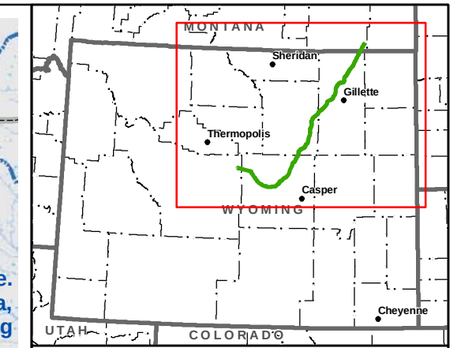
The Project would be located entirely within the Missouri River water resources region according to the USGS Hydrologic Unit Code (HUC) dataset (Watermolen 2002). **Table 3-7** details the basins and subbasins the Project would cross. **Figure 3-3** depicts the Project as it traverses these basins and subbasins. The first portion of the Project route, beginning at the Lost Cabin Gas Plant, would be located within the Badwater and Lower Wind Subbasins of the Big Horn River Basin. The route would continue southeast and cross within the South Fork Powder Subbasin of the Powder River Basin. The Project would cross Middle North Platte-Casper Subbasin of the North Platte River Basin, turn to the north, northeast, and re-enter the Powder River Basin to the Project termination point at Bell Creek Field. Subbasins that would be crossed by this latter traverse of the Powder River Basin would include South Fork Powder, Salt, Upper Powder, and Little Powder subbasins.

Table 3-7 Hydrologic Units Crossed by the Greencore Project

Region	Basin	Subbasin	HUC8 Code	From MP	To MP	Length (miles)
Missouri River	Big Horn River	Badwater, Wyoming	10080006	0.0	22.4	22.4
		Lower Wind, Wyoming	10080005	22.4	24.8	2.4
	Powder River	South Fork Powder, Wyoming	10090203	24.8	38.9	14.1
	North Platte River	Middle North Platte-Casper, Wyoming	10180007	38.9	60.9	22.0
	Powder River	South Fork Powder, Wyoming	10090203	60.9	61.4	0.4
		Salt, Wyoming,	10090204	61.4	71.5	10.2
		South Fork Powder, Wyoming,	10090203	71.5	78.9	7.3
		Salt, Wyoming,	10090204	78.9	101.5	22.6
		Upper Powder, Wyoming,	10090202	101.5	166.8	65.3
		Little Powder, Montana, Wyoming	10090208	166.8	231.1	64.8

Source: Watermolen 2002.





Legend

- Cities and Towns
- Milepost
- Proposed Main Centerline
- State Boundary
- County Boundary

Rivers/Streams

- Perennial
- Intermittent

Hydrologic Unit Subbasins

- Other Basins
- Powder-Tongue Basin
- Big Horn Basin
- North Platte Basin

Centerline: July 20, 2010
Print Date: August 11, 2010

0 5 10 20 Miles
0 5 10 20 Kilometers
1:1,250,000

N

Greencore CO_2 Pipeline Project

Figure 3-3

Hydrologic Unit Subbasins in the Project Vicinity

X:\0Projects\12603_003_GreencoreCO2PipelineEA\Figures\DocumentFigures\EA_2_DRAFT_20100811\Water Resources\FIG_3_4_HUCs_20100720CL.mxd

The Project would cross 18 perennial streams (1 or more times) that were identified by global positioning system and classified during on-the-ground field surveys conducted during the summer months of 2009 and 2010. The perennial streams that would be crossed by the Project are listed in **Table 3-8**. Numerous intermittent and ephemeral streams and minor drainages (approximately 200), also would be crossed by the Project. **Table 3-9** provides a summary of the number of streams crossed. **Appendix D** contains a complete tabulation of all waterbodies crossed or lying within the proposed temporary ROW of the Project. No wild or scenic rivers would be crossed by the Project.

The Little Powder River at approximately MP 203.1 is the most significant surface water resource that would be crossed by the Project. This river is rated Class 2AB by the WDEQ at this location, which is the most stringent classification crossed by the Project and indicates the stream supports game-fish populations. Average monthly stream discharges reported by the USGS from 1972 to 2008 at the Little Powder River above Dry Creek, near the Weston, Wyoming station ranged from 2.4 cubic feet per second (cfs) in December to 63 cfs in May. The maximum recorded streamflow during the same time was 5,300 cfs on May 19, 1978. In most years, discharges usually ranged from less than 1 cfs up to 1,000 cfs or more. Peak flows generally occurred in early spring.

Table 3-8 Perennial Streams Crossed One or More Times by the Greencore Project

Stream Name	Water Quality Classification	State	Subbasin	MP Number
South Fork Powder River	2C	Wyoming	South Fork Powder	36.7
Scott Creek	Not listed	Wyoming	Salt	83.2
Salt Creek	2C	Wyoming	Salt	95.5
Meadow Creek	2C	Wyoming	Salt	96.6–97.5
Carpenter Draw	Not listed	Wyoming	Upper Powder	104.1
Dry Fork Powder River	3B	Wyoming	Upper Powder	113.7
Pumpkin Creek	3B	Wyoming	Upper Powder	132.3
Beaver Creek	3B	Wyoming	Upper Powder	140.1
South Draw	Not listed	Wyoming	Upper Powder	147.0–147.1
North Prong Deadhorse Creek	3B	Wyoming	Upper Powder	148.5–148.6
Kingsbury Creek	3B	Wyoming	Upper Powder	160.0
Wild Horse Creek	3B	Wyoming	Upper Powder	161.4
Road Creek	Not listed	Wyoming	Little Powder	175.9
Horse Creek	3B	Wyoming	Little Powder	199.3–199.4
Little Powder River	2AB	Wyoming	Little Powder	203.1
Trail Creek	3B	Wyoming	Little Powder	218.3
Ranch Creek	B-2	Montana	Little Powder	225.2–225.3
Bell Creek	B-2	Montana	Little Powder	231.1

[1] According to the Wyoming Surface Water Classification List (WDEQ 2001), "the classification list does not contain an exhaustive listing of all the surface waters in the state. Those not specifically listed are classified as follows: Those waters supported by an approved UAA containing defensible reasons for not protecting aquatic life uses shall be 4A, 4B or 4C; the remaining waters shall be 3A, 3B or 3C."

Table 3-9 Count of Waterbodies Crossed[1] by the Greencore Project

	Ephemeral	Intermittent	Open Water	Perennial	Grand Total
Wyoming					
Fremont County	5	1	0	0	6
Natrona County	83	22	0	2	107
Johnson County	26	4	2	8	40
Campbell County	41	20	1	8	70
Montana					
Powder River County	0	0	0	2	2
Total	**155**	**47**	**3**	**20**	**225**

[1] Table count considers multiple crossings of one waterbody separately (i.e., of the 18 perennial streams, 2 are crossed twice).

3.4.1.1 Surface Water Quality

In Wyoming, 4 major classes of surface water, with various subcategories within each class, are identified by the Wyoming Department of Environmental Quality, Water Quality Division (WDEQ 2007). Wyoming waters are individually classified to 1 of the 4 major water quality classifications with Class 1 being the highest quality, and Class 4 the lowest. Montana Department of Environmental Quality classifies surface waters by drainage or tributary segments into 3 common and 6 uncommon major classes, with subcategories within most classes (MDEQ 2006a). Of the 3 common major classifications in Montana, Class A is the highest quality and Class C is the lowest. The streams crossed by the Project generally are classified as either Class 3 or 4 in Wyoming with only several exceptions of Class 2 waters and as Class B in Montana (**Table 3-8** and **Appendix D**), under the appropriate water quality standards. A narrative description of the major water quality classifications is included in **Appendix D** (WDEQ 2007; MDEQ 2006a).

Water quality standards for surface water in both states also establish numerical criteria for pH, turbidity, dissolved oxygen, and temperature along with a list of pollutants. The standards in Wyoming require "toxic materials attributable to or influenced by the activities of man shall not be present in any Wyoming surface water in concentrations or combinations which constitute 'pollution.'" The standards continue on to define the levels or concentrations that constitute said pollution (WDEQ 2007). In Montana, MDEQ has established numeric water quality parameters for pollutants that are categorized as toxic, carcinogenic, bioconcentrating, radioactive, nutrient, or harmful (MDEQ 2008).

3.4.1.2 Water Use

Water use in the state of Wyoming is managed by the Wyoming State Engineer's Office (WSEO). The North Platte River Basin's water resources are highly appropriated and have special conditions restricting new uses of water according to stipulations of the Nebraska v. Wyoming Modified North Platte Decree and the Platte River Cooperative Agreement (U.S. Supreme Court 2001). Water in the North Platte Basin has been fully appropriated, and these agreements effectively prevent the development of new uses with the exception of stock, domestic, and municipal uses.

The Montana Department of Natural Resources and Conservation, Water Resources Division manages the use and conservation of water in the State of Montana.

3.4.1.3 Floodplains

A floodplain is defined as the low-lying area near a waterway or drainage that can be expected to be inundated by high flows in a given recurrence interval. The Federal Emergency Management Agency (FEMA) maintains and updates floodplain maps through the National Flood Insurance Program. These maps have limited availability in areas of low population, such as the Project area. They are produced in several formats, including paper maps, scanned images for use in Geographic Information System (GIS), and in fully-digital and attributed polygon files also for use in GIS (Q3 data). Both scanned maps and Q3 data were available for portions of the Project area. Where these sources were not available, USGS 1:24,000 topographic maps were analyzed to determine low-lying, flood-prone areas.

No areas with a high risk of flood (100-year floodplain or 1 percent chance of flood in any given year) would be crossed in Fremont County (FEMA 2002) or Natrona County (FEMA 1996). The USGS 1:24,000 topographic maps in Johnson County named “Dead Woman Crossing” and “Hoe Ranch,” were analyzed in lieu of FEMA maps because they were unavailable. The topographic maps indicate that the Project would potentially cross flood-prone areas at Salt Creek and along the Powder River floodplain, respectively. FEMA Q3 digital flood data for Campbell County (FEMA 2008) indicate the Project would cross the 100-year floodplain of Wild Horse and Boxelder creeks, Wildcat Creek floodplain, Little Power River, Duck Creek, and Antelope Creek floodplains. The available data for Powder River County, Montana (FEMA 1979), indicate that no high-risk flood areas would be crossed in that county by the Project.

3.4.2 Groundwater

Groundwater along the Project occurs in river alluvium and consolidated geologic deposits of sandstone, lignite, shale, and limestone. The only major alluvial aquifer system that would be crossed by the Project is the Little Powder River crossing (Zelt et al. 1999). Other minor alluvial aquifers occur at Salt Creek and the Powder River (Hodson et al. 1973).

Alluvial deposits can potentially yield 1,000 gallons per minute, depending on saturated thickness and grain composition. Alluvial deposits are composed of unconsolidated silt, sand, and gravel (Hodson et al. 1973). The water level is usually within a few feet of the water’s elevation in the stream.

Other groundwater formations underlying the Project route are characterized by water-bearing units that occur at greater depths than alluvial deposits. These units are of Tertiary and Cretaceous age and are composed of semi-consolidated to consolidated sandstone interbedded with shale and coal. They are commonly known as the Fort Union Formation, the Hell Creek Formation, and the Fox Hills Sandstone. Wells that have been drilled in these aquifers indicated depths to groundwater measuring 300 to 900 feet below ground surface (Whitehead 1996).

3.4.2.1 Groundwater Quality

Groundwater in Montana and Wyoming has been classified in order to apply standards to protect water quality. Groundwater within each state is classified by use and by ambient water quality. A summary of groundwater classifications in each state is included in **Appendix D** (MDEQ 2006b; WDEQ 2005).

Groundwater quality along the Project generally is poor with total dissolved solids frequently exceeding 1,000 milligrams per liter (mg/L) in the southern portions, and generally between 500 and 1,000 mg/L in the northern portions. These values generally constitute Class II or III groundwater within the Project area. Groundwater types consist of sodium-sulfate along the southern portions of the Project and sodium-bicarbonate towards the northern portions (Hodson et al. 1973).

3.5 Vegetation, Wetlands, Agriculture, and Range Resources

3.5.1 Vegetation and Wetlands

The Project area is located entirely within the Powder River Basin floristic region of northeastern Wyoming and southeastern Montana, and characterized by flat to low rolling terrain with intermittent terraces, steep slopes,

and rocky ridges. Vegetation community characterizations were compiled from aerial photograph interpretation and field verification of each land use-land cover type. Five vegetation cover types occur within the Project area and include grassland/shrubland (i.e., rangeland), upland forest/woodland, agriculture, riparian, and developed lands. Distribution and composition of each vegetation cover type varies based on landscape position, soil type, climatic conditions, moisture, elevation, aspect, and grazing and land management practices. Descriptions of the plant communities within each vegetation cover type are provided in the following text. Species nomenclature is consistent with the NRCS Plants Database (USDA 2009). **Table 3-10** summarizes the vegetation cover types and associated linear miles along the proposed route.

Table 3-10 Vegetation Cover Types within the Greencore Project Area

Vegetation Cover Type	Linear Miles	Percent of Project Route
Grassland/shrubland	225.9	97.8
Wetland/waterbodies	1.1	0.5
Previously Disturbed	1.4	0.6
Agriculture	1.9	0.8
Upland forest/woodland	0.8	0.3
Total	**231.1**	**100.0**

Grassland/shrubland

Approximately 226.9 miles (97.8 percent) of the proposed route would cross grassland/shrubland habitat. Grassland/shrubland habitats most commonly occupy valley bottoms, plains, foothills, plateaus, and benches. This vegetation cover type is dominated by big sagebrush (*Artemisia tridentata*), black sagebrush (*Artemisia nova*), and bud sagebrush (*Picrothamnus desertorum*), and codominated by antelope bitterbrush (*Purshia tridentata*) and rabbitbrush species (*Chrysothamnus* sp.). Common graminoid species include western wheatgrass (*Pascopyrum smithii*), needlegrass (*Achnatherum* sp.), needle-and-thread (*Hesperostipa comata*), Sandberg bluegrass (*Poa secunda*), threadleaf sedge (*Carex filifolia*), bluebunch wheatgrass (*Pseudoroegneria spicata*), little bluestem (*Schizachyrium scoparium*), and Indian ricegrass (*Achnatherum hymenoides*). Common forb species include buckwheat (*Erigonum* sp.), bluebells (*Mertensia* sp.), broom snakeweed (*Gutierrezia sarothrae*), and soapweed yucca (*Yucca glauca*). Perennial herbaceous components typically contribute less than 25 percent vegetative cover. This habitat provides forage for domestic livestock and wildlife and, within the project area, is the vegetation cover type most commonly used for livestock grazing.

Waters of the U.S., Wetlands, Riparian Areas

WUS are defined in 33 CFR Part 328.3 and include all non-tidal waters that currently are, or were used in the past, or may be susceptible to use in interstate commerce; all interstate waters including wetlands; all other waters such as interstate lakes, rivers, streams (including intermittent streams), mud flats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate commerce; and all impoundments of waters otherwise defined as WUS under this definition. In addition, tributaries of the above listed waters, including arroyos and other intermittent drainages, and wetlands adjacent to the above waters also are considered to be WUS.

Criteria used by the USACE to determine whether a drainage constitutes a WUS include presence of a defined bed (i.e., a linear bed in a topographic depression which would transport surface water from a watershed); presence of defined banks (i.e., near vertical or steep-sided banks formed by erosion from flowing water); and evidence of an ordinary high water mark (i.e., indicator[s] that the drainage is subject to surface water flows on an average annual basis; such indicators include a scoured bed, shelving, an absence of terrestrial vegetation and recent alluvial or litter deposition).

As described above, wetlands adjacent to other WUS, such as streams, also are considered to be WUS. In addition, and as used in this section, the term “wetlands” has a regulatory definition as defined in 33 CFR 328.7(b). The term “wetland” is defined as “those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.” Note that the frequency and duration of saturation may vary by geographical region, and is largely dependent upon local climatic conditions.

Under the USACE’s 1987 Wetland Delineation Manual, a "three-parameter" approach is required for delineating USACE-defined wetlands (USACE 1987). Based on this approach, areas are identified as wetlands if they exhibit the following characteristics:

- The prevalence of vegetation consisting of hydrophytic species or plants that have the ability to grow in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content and depleted soil oxygen levels.
- The presence of soils that are classified as hydric or possessing characteristics that are associated with reducing soil conditions. Hydric soils are poorly drained and have a seasonal high water table within 6 inches of the surface.
- An area which is inundated either permanently or periodically at mean water depths less than or equal to 6.6 feet or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation (usually 12.5 percent of the growing season) (USACE 1987; WTI 1995). Within the Project area, an area would need to be saturated for a period of approximately 15 days to support vegetation adapted to saturated soils based on the average number of days above 32 degrees Fahrenheit (i.e., 120 days*0.125) (NRCS 2006).

The USACE (1987) requires that, under normal circumstances, all three of these conditions be met for an area to be considered a wetland under the USACE’s definition. Federal mandates governing regulatory enforcement in wetlands and other WUS include Section 10 of the Rivers and Harbors Act of 1899 (Section 10), Sections 401 and 404 of the Clean Water Act, as amended (33 U.S.C. 1251 *et seq*.), and Executive Order 11990, Protection of Wetlands (42 Federal Register [FR] 26961). Final regulatory authority and delineation boundaries for wetlands and WUS within the Project area lie with the USACE.

Riparian areas are generally defined as the vegetated transitional zones that lie between aquatic and terrestrial (or upland) environments. Riparian areas usually occur as belts along streams, rivers, lakes, marshes, bogs, and other water bodies. As a transitional zone between aquatic and upland environments, riparian systems often exhibit characteristics of both; but are not as dry as upland environments or as wet as aquatic or wetland systems. Generally, only perennial and intermittent streams can support riparian areas that serve the entire suite of riparian ecological functions. Ephemeral streams rarely possess the hydrologic conditions that allow true riparian vegetation to grow.

The riparian vegetation cover type, occupying approximately 1.1 miles (0.5 percent) of the proposed route, is a habitat composed of a mosaic of palustrine emergent wetlands (PEM), perennial, intermittent, and ephemeral waterbodies, and open water (i.e., natural and manmade ponds). These systems are dependent on a natural hydrologic regime, especially annual or episodic flooding, occurring within floodplains, islands, sand or cobble bars, and immediate streambanks that support perennial (e.g., Salt Creek, Meadow Creek, Little Powder River, South Fork Powder River, and Ranch Creek) and intermittent waterbodies throughout the Project area. Dominant species include boxelder (*Acer negundo*), narrowleaf cottonwood (*Populus angustifolia*), quaking aspen (*Populus tremuloides*), eastern cottonwood (*Populus deltoides*), Fremont cottonwood (*Populus fremontii*), peachleaf willow (*Salix amygdaloides*), chokecherry (*Prunus virginiana*), skunkbush sumac (*Rhus trilobata*), Drummond’s willow (*Salix drummondiana*), narrowleaf willow (*Salix exigua*), silver buffaloberry (*Shepherdia argentea*), snowberry species (*Symphoricarpos* sp.), and sedge species (*Carex* sp.).

Prior to field survey commencement, a desktop review of the National Wetland Inventory (NWI) database in conjunction with aerial photographic interpretation was completed to identify the spatial extent of hydrological features within the Project area. On-the-ground wetland and waterbody delineations were conducted in 2009 and 2010 along the proposed pipeline route and access roads. The following features were identified within the Project area: 16 PEM complexes, 155 ephemeral waterbodies, 47 intermittent waterbodies, 18 perennial waterbodies, and 3 open water features. A detailed waterbody crossing table is presented in Section 3.4, Water Resources.

Previously Disturbed

Approximately 1.4 miles (0.6 percent) of the proposed route would cross previously disturbed land, which is typically characterized as ROWs including roads, railroads, and utility corridors. This cover type only includes ROWs that are crossed by the Project centerline; in other words, the 1.4 miles listed above does not include areas where the Greencore ROW is collocated with existing utility ROWs (210 miles, 91 percent of route is collocated). Therefore, the miles of previously disturbed land is misleading. In areas where the Project is collocated, the mileage of the reclaimed, adjacent ROW was included in the grassland/shrubland vegetation cover type instead of previously disturbed land.

Agriculture

Approximately 1.9 miles (0.8 percent) of the proposed route would cross agricultural lands. The agriculture vegetation type is characterized by both dryland (i.e., areas of grasses, legumes, or grass-legume mixtures) and pivot irrigated cropland (i.e., areas used for production of annual crops such as corn and soybeans).

Upland forest/woodland

Approximately 0.8 mile (0.3 percent) of the proposed route would traverse the upland forest/woodland vegetation type. This vegetation cover type, restricted to the Project area within Powder River County, Montana, is characterized by moderately sloping to very steep sideslopes on shallow, rocky soils. Dominant species include ponderosa pine (*Pinus ponderosa*) and understory species such as big sagebrush, rabbitbrush, western wheatgrass, squirreltail (*Elymus elymoides*), broom snakeweed, and Indian ricegrass. This vegetation type is used for livestock grazing and wildlife habitat.

3.5.1 Noxious Weeds

An increasing concern on both public and private lands is the introduction, spread, and proliferation of noxious weed and invasive plant species. Pursuant to the Montana Department of Agriculture and the Montana Annotated Code, a ‘noxious weed’ is defined as “any exotic plant species established or that may be introduced in the state that may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities” (Montana Legislative Services 2009). Montana currently declares 32 plant species as state-designated noxious weeds based on the following categorical characterizations:

- Category 1 noxious weeds (15 species total) are weeds that are currently established and generally widespread in many counties of the state. Management criteria include awareness and education, containment and suppression of existing infestations and prevention of new infestations. These weeds are capable of rapid spread and render land unfit or greatly limit beneficial uses.
- Category 2 noxious weeds (10 species total) have recently been introduced into the state or are rapidly spreading from their current infestation sites. These weeds are capable of rapid spread and invasion of lands, rendering lands unfit for beneficial uses. Management criteria include awareness and education, monitoring and containment of known infestations and eradication where possible.
- Category 3 noxious weeds (6 species total) have not been detected in the state or may be found only in small, scattered, localized infestations. Management criteria include awareness and education, early detection and immediate action to eradicate infestations. These weeds are known pests in nearby states and are capable of rapid spread and render land unfit for beneficial uses.

- Category 4 noxious weeds (1 species total) are invasive plants and may cause significant economic or environmental impacts if allowed to become established in Montana. Management criteria include prohibition from sale by the nursery trade. Research and monitoring may result in the plant being listed in a different category (Montana Department of Agriculture 2010).

Pursuant to the Wyoming Weed and Pest Control Act of 1973, a total of 23 plant species are defined as designated and prohibited noxious weed species (Designated Noxious Weeds .S. 11-5-102 (a)(xi) and Prohibited Noxious Weeds W.S. 11-12-104) (Wyoming Department of Agriculture no date). In addition to the Wyoming state designated species, management is required for additional county-specific species for Natrona, Johnson, and Fremont counties, Wyoming and BLM noxious weed species for the Buffalo, Lander, and Casper FOs.

As required by the BLM as an integral component of the environmental impact evaluation, noxious weed surveys were conducted along the proposed pipeline route for all Montana and Wyoming state-designated species between September to November 2009 and April to July 2010. Noxious weed populations were identified and mapped within the 200-foot-wide pipeline ROW corridor for both the proposed route and potential reroutes. The Noxious Weed Management Plan POD (Appendix K) lists all aforementioned noxious weed species and further summarizes species distribution within the Project area based on known population records and field identified populations.

3.5.2 Agriculture and Range Resources

The proposed pipeline route is characterized as a patchwork of BLM, State of Wyoming, State of Montana, and private surface ownership parcels encompassing numerous private ranching operations and 64 BLM grazing allotments (i.e., BLM-managed federal parcels designated for authorized grazing privileges). Ranching activities in the Project area include cow-calf, yearling, and sheep grazing operations.

Table 3-11 summarizes each BLM grazing allotment within the Project area, including acreage calculations, current stocking rates, and permitted uses. Grazing capacities within the Project area vary based on vegetation types (range sites), landform, slope, and range condition. Grazing capacities range from 0.1 to 11.4 acres per animal unit month (AUM); areas with low carrying capacities occur in lower average annual precipitation zones (less than 9 inches annually) and, conversely, moderate carrying capacities would correlate to higher average annual precipitation rates (9 to 12 inches annually).

Table 3-12 summarizes range improvements within the Project area. Improvements consist of water retention and diversion structures (reservoirs/dams, ditches, pipelines, etc.), well and spring developments, fencing, livestock containment structures, and roads. The 18 perennial waterbodies crossed by the Project are the source for the water-based improvements (**Table 3-8**).

3.5.3 Threatened, Endangered, Candidate, and Sensitive Plant Species

Special status species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Seventeen special status plant species including federally listed, federally proposed, and federal candidate; and BLM and state sensitive species were identified as potentially occurring within the Project area (BLM 2010f; USFWS 2010; WYNDD 2010). The potential occurrence of special status plant species within the Project area was based on range, known distribution, and the presence of suitable habitat crossed by the Project (**Appendix E**). Of the 17 species, a total of 12 species were eliminated from detailed analysis based on rationale presented in **Appendix E**. The remaining five species, which have the potential to occur within the Project area, as detailed in **Appendix E** include the following species: Porter's sagebrush, blowout penstemon, persistent sepal yellowcress, limber pine, and Ute's ladies'-tresses orchid.

Table 3-11 Grazing Allotments within the Greencore Project Area

Grazing Allotment Name	Total Allotment Acreage	Total Allotment Active AUMs[1]	Allotment Acreage within the Project Area	Projected Active AUMs within the Project Area[2]	Livestock		Grazing Period		Type of Use
					Type	Stocking Rate	Begin	End	
33 Mile SDW	38,755.8	0	60.0	0.0	C	9	1-Nov	26-Dec	M
Beck Place	29,767.6	1,550	86.8	4.5	C,H	259	1-Mar	28-Feb	I
Brown Kennedy Ranch	32,541.0	501	64.6	1.0	C	42	1-Mar	28-Feb	A
Burke	69,421.5	3,693	46.3	2.5	C,H	2,176	1-Mar	28-Feb	I
Camel's Hump	10,948.6	447	52.6	2.1	C,H	59	1-Mar	28-Feb	I
Carpenter Draw	2,157.3	81	0.0	0.0	C	7	2-Mar	28-Feb	A
Castle Creek	19,833.8	1,026	27.5	1.4	C,S,H	350	1-Mar	28-Feb	M
Crenshaw Hill	5,853.8	87	20.2	0.3	C	72	1-Mar	28-Feb	C
Crooked Creek	26,578.1	2,694	63.8	6.5	C	345	1-Mar	28-Feb	A
Daly Livestock Co	55,446.8	1,107	124.9	2.5	C	615	1-Mar	28-Feb	A
Dead Horse Creek Oilfield	6,390.1	216	76.4	2.6	C	18	1-Mar	28-Feb	A
Deadhorse II	10,543.2	286	29.5	0.8	C,H	73	1-Mar	28-Feb	M
Dry Trail Creek	4,855.4	389	38.8	3.1	C	32	1-Mar	28-Feb	C
Dugout Creek	13,647.5	2,434	63.9	11.4	C	221	1-Mar	28-Feb	A
East Spring Draw	25,192.8	550	54.3	1.2	C	46	1-Mar	28-Feb	A
Eccles	13,815.0	1,286	55.9	5.2	C,H	281	1-Apr	28-Feb	I
Eighty-Five Divide	12,827.1	384	27.9	0.8	C	32	1-Mar	28-Feb	A
Falxa	40,007.6	1,546	46.7	1.8	C	560	1-Mar	28-Feb	A
Flying U Ranch	22,739.9	819	103.7	3.7	C	511	15-May	16-Aug	A
Government Draw	4,098.6	380	17.5	1.6	C	63	1-Mar	28-Feb	A

Table 3-11 Grazing Allotments within the Greencore Project Area

Grazing Allotment Name	Total Allotment Acreage	Total Allotment Active AUMs[1]	Allotment Acreage within the Project Area	Projected Active AUMs within the Project Area[2]	Livestock		Grazing Period		Type of Use
					Type	Stocking Rate	Begin	End	
Gowin	14,662.8	260	22.3	0.4	C	22	1-Mar	28-Feb	C
Hines	3,641.4	24	34.3	0.2	C	2	1-Mar	28-Feb	A
Hoe Ranch	35,254.3	1,676	102.6	4.9	S	1486	1-Mar	28-Feb	A
Horse Creek/Pipeline	1,281.4	8	15.9	0.1	C	80	1-Jun	30-Nov	C
Kingsbury/Wild Horse	7,204.1	33	33.2	0.2	C	100	1-Mar	28-Feb	
Kingsbury/Wild Horse	NA	NA	NA	NA	H	37	1-Mar	28-Feb	A
Little Willow	24,060.8	823	80.9	2.8	C	69	1-Mar	24-Feb	C
Little Willow	NA	NA	NA	NA	S	30	15-Apr	15-Feb	A
Madden Ranch Past	5,529.2	170	2.6	0.1	NA	NA	NA	NA	NA
Meadow Creek	10,074.5	248	71.4	1.8	C	172	1-Mar	28-Feb	A
Miller	10,150.8	312	17.7	0.5	C,H	26	1-Mar	28-Feb	C
Mumma Draw	9,229.3	54	28.0	0.2	C	4	1-Mar	28-Feb	C
North Mitten	2,542.5	21	2.6		NA	NA	NA	NA	NA
North Of Tracks	17,788.9	2,205	52.4	6.5	NA	NA	NA	NA	NA
Okie Trail	45,862.8	3,064	84.2	5.6	C	554	1-Mar	28-Feb	M
Paul Place	3,305.9	202	32.1	2.0	C,H	29	1-Mar	28-Feb	C
Pine Mountain	13,861.8	641	38.1	1.8	C	206	1-Mar	28-Feb	C
Pine Ridge	3,552.8	27	21.1	0.2	C	59	1-Aug	31-Dec	A
Potter	17,773.2	2,448	25.8	3.6	C	271	1-Mar	28-Feb	I
Powder River Draw	6,366.6	229	40.9	1.5	C	57	1-Mar	28-Feb	M
Pumpkin Creek	28,999.5	1,454	74.9	3.8	C	263	1-Mar	28-Feb	A
Railroad	19,863.9	1,477	103.3	7.7	C	206	1-Mar	28-Feb	I

Table 3-11 Grazing Allotments within the Greencore Project Area

Grazing Allotment Name	Total Allotment Acreage	Total Allotment Active AUMs[1]	Allotment Acreage within the Project Area	Projected Active AUMs within the Project Area[2]	Livestock		Grazing Period		Type of Use
					Type	Stocking Rate	Begin	End	
Ryan	3,738.8	46	12.1	0.1	C	4	1-Mar	28-Feb	C
SF Holler Draw	4,107.2	26	34.9	0.2	C	16	1-Mar	28-Feb	C
Shamrock	5,876.1	569	40.0	3.9	C,S	92	1-Mar	28-Feb	I
Skidmore Estate	4,571.0	9	10.2	0.0	S	50	1-Jun	1-Sep	A
Smoky Gap-H. Jarra	6,524.9	262	20.0	0.8	C,H	53	16-Jun	28-Feb	M
South Carpenter Draw	2,612.7	11	53.7	0.2	C	50	1-Mar	28-Feb	A
South Cave Gulch	14,810.5	395	69.2	1.8	C,H	650	1-Mar	28-Feb	M
South Fork Casper	3,867.0	236	8.7	0.5	C	21	1-Mar	28-Feb	C
Springsteen	1,319.6	679	0.9	0.4	C	172	1-Mar	28-Feb	M
St. Clair South Pa	4,955.5	814	9.1	1.5	NA	NA	NA	NA	NA
Sullivan	19,863.9	2,299	52.6	6.1	C,S	1,965	1-Mar	7-Sep	I
Summer Brewer	8,745.1	374	24.3	1.0	C	108	1-Mar	28-Feb	C
Swartz, Edward H.	15,045.3	496	32.1	1.1	C	370	1-Mar	28-Feb	A
Throne John and Earl	6,642.9	24	0.0	0.0	C	66	1-Mar	28-Feb	A
Trail Creek	30,178.8	2,629	32.0	2.8	C	249	1-Mar	28-Feb	A
Ttt-Scotts Place	8,888.1	589	47.3	3.1	C,G,H	139	1-Jul	28-Feb	M
Tuttle Draw	1,598.6	92	9.4	0.5	C	100	1-Mar	28-Feb	A
Tuttle Draw/Deep Creek	8,618.2	154	15.4	0.3	C	182	1-Mar	28-Feb	A
Waltman	6,363.9	205	7.9	0.3	C,H	93	16-May	31-Oct	C
Weidt	3,336.5	221	23.2	1.5	C	49	1-Jul	28-Feb	M

Table 3-11 Grazing Allotments within the Greencore Project Area

Grazing Allotment Name	Total Allotment Acreage	Total Allotment Active AUMs[1]	Allotment Acreage within the Project Area	Projected Active AUMs within the Project Area[2]	Livestock		Grazing Period		Type of Use
					Type	Stocking Rate	Begin	End	
Wormwood Ranch	85,691.2	2,491	172.1	5.0	S	1000	1-Mar	28-Feb	A
Wormwood Ranch	NA	NA	NA	NA	C	361	1-Mar	28-Feb	A
Wyatt Draw	814.6	11	20.2	0.3	S	14	1-Mar	28-Feb	C
Total	**6,201,922.4**	**47,463**	**2,831.4**	**128.2**	**NA**	**NA**	**NA**	**NA**	**NA**

[1] An AUM represents the quantity of forage necessary to sustain 1 cow-calf pair or 5 sheep for 1 month.

[2] Projected active AUMs were calculated based on the percentage of the allotment within the Project area compared to the allotment as a whole.

“A” denotes active use, “C” denotes custodial use, “M” denotes maintain or healthy rangeland status, “I” denotes need for improvement.

NA = Information not available for analysis.

Table 3-12 Range Improvements within the Greencore Project Area

Grazing Allotment Name/Range Improvement per Allotment	Legal Location				
	Meridian	Township	Range	Section	Subdivision
Crooked Creek					
Johnny #2 (reservoir)	6th Principal	14	4	25	NENW
Indian Draw Fence	6th Principal	43	80	35	W2E2
Johnny #1 (reservoir)	6th Principal	14	5	30	NESE
Johnson Ditch	6th Principal	14	4	17	SESE
Moreau Division Fence	6th Principal	14	4	25	NENE
Dugout Pasture Fence	6th Principal	41	79	32	--
Well Dugout Pasture	6th Principal	42	79	18	SE
Dugout Well	6th Principal	42	80	25	--
Macy Fence	6th Principal	14	4	21	NW4SE4
Crooked Creek Stock Facility	6th Principal	41	79	5	NESE
Daly Livestock Co.					
Twentymile Pipeline	6th Principal	51	74	4	NWNW
Timber Creek Pipeline	6th Principal	52	74	21	NENE
Dugout Creek					
Freiberg Pit (reservoir)	6th Principal	6	16	17	SENW
Freiberg Fence	6th Principal	6	16	8	NWNW
Freiberg Reservoir	6th Principal	6	16	17	SENW
Dugout Pipeline	6th Principal	40	79	6	NWSW
East Spring Draw					
Mieko Fence	6th Principal	42	86	2	NENE
Cole Draw Well	6th Principal	43	78	30	NWNE
Meike Emergency Pipeline	6th Principal	42	79	14	NENE
Falxa					
Falxa Pipeline Extension	6th Principal	47	78	32	SWSE
Falxa Divide Fence	6th Principal	47	78	27	SESE
Falxa Pipeline Extension	6th Principal	46	78	11	--
Flying U Ranch					
Short Creek Spring Development	6th Principal	54	71	28	--
Hoe Ranch					
Jepson Draw Stockwater Well	6th Principal	45	77	18	SWNW

Table 3-12 Range Improvements within the Greencore Project Area

Grazing Allotment Name/Range Improvement per Allotment	Legal Location				
	Meridian	Township	Range	Section	Subdivision
Horse Creek/Pipeline					
Gray Sky Fence	6th Principal	11	3	25	NENE
Magnuson Stockwater Pipeline	6th Principal	55	71	28	NESE
Little Willow Allotment					
Skyline Fence	6th Principal	13	4	24	SENW
Cook Burke Fence 1	6th Principal	14	4	33	SWSE
Sect 13 SC Dam	6th Principal	14	4	13	NWSE
Sect 13 NW Dam	6th Principal	14	4	13	SENW
SEC 13&24 Division Fence	6th Principal	13	4	13	NESE
Pumpkin Creek					
Upper Culp East Fence	6th Principal	47	77	10	--
Pumpkin Hill Well	6th Principal	46	77	9	NENE
Culp Divide Fence	6th Principal	47	77	11	--
PR Fed 12-9 Road	6th Principal	47	77	8	E2
Big Mike Flats Fence	6th Principal	48	77	18	W2NE4
Swartz, Edward H.					
Spring Draw Pipeline	6th Principal	54	72	30	SWSE
Lower Batz Drive Fence	6th Principal	54	72	33	SENW
Batz Draw Fence	6th Principal	54	72	29	NWSW
Swartz Fence 1	6th Principal	53	72	9	NWSE
Batz Draw Pipeline	6th Principal	54	72	33	NESW
Trail Creek					
Rockypoint Reservoir	6th Principal	56	69	4	NESE
Tuttle Draw/Deep Creek					
Beecham Draw Reservoir	6th Principal	11	2	20	NWSW
South Slope Pit (reservoir)	6th Principal	11	2	28	NWSE
Cut Blade Reservoir	6th Principal	11	2	20	SWNW
P. Davis Fence	6th Principal	11	2	21	NESW
South Slope Pit Snowfence	6th Principal	11	2	28	NW4NE4
Sutton Reservoir	6th Principal	11	2	15	SWSW
Crook Road Pit (reservoir)	6th Principal	11	2	28	SWNE
Arrowhead Reservoir	6th Principal	11	2	28	NWNE
P J Reservoir	6th Principal	11	2	28	NWSE

Table 3-12 Range Improvements within the Greencore Project Area

Grazing Allotment Name/Range Improvement per Allotment	Legal Location				
	Meridian	Township	Range	Section	Subdivision
P J Fence	6th Principal	11	2	28	NWNE
Wormwood Ranch					
Flora Fence	6th Principal	47	76	5	--
Burger Fence	6th Principal	48	77	22	--
Wormwood Pipeline	6th Principal	46	77	1	--

Source: AECOM 2010d.

Suitable habitat for each species was determined through the implementation of a species-specific habitat suitability model based on soil, geology, and vegetation association parameters and known distribution records. **Table 3-13** summarizes each species analyzed in detail and indicates where within the Project area the species may occur based on the implementation of the suitability model, aerial photographic interpretation, on-site field verification, and species-specific surveys. After further analysis, it was determined through the use of the suitability model that potential habitat does not occur within the Project area for limber pine. Suitable habitat for the Porter's sagebrush and blowout penstemon was further defined based on species-specific surveys as conducted on June 15 through 19, 2010. Suitable habitat for persistent sepal yellowcress was further defined based on species-specific surveys conducted on July 23 through 30, 2010. Suitable habitat for the Ute's ladies'-tresses orchid was further defined based on species-specific surveys conducted on August 2, 2010, and August 16 through 18, 2010.

Table 3-13 Special Status Plant Species Potentially Occurring within the Greencore Project Area

Common Name	Scientific Name	Status[1]	Potentially Suitable Habitat Areas (MP) (20100714 CL)[2]
Porter's sagebrush	*Artemisia porteri*	BLM	MP 2.0-5.4; 5.9-6.8; 10.5-21.7; 23.3-25.5 (P); 28.4-33.3 (P); 61.0-61.1; 72.0-75.9 (P); 80.3-80.7 (P); 81.9-82.4 (P); 82.7-83.1 (P)
Limber pine	*Pinus flexilis*	BLM	No potential habitat locations were identified based on the species-specific habitat suitability model.
Blowout penstemon	*Penstemon haydenii*	FE	MP 47.4-50.4 (P); AR 2D (P)
Persistent sepal yellowcress	*Rorippa calycina*	BLM	MP 95.4
Ute's ladies'-tresses orchid	*Spiranthes diluvialis*	FT	MP 148.5; 199.3

[1] BLM = BLM Sensitive Species; FE = Federally Listed as Endangered; FT = Federally Listed as Threatened.

[2] P = Partially suitable habitat and partially unsuitable habitat noted within the indicated MP range.

3.6 Wildlife Resources

3.6.1 Recreationally and Economically Important Species and Nongame Wildlife

As discussed in Section 3.5, Vegetation, Wetlands, Agriculture, and Range Resources, the Project route would cross five habitat types including grassland/shrubland, upland forest/woodland, agriculture, wetland/

waterbodies, and developed lands. The Project area is characterized by flat to low rolling terrain with intermittent terraces, steep slopes, and rocky ridges. Baseline descriptions of both resident and migratory wildlife include species that have either been documented along the Project route or those that may occur in the Project region based on habitat associations. Wildlife species that may occur along the majority of the Project route are typical of the grassland/shrubland communities of central/northeast Wyoming and southeast Montana. Species that inhabit wetland/waterbody habitat are limited to the Powder River, perennial and intermittent drainages, and ponds and marshes that are either crossed by the Project or occur in the surrounding uplands.

3.6.1.1 Big Game Species

Big game species that occur in the Project region include pronghorn, mule deer, and elk (BLM 2007a, 2001a, 2000b, 1987; WGFD 2004). Seasonal ranges considered to be crucial for these species during the winter months (generally November 15 to April 30) include habitats that provide adequate forage and thermal cover for over-winter survival and reproduction requirements, particularly during extreme winters.

Pronghorn occur throughout the majority of the region crossed by the Project. Pronghorn inhabit grasslands and semi-desert shrublands on flat to rolling topography and browse on shrubby plants, especially sagebrush, throughout the year. During the winter, pronghorn generally utilize areas of relatively high sagebrush densities and overall low snow accumulations, on south- and east-facing slopes. Crucial winter/yearlong range for this species occurs along 20.1 miles of the Project ROW (**Table 3-14**).

Table 3-14 Big Game Ranges Crossed by the Greencore Project

Species	Habitat Type[1]	Mileposts	Miles Crossed
Pronghorn	Crucial Winter/Yearlong	1.0 – 3.3	2.3
		3.5 – 3.7	0.2
		5.0 – 6.4	1.4
		10.3 – 10.9	0.6
		18.2 – 19.3	1.1
		39.7 – 54.2	14.5

[1] Source: WGFD 2010b.

Mule deer also occur throughout the majority of the region associated with the Project, inhabiting virtually all vegetation types. Mule deer feed on a wide variety of plants including forbs, grasses, sedges, shrubs, and trees. Like pronghorn, winter habitat for mule deer occurs in areas of relatively high sagebrush densities and overall low snow accumulation, on south- and east-facing slopes. The Project route does not cross mule deer crucial winter range.

Elk occur in a variety of habitats in the Project region including coniferous forests, aspen, shrublands, grasslands, and agricultural areas. However, they tend to occur in low densities on large tracts of private land along the majority of the Project route. The Greencore route does not cross elk crucial winter range or parturition range.

3.6.1.2 Small Game Species

Small game species that occur within the Project area include upland game birds, small mammals, furbearers, and waterfowl. Upland game birds that occur within the Project area include greater sage-grouse, sharp-tailed grouse, gray (Hungarian) partridge, and mourning dove. The greater sage-grouse is a BLM sensitive species and discussed further under Section 3.6.2, Threatened, Endangered, Candidate, and Sensitive Wildlife Species. Sharp-tailed grouse occur in a wide variety of habitats including grasslands, agricultural areas, and

shrublands. Sharp-tailed grouse populations are known to occur along the Project route in portions of northeastern Wyoming and southeast Montana. Gray (Hungarian) partridge are associated with grasslands, shrublands, and agricultural areas and are considered widespread but not common in the northern portions of the Project region (Stokes and Stokes 1996; WGFD 2004). Mourning dove occur in habitats ranging from deciduous forests to shrubland and grassland communities, often nesting in trees or shrubs near riparian areas or water sources. Small game mammals likely to occur within the Project area include desert cottontail and white-tailed jackrabbit.

Furbearers likely to occur along the Project route include beaver, raccoon, striped skunk, muskrat, mink, long-tailed weasel, short-tailed weasel, badger, bobcat, coyote, and red fox (BLM 2007a,b; MFWP 2010c; WGFD 2004). These species have a wide distribution in Wyoming and Montana and are found within a variety of habitat types including grasslands, riparian woodlands, coniferous forests, and sagebrush shrublands.

Numerous species of waterfowl nest and migrate through the region, especially in the vicinity of the Powder River. Common waterfowl species along the Project route include Canada goose, mallard, green-winged teal, northern pintail, gadwall, and American widgeon. Other common summer residents include blue-winged teal, cinnamon teal, northern shoveler, redhead, and ring-necked duck (BLM 2007a; Stokes and Stokes 1996; WGFD 2004).

3.6.1.3 Nongame Species

A diversity of nongame species (e.g., small mammals, raptors, passerines, amphibians, and reptiles) occupies a variety of trophic levels and habitat types along the Project route. Common nongame wildlife species include small mammals such as bats, voles, squirrels, gophers, prairie dogs, woodrats, and mice. These small mammals provide a substantial prey base for predators in the Project region including larger mammals (coyote, badger, bobcat), raptors (eagles, buteos, accipiters, owls), and reptiles (snakes). The white-tailed prairie dog and black-tailed prairie dog are BLM sensitive species and are discussed further in Section 3.6.2, Threatened, Endangered, Candidate, and Sensitive Wildlife Species. A number of bat species also occur within the Project region including long-legged myotis, little brown myotis, big brown bat, and western small-footed myotis. BLM sensitive bat species are discussed further in Section 3.6.2, Threatened, Endangered, Candidate, and Sensitive Wildlife Species.

<u>Raptors and Other Migratory Birds</u>

Nongame birds encompass a variety of passerine and raptor species including migratory bird species that are protected under the Migratory Bird Treaty Act (16 U.S.C. 703-711) and Executive Order (EO) 13186 (66 FR 3853). Pursuant to EO 13186, a Memorandum of Understanding (MOU) between the BLM and USFWS outlines a collaborative approach to promote the conservation of migratory bird populations. The purpose of the MOU is to strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and avoid or minimize adverse impacts on migratory birds in coordination with state, tribal, and local governments. This MOU identifies specific activities where cooperation between the BLM and USFWS would contribute to the conservation of migratory birds and their habitat.

Raptor species that could potentially occur as residents or migrants within the Project region include eagles (bald and golden eagles), buteos (e.g., red-tailed hawk, Swainson's hawk, ferruginous hawk), falcons (e.g., prairie falcon, American kestrel), accipiters (e.g., Cooper's hawk, sharp-shinned hawk), owls (e.g., great-horned owl, burrowing owl, long-eared owl, short-eared owl), northern harrier, and turkey vulture (BLM 2007a; Stokes and Stokes 1996; WGFD 2004). Breeding raptor surveys were conducted along the proposed ROW, known access roads, and ATWS using aerial inventory procedures. The aerial raptor surveys were conducted on May 27 and 28, 2010, to identify occupied territories or active nest sites located within 1.0 mile from the outside edge of the ROW boundary. Aerial surveys focused on cliff nesters (e.g., golden eagle, falcon species) and species that commonly build nests in deciduous trees or on promontory points (e.g., red-tailed hawk, Swainson's hawk, ferruginous hawk, great-horned owl). The aerial surveys did not concentrate on cavity nesters (e.g., American kestrel), ground nesters (e.g., northern harrier), sub-terranean nesters (e.g., burrowing owl), or most conifer nesters (e.g., accipiters), based on visibility limitations from the helicopter. These species would be surveyed for during additional ground surveys that would be conducted in spring 2011

if construction occurs during the raptor breeding season (generally February 1 to July 31). In addition, ground surveys would be conducted at nest sites where either breeding status could not be determined or in areas that were identified as potentially supporting nesting birds during the 2010 aerial surveys.

Based on the results of the 2010 breeding raptor surveys and other biological surveys, 215 nest sites (43 new and 172 historic) were identified within 1.0 mile of the Project ROW. Of these 215 nest sites, 33 were active, and 182 were inactive (AECOM 2010a). The active nest sites were occupied by bald eagles (3); golden eagles (2); red-tailed hawks (17); Swainson's hawk (1); ferruginous hawks (2); prairie falcons (2); great horned owls (3); and American kestrel and unknown (2).

A variety of passerines occur within the Project region throughout the year; however, they are most abundant during the spring/fall migration as well as during the breeding season (May 15 to June 30 [Nicholoff 2003]). Representative bird species that occur in the Project region include Say's phoebe, horned lark, barn swallow, black-billed magpie, American raven, western meadowlark, and lark bunting (BLM 2007a; Stokes and Stokes 1996; WGFD 2004).

Reptiles

Reptiles occupying the Project region are typically limited by their specific habitat requirements. Species that could potentially occur within the Project area include the eastern short-horned lizard, northern sagebrush lizard, and prairie rattlesnake (Baxter and Stone 1980; BLM 2007a,b; WGFD 2004).

3.6.2 Threatened, Endangered, Candidate, and Sensitive Wildlife Species

Special status species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Twenty-six special status wildlife species including federally listed, federally proposed, and federal candidate; and BLM sensitive species were identified as potentially occurring within the Project area (BLM 2010f, 2007a; USFWS 2010; WGFD 2010a; WYNDD 2010). The potential occurrence of special status species within the Project area was based on range, known distribution, and the presence of potentially suitable habitat crossed by the Project route (**Appendix E**). A total of seven wildlife species were eliminated from detailed analysis (Preble's meadow jumping mouse, pygmy rabbit, northern goshawk, peregrine falcon, Baird's sparrow, white-faced ibis, trumpeter swan) based on rationale presented in **Appendix E**. The remaining 19 wildlife species that have the potential to occur along the Project route are discussed below.

3.6.2.1 Mammals

Black-footed Ferret

The black-footed ferret (*Mustela nigripes*) is classified as a federally endangered species. The historic range of this species included the Rocky Mountain and western Great Plains regions of North America (Fitzgerald et al. 1994). This species utilizes semi-arid grasslands and mountain basins associated with prairie dog colonies. The only known populations of black-footed ferrets are either captive or have been reintroduced, with no natural wild populations known to occur. In Wyoming, the known distribution of this species is limited to a non-essential experimental population area within the Shirley Basin approximately 35 miles southeast of Casper (WGFD 2005). While suitable habitat (i.e., white-tailed and black-tailed prairie dog colonies) does occur along the Project route, the USFWS has "block-cleared" all prairie dog colonies along the Project route in Wyoming (USFWS 2004). No prairie dog colonies are crossed by the Project ROW in Montana (AECOM 2010c).

White-tailed Prairie Dog

The white-tailed prairie dog (*Cynomys leucurus)* is classified as a BLM sensitive species. White-tailed prairie dogs inhabit xeric sites with mixed shrubs and grasses. This species is often associated with sagebrush and saltbrush and tends to occupy higher elevations than the black-tailed prairie dog (MFWP 2010a; WGFD 2005). In Wyoming, the white-tailed prairie dog is found in the western two-thirds of the state, excluding the areas

near Yellowstone and Grand Teton National Parks (WGFD 2005). In Montana, this species is limited to the extreme south-central portion of the state (MFWP 2010a).

Aerial and ground white-tailed prairie dog surveys were conducted from September 20 and 22, 2009, April 13 to 17, 2010, and May 5 to June 4, 2010, respectively, to determine location, size, and density of active colonies. Six active white-tailed prairie dog colonies, encompassing 189.6 acres, were located within 0.25 mile of the Project ROW (AECOM 2010c). Based on the results of these surveys the potential for this species to occur along the Project route is considered high.

Black-tailed Prairie Dog

The black-tailed prairie dog (*Cynomys ludovicianus*) is classified as a BLM sensitive species. Black-tailed prairie dogs inhabit shortgrass prairie and mixed grasslands that contain suitable upland soil types for constructing extensive burrow systems. In Wyoming, the historical range of this species included much of eastern Wyoming and the Bighorn Basin (WGFD 2005). The current distribution of this species is similar to the historic range and includes mountain-foothills and shrublands along the southern end of the Bighorn Mountains as a habitat link between the eastern grasslands and the Bighorn Basin. In Montana, this species is found throughout the eastern portion of the state in suitable sparse grassland and shrubland habitats (MFWP 2010b).

Aerial and ground black-tailed prairie dog surveys were conducted from September 20 and 22, 2009, April 13 to 17, 2010, and May 5 to June 4, 2010, respectively, to determine location, size, and density of active colonies. Twenty-two active black-tailed prairie dog colonies, encompassing 389.8 acres, were located within 0.25 mile of the Project ROW (AECOM 2010c). Based on the results of these surveys the potential for this species to occur along the Project route is considered high.

Swift Fox

The swift fox (*Vulpes velox*) is classified as a BLM sensitive species. The swift fox was once distributed throughout the prairie regions from southern Canada, south through the Great Plains of the U.S. (WGFD 2005). Currently, this species exists in several highly disjunct populations in small portions of its historic range. Swift fox habitat is composed of level to gently sloping topography containing an open view of the surrounding landscape, abundant prey, and lack of predators and competitors (MFWP 2010d; WGFD 2005). In Wyoming, this species occurs in the eastern half of the state and inhabits short- and mid-grass prairies, often using highways and railroad ROWs for denning, and cultivated fields, old corrals, and buildings for foraging (WGFD 2005). In Montana, this species occurs throughout the eastern portion of the state, although the highest densities have been documented near the Canadian border (MFWP 2010d). This species was observed near MP 15.4 during fall 2009 field surveys (HWA 2009). Due to the presence of suitable habitat along the entire Project route, the potential for this species to occur along the Project route is considered high.

Sensitive Bat Species

The Townsend's big-eared bat (*Corynorhinus townsendii*), spotted bat (*Euderma maculatum*), long-eared myotis (*Myotis evotis*), and fringed myotis (*Myotis thysanodes*) are classified as BLM sensitive species. These species occur in a wide variety of habitats including semi-desert scrub, sagebrush shrubland, grassland, coniferous forest, and riparian areas. Roost sites consist of buildings, caves, mines, rock crevices, trees, and cliffs (Fitzgerald et al. 1994; WGFD 2005). However, no roost sites have been identified along the proposed project area. Based on the presence of suitable habitats, the potential for these species to occur along the Project route is considered high.

3.6.2.2 Birds

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) is classified as a BLM sensitive species. Most nesting bald eagles in Wyoming occur in the greater Yellowstone area, including Teton County, Grand Teton National Park, and Yellowstone National Park (WGFD 2005). Several historic nest sites have been documented within or adjacent to the project ROW along the Powder River. The aerial surveys conducted for breeding raptors

(May 27 and 28, 2010) examined potential bald eagle suitable nesting habitat (e.g., Powder River) up to 1 mile on either side of the ROW. A total of three active bald eagle nest sites were found during the May 2010 raptor surveys (AECOM 2010a). In addition, one winter concentration area has been recorded within or adjacent to the Project ROW along the Powder River (AECOM 2010b). Based on the results of the biological surveys, the potential for this species to occur along the Project route is considered high.

Ferruginous Hawk

The ferruginous hawk (*Buteo regalis*) is classified as a BLM sensitive species. The ferruginous hawk breeds from the Canadian Prairie Provinces south to Oregon, Nevada, Arizona, and Oklahoma. It winters from the central and southern portions of its breeding range south into Baja California and central Mexico. This species inhabits semiarid open country, primarily grasslands, basin-prairie shrublands, and badlands. It requires large tracts of relatively undisturbed rangeland and nests on rock outcrops, the ground, knolls, cliff ledges, or trees (Johnsgard 1990; WGFD 2005). In Wyoming, this species is found throughout the state, although it is most common in the south-central portion of the state (WGFD 2005). In Montana, this species is found throughout the state but is most common in semiarid open shrubland and grassland habitats (MFWP 2010e). A total of two active ferruginous hawk nests were found during the May 2010 raptor surveys (AECOM 2010a). One of the active nests was located on a rock formation and the other active nest was on a BLM-constructed Artificial Nesting Structure (ANS). Based on the results of the May 2010 raptor nest survey, the potential for this species to occur along the Project route is considered high.

Burrowing Owl

The burrowing owl (*Athene cunicularia*) is classified as a BLM sensitive species. This species breeds from south-central British Columbia, south through most of the western U.S. and Mexico (WGFD 2005). The burrowing owl typically inhabits level, open areas in heavily grazed or low-stature desert vegetation, with available burrows for nesting and cover (Johnsgard 1988; WGFD 2005). Nesting habitat consists of abandoned mammal burrows on flat, dry, and relatively open terrain (Johnsgard 1988). Several historic nest sites occur in prairie dog colonies along the Project route; however, no active nest sites were located during field surveys conducted in 2010 (AECOM 2010c). Based on the habitats that would be crossed by the Project ROW, additional burrowing owl nest sites may occur in the vicinity of the Project ROW. The potential for this species to occur along the Project route is considered high.

Greater Sage-grouse

The greater sage-grouse (*Centrocercus urophasianus*) is classified as a federal candidate species as well as a BLM sensitive species. On March 5, 2010, the USFWS determined that the greater sage-grouse warrants protection under the ESA; however, the USFWS concluded that proposing the species for protection is precluded by the need to take action on other species facing more immediate and severe extinction threats. Therefore, greater sage-grouse in Wyoming and Montana continue to be managed by the WGFD and MFWP, respectively. Conservation efforts for this species in Wyoming and Montana currently are coordinated by the WGFD and MFWP in cooperation with the USFWS, BLM, and regional greater sage-grouse working groups in an attempt to increase population levels and avoid federal listing under the ESA. In an effort to prevent federal listing of greater sage-grouse, the WGFD has recently completed a revised map of greater sage-grouse core population areas in Wyoming. Greater sage-grouse core population areas include areas with the highest densities of breeding greater sage-grouse in the state, as well as areas important for connectivity between populations. The core population areas include roughly 25 percent of the state but contain 83.1 percent of the greater sage-grouse population in the state.

Lekking/Nesting Habitat

The center of breeding activity for greater sage-grouse is referred to as a strutting ground or lek. Leks are characterized as flat, sparsely vegetated areas within large tracts of sagebrush (Connelly et al. 2004). Males begin to appear on leks in March with peak attendance of Wyoming and Montana leks occurring in April (MFWP 2010f; WGFD 2005). Greater sage-grouse nesting habitat typically is centered on active leks and consists of medium to tall sagebrush with a perennial grass understory (Connelly et al. 2000). Studies have

shown that taller sagebrush with larger canopies and more residual understory cover usually lead to higher nesting success (Connelly et al. 2004, 2000).

A total of 69 lek sites have been identified within 4 miles of the Project ROW. All 69 leks are determined to be "occupied" by the WGFD. In addition, nesting habitat surveys were conducted from April 13 to 17, 2010, and May 5 to June 4, 2010, to determine location, size, and species composition of suitable nesting habitat. Based on these results, 38,231 acres of suitable nesting habitat in core population areas and 97,945 acres of suitable nesting habitat in non-core population areas was mapped within 0.5 mile of the Project ROW during field surveys in 2010 (AECOM 2010c). An additional 1,898 acres of suitable nesting habitat in core population areas and 17,269 acres of suitable nesting habitat in non-core population areas was mapped within 0.5 mile of access roads using a desktop analysis, aerial photo interpretation, and ground truthing (AECOM 2010c).

Brooding Habitat

During the late spring and summer, hens and broods typically are found in more lush habitats consisting of a high diversity of grasses and forbs that attract insects. These habitats include wet meadows, riparian areas, and irrigated farmland within or near sagebrush. Hens with broods would utilize these habitats until forbs desiccate and insect abundance decreases. Unsuccessful hens and cocks also would utilize these same habitats; however, due to their nutritional flexibility, they are able to occupy a wider variety of habitats during the spring and summer months (Connelly et al. 2004). In many greater sage-grouse populations, high quality brooding habitat is often the limiting factor due to drought, invasive weeds, and overgrazing associated with improper range management.

Wintering Habitat

Depending on the severity of the winter, greater sage-grouse would move to south- and east-facing slopes that maintain exposed sagebrush. Studies have shown that south-facing slopes with sagebrush at least 10 to 12 inches above the snow level are required for both food and cover. Windswept ridges, draws, and swales also may be used, especially if these areas are in close proximity to exposed sagebrush (Connelly et al. 2004). In years with severe winter conditions (i.e., deep snow), greater sage-grouse would often gather in large flocks in areas with the highest quality winter habitat. It is suggested that high quality winter habitat is limited in portions of the greater sage-grouse's range (Connelly et al. 2000).

Greater sage-grouse winter concentration area surveys were conducted on January 28 and 29, 2010, along the entire Project route. This survey documented one area with greater sage-grouse present (AECOM 2010b). Two additional winter concentration area surveys are scheduled to take place in December 2010 or January 2011, depending on snow conditions.

Based on the presence of occupied leks and suitable nesting, brooding, and wintering habitat, the potential for this species to occur along the Project route is considered high.

<u>Brewer's Sparrow, Loggerhead Shrike, Sage Sparrow, Sage Thrasher</u>

The Brewer's sparrow (*Spizella breweri*), loggerhead shrike (*Lanius ludovicianus*), sage sparrow (*Amphispiza belli*), and sage thrasher (*Oreoscoptes montanus*) are classified as BLM sensitive species. These species are typically found in open habitats including grassland, sagebrush shrubland, semi-desert scrub, and agricultural areas (BLM 2007a; WGFD 2005). These species have been documented within the Project region and are fairly abundant in areas of suitable habitat (WGFD 2005). Based on the presence of suitable habitat, the potential for these species to occur along the Project route is considered high.

<u>Long-billed Curlew</u>

The long-billed curlew (*Numenius americanus*) is classified as a BLM sensitive species. The long-billed curlew breeds in southern Canada south into portions of most of the western U.S. It winters in California, Arizona, Mexico, Texas, Louisiana, and South Carolina. The long-billed curlew occurs and breeds throughout a majority of Wyoming and Montana. This species inhabits a variety of grassland types ranging from moist meadow grasslands to agricultural areas to dry prairie uplands, usually near water. This species prefers a complex of

shortgrass prairies, agricultural fields, wet and dry meadows and prairies, and grazed mixed-grass and scrub communities (MFWP 2010h; WGFD 2005). A total of 18 acres of suitable habitat was mapped during wetland/waterbodies surveys along the Project route in 2009 and 2010. Based on the presence of suitable habitat, the potential for this species to occur along the Project route is considered high.

Mountain Plover

The mountain plover (*Charadrius montanus*) is classified as a federally proposed species as well as a BLM sensitive species. The historic breeding range of the mountain plover included short-grass prairies from extreme southern Canada, south through the Great Plains of the U.S. (WGFD 2005). Currently, mountain plovers only nest in isolated areas throughout their range. In Wyoming and Montana, the breeding range of this species is widespread and relatively common in favored habitat; however, population levels and trends are not known (MFWP 2010g; WGFD 2005). Breeding habitat for this species appears to vary geographically. However, throughout its range, suitable breeding habitat is characterized primarily by shortgrass prairie grassland where grazing is intensive, or in areas of fallow fields or active prairie dog towns (WGFD 2005). Ground surveys were conducted from April 13 to 17, 2010, and May 5 to June 4, 2010, to determine location, size, and species composition of suitable habitat. A total of 611.4 acres of suitable habitat were mapped within 0.25 mile of the Project ROW (AECOM 2010c). Based on the results of the spring 2010 mountain plover habitat surveys, the known distribution of the mountain plover in Wyoming and Montana, and documented observations within the Project region (WGFD 2005), mountain plovers could potentially occur within the project area. Therefore, the potential for this species to occur along the Project route is considered high.

Yellow-billed Cuckoo

The yellow-billed cuckoo (*Coccyzus americanus*) is classified as a BLM sensitive species. The yellow-billed cuckoo is found from southern Canada to South America, breeding across most of the U.S. (except Oregon, Washington, Idaho, and Montana) and wintering in South America. In eastern Wyoming, the only areas that currently support the large cottonwood-riparian stands that are required by this species occur in isolated stands along the Bighorn, Powder, and North Platte rivers (WGFD 2005). This species nests primarily in large stands of cottonwood-riparian habitat below 7,000 feet in elevation. The yellow-billed cuckoo is a riparian obligate species that prefers extensive areas of dense thickets and mature deciduous forests near water, and requires low, dense, shrubby vegetation for nest sites (BLM 2007a; Stoke and Stokes 1996; WGFD 2005). Based on the presence of suitable habitat along the Powder River, the potential for this species to occur along the Project route is considered moderate.

3.7 Aquatic Resources

Aquatic species found along the Project route are typical of the perennial and intermittent waterbodies found in the rolling sagebrush shrublands and grasslands of northeastern Wyoming and southeastern Montana. Most of these species have wide distributions but are primarily found in larger perennial waterbodies such as the Little Powder River. The types of information used to identify aquatic species that may occur along the Project route consist of identification of aquatic habitat and distribution/occurrence information for fish and amphibian species.

3.7.1 Habitat

Aquatic habitat along the Project includes streams, wetlands, and springs located primarily within the Powder River Basin. Most of the habitat consists of intermittent and ephemeral streams and springs that provide water only during spring run-off and seasonal storm events. Eighteen perennial streams are crossed by the Project ROW, including one that contains recreational game fish species (Little Powder River). The most significant perennial waterbody crossed by the Project is the Little Powder River.

Springs represent the other type of aquatic habitat in the overall region. Spring habitat along the Project route is limited to unnamed springs and seeps, which are wet after snowmelt and precipitation events. These areas often are associated with wetlands vegetation that provide habitat to several amphibian species, including the northern leopard frog.

3.7.2 Aquatic Communities

3.7.2.1 Fish

Coolwater and warmwater fish species are found in perennial waterbodies in the Project region. Spawning seasons for warmwater species are variable and species-specific, but spawning generally occurs between April and August and peaks in June and July. Spawning periods for various coldwater species occur from February through November, peak in April or October, and are species specific.

As presented in Section 3.4, Water Resources, the Little Powder River in the area of the Project crossing is classified as a Class 2AB waterbody. Game fish species inhabiting this section of river include rainbow trout, green sunfish, and channel catfish. Populations of channel catfish exist in the Little Powder River, but the potential for a sport fishery is very low because of the stream's small size. Native non-game species in this section of the Little Powder River include flathead chub, fathead minnow, white sucker, and longnose sucker (BLM 2003a). Several other waterbodies crossed by the Project (i.e., Salt Creek, Ranch Creek) maintain a diverse non-game fish community including several species of Cyprinid minnows that are tolerant of periodic low flow, turbid, saline, and alkaline conditions in streams of the northern Great Plains (BLM 2006).

3.7.2.2 Amphibians

Potential habitat for amphibians includes perennial and intermittent stream reaches, wetlands, springs, and ephemeral ponds. Common species found along the Project route include Woodhouse's toad, tiger salamander, chorus frog, and northern leopard frog (Baxter and Stone 1980; BLM 2007a). The northern leopard frog and Great Basin spadefoot are BLM sensitive species and are discussed in detail in Section 3.7.3, Threatened, Endangered, and Sensitive Species.

3.7.3 Threatened, Endangered, and Sensitive Species

Special status species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Five special status aquatic species, identified as BLM sensitive species, were identified as potentially occurring within the Project area (BLM 2010f, 2007a). The potential occurrence of special status species within the Project area was based on range, known distribution, and the presence of potentially suitable habitat crossed by the Project route (**Appendix E**). A total of three aquatic species were eliminated from detailed analysis (boreal toad, Columbia spotted frog, and Yellowstone cutthroat trout) based on rationale presented in **Appendix E**. The remaining species that have the potential to occur along the Project route are discussed below.

3.7.3.1 Northern Leopard Frog

The northern leopard frog (*Rana pipiens)* is classified as a BLM sensitive species. It is one of the most common and widespread amphibians in the U.S; however, populations are known to be declining throughout its range. This species is found in or near permanent water in the plains, foothills, and montane zones. They range to 11,000 feet amsl in the mountains. Their preferred habitats are swampy cattail marshes on the plains and beaver ponds in the foothills and montane zones. In Wyoming, this species is common throughout the state except in Teton County, Park County, and Yellowstone National Park (WGFD 2005). Based on the presence of suitable habitat, the potential for this species to occur along the Project route is considered high.

3.7.3.2 Great Basin Spadefoot

The great basin spadefoot (*Spea intermontana*) is classified as a BLM sensitive species. This species ranges from southern British Columbia south through the Great Basin to northern Arizona and New Mexico. Great Basin spadefoots prefer sagebrush communities below 6,000 feet amsl, although they have been found at elevations of 9,200 feet amsl. This species requires loose soil for burrowing. In Wyoming, this species is most abundant west of the Continental Divide in the Wyoming Basin and the Green River Valley, but in the center of the state, it crosses the Divide into Fremont and Natrona counties (WGFD 2005). Suitable habitat occurs along the Project route, most occurrence records for this species in Wyoming are southwest of the Project route; therefore, the potential for this species to occur along the Project route is considered low.

3.8 Land Use and Recreation

3.8.1 Land Use

Existing land use along the Project consists primarily of livestock grazing, wildlife habitat, open space (range land), and dispersed recreation. Existing pipelines and utilities also are located in the immediate vicinity of the Project area. The Project would parallel other utilities for approximately 210 miles, or 91 percent of the total pipeline length. The Project would traverse lands under the regulatory and management control of the BLM, the State of Wyoming, and private land, which is regulated by county land use plans and ordinances. Approximately 66 percent (153 miles) of the Project would cross private lands, 28.5 percent (66 miles) would cross federal lands, and 5.5 percent (13 miles) would cross state lands.

The lands under the regulatory and management control of the BLM include portions of the Lander, Casper, Buffalo, and Miles City FO areas. The Project does not transect any BLM land in Montana. BLM-administered lands are open for the location of utility and transportation systems. These systems are required to be concentrated in existing utility corridors whenever possible (BLM 1987).

The management of public lands and resources in the Lander FO area is directed and guided by the BLM's Final RMP/EIS (BLM 1986) and the Record of Decision for the Lander RMP (BLM 1987). Approximately 4.7 miles of the Project occurs within the Lander FO area. There are no special designations transected by the Project.

The management of public lands and resources in the Casper FO area is directed and guided by the Record of Decision for the Casper RMP (BLM 2007d). The West-Wide Energy Corridor (WWEC) is a multi-modal corridor designated along U.S. Highway 20/26 to accommodate major ROWs. The WWEC has an approximate width of 3,500 feet. Approximately 38 miles (MP 0 to MP 38) of the Project would be located in this corridor. Approximately 14 miles of the Project (MP 32 to MP 46), would follow the general corridor along U.S. Highway 20/26. Approximately 5.8 miles of the Project would be located on BLM land through this area. The Casper FO area RMP states that cross-country ROW placements would be allowed only when placement in a designated corridor is not practical or feasible (BLM 2007d).

The Wind River Basin Management Area near Waltman, Wyoming, within the Casper FO area, is crossed by the Project, which also comes within 5 miles of the Salt Creek Management Area. Management objectives for both the Wind River Basin and Salt Creek management areas emphasize oil and gas development with minimum restrictions (BLM 2007a).

The management of public lands and resources in the Buffalo FO area is directed and guided by the Record of Decision for the RMP (BLM 2001a). The Buffalo FO area's management policy is to locate transmission and transportation facilities within designated corridor areas (BLM 2001a). There are several designated corridors within the FO area. The Project is not located within any of the designated corridors. The Buffalo FO area RMP states that transmission lines are to be located to the extent feasible within identified corridor areas (BLM 2001a).

3.8.2 Recreation

Recreation resources are areas that are designated for the enjoyment and relaxation of both residents and visitors. These areas include lands formally managed for recreation purposes such as recreation sites or parks and other areas where no facilities are provided, such as sightseeing, hiking, rock climbing, hunting, fishing, or off-highway vehicle (OHV) use areas. Recreation resources can be further categorized as non-urban or dispersed resources such as rural parks, campgrounds, rivers, or undeveloped open lands. Rural-based recreation typically takes place in open spaces and does not include facilities associated with infrastructure. Urban-oriented developed resources such as parks and recreation facilities are typically within the boundaries of cities and towns.

The primary population centers in the project area occur in the communities and cities of Casper, Midwest, Lander, Natrona, Edgerton, Kaycee, Powder River, and Gillette. Casper and Gillette are the largest

municipalities and are relatively centrally located along the Project. Therefore, it is likely that the majority of pipeline workers would temporarily reside in these cities during construction. Camping by construction workers and their families could occur in areas where other housing is not readily available or where workers would otherwise prefer to camp. Details regarding housing availability, including recreational vehicle (RV) sites and campgrounds, are provided in Section 3.11.

Non-urban recreation resources in the Project area are primarily available on public lands managed by the BLM. Most of the recreational use on public land in the Lander FO area is widely dispersed. Visitors generally participate in a wide variety of recreational activities, including picnicking, hunting, camping, winter sports, and fishing (BLM 1986). OHV use is limited to existing roads and trails (BLM 1986).

The Project does not cross any Recreation Management Areas (RMAs) or developed recreation areas in the Casper FO area (BLM 2007a). OHV use in the Project is limited to existing roads and vehicle trails; however, temporary OHV use is allowed 300 feet from an existing road or trail for performance of necessary tasks (BLM 2007a).

The Project does not cross any RMAs or developed recreation areas in the Buffalo FO area (BLM 2001a). OHV use in the Project area is closed, open, or limited to designated roads and trails (BLM 2001a).

Big game hunting occurs throughout the Project area and is regulated by the WGFD. In the Lander and Casper FO areas, the southern edge of the Bighorns (Lost Cabin to Arminto, MP 0.0 to MP 20) is highly desirable for elk, mule deer, and antelope. Heavy use is made along the route from Natrona to Midwest and up to Gillette. North of Gillette, in the BLM Buffalo and Miles City FO areas, elk, mule deer, white tail deer, and turkey are the commonly hunted species. Access to public lands is increasingly difficult to the north and east.

3.9 Wilderness

There are no designated wilderness areas within 50 miles of the Project ROW. However, there are two WSAs within 50 miles of the Project ROW including the Fortification Creek WSA in the Buffalo FO and the Buffalo Creek WSA in the Miles City FO (**Figure 3-4**). These areas maintain a primeval character, without permanent improvements and generally appear to have been affected primarily by the forces of nature. WSAs are not included in the National Wilderness Preservation System until the U.S. Congress passes wilderness legislation.

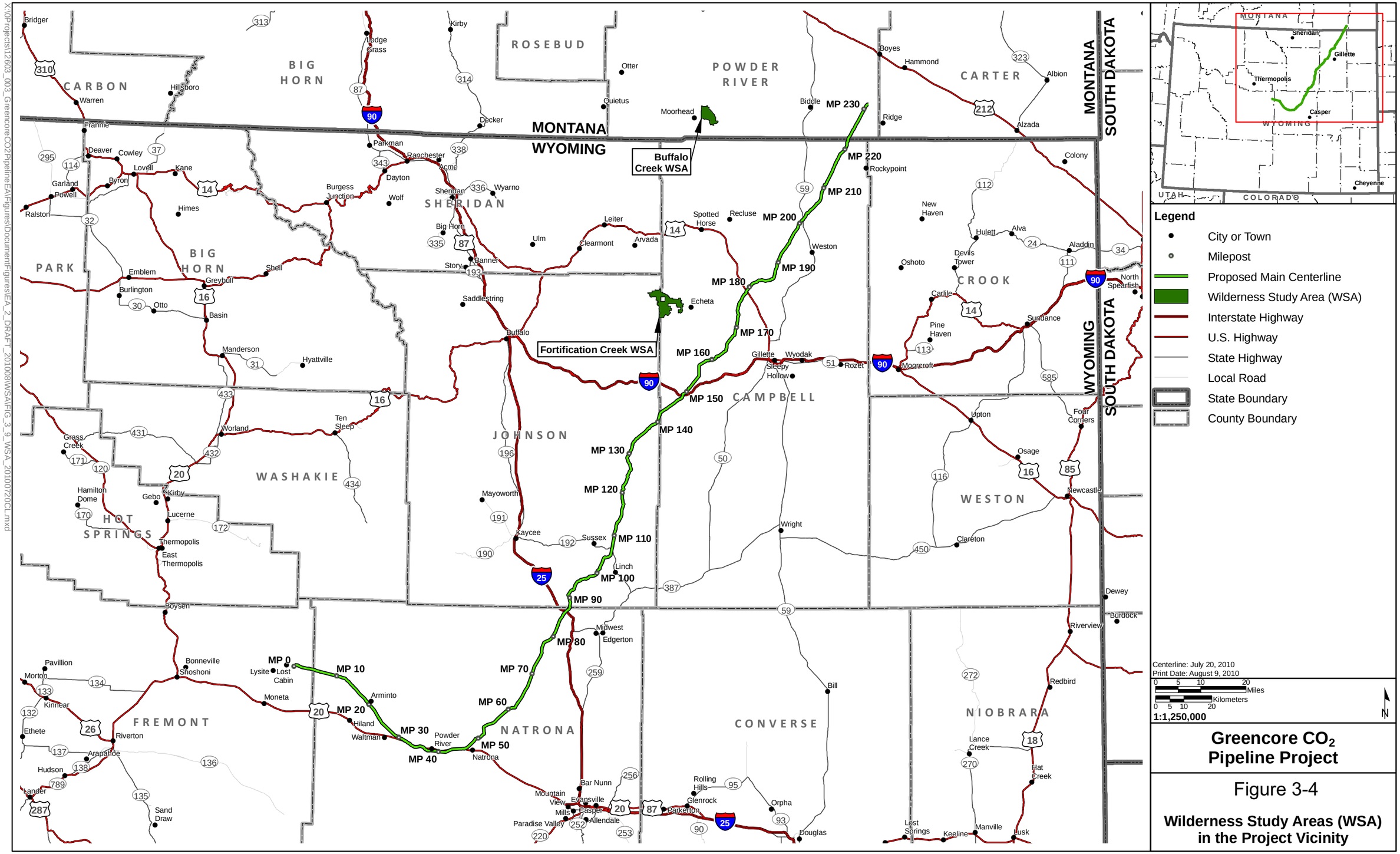
The Fortification Creek WSA is located approximately 12 miles west of the Project ROW near MP 159 in Wyoming. This area contains unique undeveloped terrain along the Powder River. Sharp breaks, ridges, and ephemeral drainages cross this WSA. This WSA provides important habitat for a population of elk that were re-established in the region during the 1950s from Yellowstone National Park. Due to this WSA being surrounded on all sides by private land, public access is not available without landowner permission (BLM 2001a).

The Buffalo Creek WSA is located approximately 28 miles west of the Project ROW near MP 210 in Montana. This WSA is 5,650 acres in size and occurs in the rugged breaks of the Powder River. The Buffalo Creek WSA meets minimum standards for solitude because of the rugged terrain and widespread cover of trees. Currently, hiking and hunting are the only recreational uses within the WSA (BLM 2000a).

3.10 Visual Resources and Noise

3.10.1 Visual Resources

Scenic quality is the measure of the visual appeal of a unit of land. Section 102 (a) of the Federal Land Policy and Management Act (FLPMA 1976), states that "...the public lands are to be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values." Section 103(c) identifies "scenic values" as one of the resources for which



Greencore CO_2 Pipeline Project

Figure 3-4

Wilderness Study Areas (WSA) in the Project Vicinity

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public land should be managed. Section 201(a) states that "the Secretary shall prepare and maintain on a continuing basis an inventory of all public lands and their resources and other values (including scenic values)..." Section 505(a) requires that "each ROW shall contain terms and conditions which will...minimize damage to the scenic and esthetic values..."

Section 101 (b) of the NEPA requires that measures be taken to ensure that aesthetically pleasing surroundings be retained for all Americans.

Under FLPMA, BLM developed and applies a standard visual assessment methodology, known as the Visual Resource Management System (VRM), to inventory and manage scenic values on lands under its jurisdiction. Guidelines for applying the system are described in BLM Manual 8400 et seq.

BLM VRM class objectives, which are used in management and in the assessment of potential Project impacts and identification and application of mitigation measures, are:

VRM Class I: Preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

VRM Class II: Retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

VRM Class III: Partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

VRM Class IV: Provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. Every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

The proposed Greencore CO_2 Pipeline project crosses VRM Class II, Class III, and Class IV areas, with approximately 5 percent of the land designated Class II, 15 percent Class III, and 80 percent Class IV.

The Project would closely parallel existing pipelines for approximately 91 percent of its length.

The characteristic landscape of the pipeline corridor is contained within the elevated plains and isolated mountains of the Wyoming Basin physiographic province and the flat to gently sloping Missouri Plateau Region (unglaciated section) of the Great Plains physiographic province (Fenneman 1931). The Project crosses through a mix of rangeland and agricultural fields in Wyoming and Montana. Cottonwood dominated riparian vegetation characterizes crossings of the South Fork of the Powder River, Powder River and Little Powder River. Rangeland vegetation is dominated by mixed shrub grasslands. **Figures 3-5** through **3-13** illustrate eight characteristic views of the study area landscape from KOPs 1 through 8. Human modifications to the natural landscape character are sparsely scattered, most commonly back country roads with occasional clusters of ranch buildings and fences. There are few populated settlements.

The Project would cross the Bozeman Trail twice and Texas Trail once. Both trails are historic trails but are not designated as "National" historic trails. The specific location of the Texas Trail is unknown in the vicinity of the project.

The Interstate, U.S. and State highways that afford public viewing opportunities of the Project include I-25, I-90, U.S. 20, U.S. 14/16, SH 192 and SH 59 in Wyoming. The Project also is visible from less-traveled roads and homes within its viewsheds in Wyoming and Montana. The Project is not visible from designated recreation areas, cities, towns, or villages. The Bighorn Backcountry Byway, I-25, I-90, U.S. 20, U.S. 14/16, and Wyoming SH 192 and SH 59 are selected KOPs.

3.10.2 Noise

The Project would be constructed entirely through rural areas where the nearest residences would be at least 0.5 mile from the ROW. In addition, the pipe yard work area would be located in a rural area located northwest of Casper. The closest residence to the pipe yard would be greater than 0.25 mile.

Existing noise sources in rural areas are predominantly natural (i.e., wind, birds). Areas near highways would exhibit vehicle-related noise. The BLM has estimated that the average noise level in the Casper FO area is between 30 and 40 A-weighted decibels (BLM 1997). This range also is suggested in other EAs and in EISs and has been confirmed by field measurements taken elsewhere in Wyoming (Kruger 1981). The background level can be affected by atmospheric conditions, wind levels, topography, vegetation, time of day, bird, and human activity.

3.11 Socioeconomics

This section summarizes historical and current socioeconomic conditions in the five counties (Fremont, Natrona, Johnson, Campbell, and Powder River) that would be affected by the Project. All of the affected counties, with the exception of Powder River County, Montana, are within Wyoming. Elements reviewed include population, economic conditions, income, employment, housing, local government facilities and services, and local government fiscal conditions. **Tables 3-15** through **3-19** summarize baseline conditions within the five-county Project area.

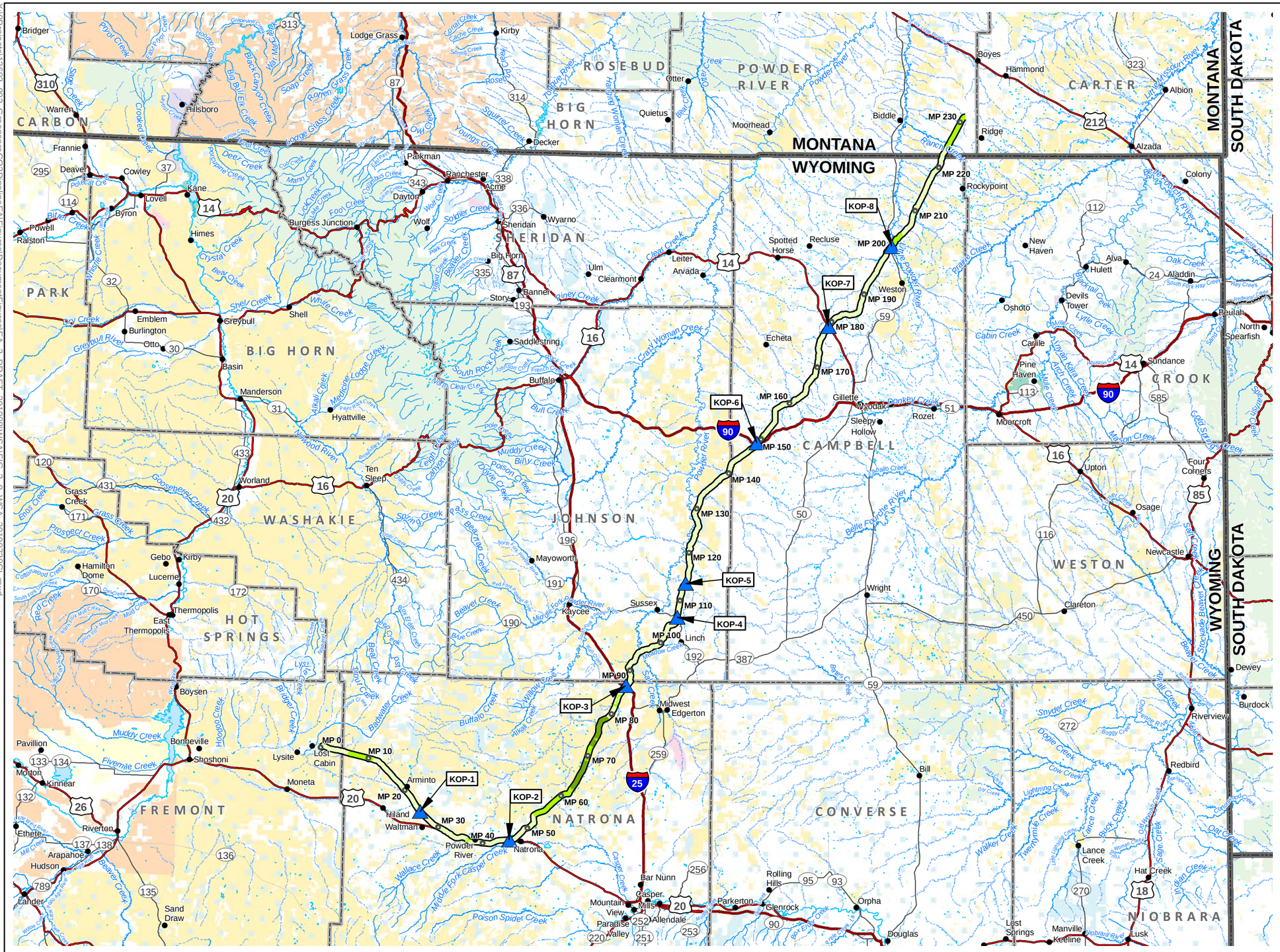
3.11.1 Population

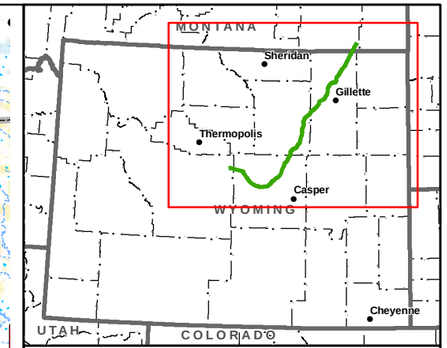
The Project area is predominantly rural and sparsely populated. The estimated population in Fremont, Natrona, Johnson, and Campbell counties has increased from 2000 to 2008. Population in Powder River County declined slightly over the same period. Since 2000, population has increased an estimated 6.4 percent in Fremont County, 9.9 percent in Natrona County, 19.6 percent in Johnson County, and 23.1 percent in Campbell County (**Tables 3-15** through **3-19**). Population in Powder River County decreased an estimated 8.8 percent since 2000 (U.S. Census Bureau 2008).

3.11.2 Economic Conditions

The primary industries for all five counties within the Project area include energy production (oil and gas), retail trade, services, and government. In **Tables 3-15** through **3-19,** oil and gas employment is incorporated under mining. As is evidenced in the data, employment in the oil and gas industry has steadily risen in recent years.

In the early 1980s, Fremont County depended on uranium mining and milling as the mainstay of the local economy. When the industry collapsed in 1983, the economy of Fremont County declined steadily until the latter part of the decade. More recently, Fremont County's economy has improved with a 44 percent increase in personal income between 2003 and 2008 (Wyoming Department of Administration and Information 2008). An increase in wealthy, out-of state people also has contributed to increased incomes in Fremont and Natrona counties.





Legend

- City or Town
- Milepost
- Key Observation Point (KOP)

VRM Classification

- Class II
- Class III
- Class IV
- Interstate Highway
- U.S. Highway
- State Highway
- Local Road

Rivers/Streams

- Perennial
- Intermittent
- State Boundary
- County Boundary

Jurisdiction

- Bureau of Indian Affairs/Tribal
- Bureau of Land Management
- Bureau of Reclamation
- DOD/USACE
- Fish & Wildlife
- US Forest Service
- National Park Service
- State

Centerline: July 20, 2010
Print Date: November 5, 2010

0 5 10 20 Miles
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N

Greencore CO_2 Pipeline Project

Figure 3-5
VRM Classes and
Key Observation Point Locations

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Figure 3-6 View northeast from KOP-1 along South Bighorn Backcountry Byway

Figure 3-7 View north from KOP-2 along U.S. 20

Figure 3-8 View east from KOP-3 along I-25

Figure 3-9 View northwest from KOP-4 along SH 192

Figure 3-10 View southwest from KOP-5 along Bozeman Trail

Figure 3-11 View northeast from KOP-6 along I-90

Figure 3-12 View northeast from KOP-7 along U.S. 14/16

Figure 3-13 View west from KOP-8 along SH 59

Table 3-15 Fremont County Economic/Demographic Profile for the Greencore Project

	2003	2004	2005	2006	2007	2008	Percent Change 2003 - 2008
Total Population[1]	35,810	35,962	36,300	36,829	37,479	37,870	5.8[2]
Percent Change/Previous Year	0.03	0.4	0.9	1.5	1.8	1.0	
Labor Force[3]	17,763	17,595	17,760	17,725	18,015	18,353	3.3
Percent Change/Previous Year	-2.2	-0.9	0.9	-0.2	1.6	1.9	
Employment	16,733	16,679	16,898	16,941	17,320	17,602	5.2
Unemployment	1,030	916	862	784	695	751	-27.1
Unemployment Rate	5.8	5.2	4.9	4.4	3.9	4.1	-29.3
Farm Employment	1,162	1,159	1,160	1,147	1,100	NA	-5.3
Total Non-Agricultural Employment[1]	20,374	20868	21,571	22,133	22,940	NA	12.6[3]
Mining	497	578	761	961	1,016	NA	104.4[3]
Construction	1,657	1,705	1,773	1,802	1,969	NA	18.8[3]
Manufacturing	601	607	622	628	641	NA	6.7[3]
Retail Trade	2,546	2,557	2,612	2,659	2,737	NA	7.5[3]
Transportation and Warehousing	530	530	569	607	635	NA	19.8[3]
Finance and Insurance	531	535	531	535	511	NA	-3.8[3]
Real Estate and Rental and Leasing	688	718	889	988	1,130	NA	64.2[3]
Professional, Scientific, and Tech Services	753	838	816	837	901	NA	19.7[3]
Administrative and Waste Services	472	497	441	473	547	NA	15.9[3]
Health Care and Social Assistance						NA	
Accommodation and Food Services	1,613	1,670	1,688	1,672	1,688	NA	4.6[3]
Other Services, Except Public Administration	1,299	1,343	1,392	1,425	1,490	NA	14.7[3]
Government and Government Enterprises	5,264	5,240	5,332	5,377	5,471	NA	3.9[3]
Personal Income (Million $)[1]	$924.1	$995.6	$1,089	$1,209.4	$1,330.3	NA	44.0[3]

Table 3-15 Fremont County Economic/Demographic Profile for the Greencore Project

	2003	2004	2005	2006	2007	2008	Percent Change 2003 - 2008
Per Capita Income[1]	$25,814	$27,701	$30,023	$32,890	$35,512	NA	37.6[3]
2008 Average Mill Levy (mills)[1]						73.193	
2008 Total Assessed Valuation (Million $)[1]						$344.8	
Gross Sales Tax (Thousand $)[1]	$21,223	$23,843	$27,291	$30,954	$32,550	$44,235	108.4

[1] Wyoming Department of Administration and Information 2008.

[2] Wyoming Department of Employment 2008.

[3] 2003 to 2007.

Table 3-16 Natrona County Economic/Demographic Profile for the Greencore Project

	2003	2004	2005	2006	2007	2008	Percent Change 2003 - 2008
Total Population[1]	67,977	68,692	69,478	70,252	71,750	72,680	6.9
Percent Change/Previous Year	0.9	1.1	1.1	1.1	2.1	1.3	
Labor Force[2]	37986	38651	39220	40071	40201	40563	6.8
Percent Change/Previous Year	1.4	1.8	1.5	2.2	0.3	0.9	
Employment	36,271	37,197	37,827	38,847	39,129	39,400	8.6
Unemployment	1,715	1,454	1,393	1,224	1,072	1,163	-32.2
Unemployment Rate	4.5	3.8	3.6	3.1	2.7	2.9	-35.6
Farm Employment	438	437	433	429	411	NA	-6.2[3]
Total Non-Agricultural Employment[1]	45,912	47814	49622	51800	53516	NA	16.6[3]
Mining	3606	4061	4597	5475	5131	NA	42.3[3]
Construction	3312	3464	3679	3918	4264	NA	28.7[3]
Manufacturing	1729	1784	1976	2151	2217	NA	28.2[3]
Retail Trade	6028	6280	6383	6420	6622	NA	9.9[3]
Transportation and Warehousing	NA	NA	NA	NA	NA	NA	NA
Finance and Insurance	1786	1841	1800	1830	1830	NA	2.5[3]
Real Estate and Rental and Leasing	1890	1961	2200	2405	2746	NA	45.3[3]
Professional, Scientific, and Tech Services	2134	2264	2340	2416	2561	NA	20.0[3]
Administrative and Waste Services	2655	2343	2179	2238	2291	NA	-13.7[3]
Health Care and Social Assistance	5333	5515	5664	5785	5965	NA	11.9[3]
Accommodation and Food Services	3163	3364	3471	3553	3736	NA	18.1[3]
Other Services, Except Public Administration	2690	2805	3017	3143	3282	NA	22.0[3]
Government and Government Enterprises	5736	5783	5825	5882	6053	NA	5.5[3]
Personal Income (Million $)[1]	$2,410.4	$2,613.7	$2943.9	$3,413	$3,771.7	NA	56.5[3]

Table 3-16 Natrona County Economic/Demographic Profile for the Greencore Project

	2003	2004	2005	2006	2007	2008	Percent Change 2003 - 2008
Per Capita Income[1]	$35,479	$38,081	$42,414	$48,605	$52,543	NA	48.1[3]
2008 Average Mill Levy (mills)[1]						68.529	
2008 Total Assessed Valuation (Million $)[1]						$661.9	
Gross Sales Tax (Thousand $)[1]	$65,891	$76,674	$83,221	$95,483	$101,744	$113,622	72.4

[1] Wyoming Department of Administration and Information 2008.

[2] Wyoming Department of Employment 2008.

[3] 2003 to 2007.

Table 3-17 Johnson County Economic/Demographic Profile for the Greencore Project

	2003	2004	2005	2006	2007	2008	Percent Change 2003 - 2008
Total Population[1]	7,472	7,525	7,651	7,820	8,142	8,330	11.5
Percent Change/Previous Year	1.6	0.7	1.7	2.2	4.1	2.3	
Labor Force[2]	3626	3688	3793	3844	3914	4060	12.0
Percent Change/Previous Year	1.4	1.8	2.8	1.3	1.8	3.7	
Employment	2266	2249	2223	2240	2285	2335	3.0
Unemployment	167	137	147	123	133	149	-10.8
Unemployment Rate	4.6	3.7	3.9	3.2	3.4	3.7	-19.6
Farm Employment	456	457	453	448	429	NA	-5.9[3]
Total Non-Agricultural Employment[1]	4700	4861	5118	5382	5625	NA	19.7[3]
Mining	322	309	348	448	513	NA	59.3[3]
Construction	455	498	602	667	636	NA	39.8[3]
Manufacturing	94	117	122	108	85	NA	-9.6[3]
Retail Trade	565	524	532	541	537	NA	-5.0[3]
Transportation and Warehousing	154	150	162	165	179	NA	16.2[3]
Finance and Insurance	222	220	229	213	213	NA	-4.1[3]
Real Estate and Rental and Leasing	210	250	281	311	370	NA	76.2[3]
Professional, Scientific, and Tech Services	181	208	228	260	271	NA	49.7[3]
Administrative and Waste Services	123	134	NA	NA	NA	NA	NA
Health Care and Social Assistance	NA	NA	NA	NA	NA	NA	NA
Accommodation and Food Services	508	514	519	531	555	NA	9.3[3]
Other Services, Except Public Administration	266	280	286	298	287	NA	7.9[3]
Government and Government Enterprises	924	949	942	957	996	NA	7.8[3]
Personal Income (Million $)[1]	$231.1	$242.5	$266.8	$298.1	$329.3	NA	42.5[3]

Table 3-17 Johnson County Economic/Demographic Profile for the Greencore Project

	2003	2004	2005	2006	2007	2008	Percent Change 2003 - 2008
Per Capita Income[1]	$30,923	$32,237	$34,897	$38,179	$40,462	NA	30.8[3]
2008 Average Mill Levy (mills)						70.252	
2008 Total Assessed Valuation (Million $)						$177.3	
Gross Sales Tax (Thousand $)	$6,193	$6,924	$8,552	$14,285	$16,973	$16,142	160.7

[1] Wyoming Department of Administration and Information 2008.

[2] Wyoming Department of Employment 2008.

[3] 2003 to 2007.

Table 3-18 Campbell County Economic/Demographic Profile for the Greencore Project

	2003	2004	2005	2006	2007	2008	Percent Change 2003 – 2008
Total Population[1]	36,080	36,251	37,053	38,480	40,433	41,510	15.0
Percent Change/Previous Year	0.6	0.5	2.2	3.9	5.1	2.7	
Labor Force[3]	21,657	21,783	23,245	25,049	26,127	27,097	25.1
Percent Change/Previous Year	-2.0	0.6	6.7	7.8	4.3	3.7	
Employment	20,856	21,104	22,623	24,499	25,586	26,544	27.3
Unemployment	801	679	622	550	541	553	-31.0
Unemployment Rate	3.7	3.1	2.7	2.2	2.1	2.0	-45.9
Farm Employment	611	609	611	603	580	NA	-5.1[3]
Total Non-Agricultural Employment[1]	24486	25198	27102	29900	31870	NA	30.2[3]
Mining	6528	6851	7338	8338	8482	NA	29.9[3]
Construction	2316	2292	2717	3298	3977	NA	71.7[3]
Manufacturing	524	553	629	673	714	NA	36.3[3]
Retail Trade	2367	2382	2464	2624	2871	NA	21.3[3]
Transportation and Warehousing	939	1036	1246	1452	1518	NA	61.7[3]
Finance and Insurance	429	421	452	494	528	NA	23.1[3]
Real Estate and Rental and Leasing	372	403	449	516	613	NA	64.8[3]
Professional, Scientific, and Tech Services	801	851	934	1041	1071	NA	33.7[3]
Administrative and Waste Services	821	704	852	883	977	NA	19[3]
Health Care and Social Assistance	1067	972	968	994	1050	NA	-1.6[3]
Accommodation and Food Services	1655	1674	1752	1915	1982	NA	19.8[3]
Other Services, Except Public Administration					1467	NA	NA
Government and Government Enterprises	3653	3849	3914	3909	4035	NA	10.5[3]
Personal Income (Million $)[1]	$1,135.1	$1,244.3	$1,450.2	$1,704.3	$1,906.4	NA	68.0[3]

Table 3-18 Campbell County Economic/Demographic Profile for the Greencore Project

	2003	2004	2005	2006	2007	2008	Percent Change 2003 – 2008
Per Capita Income[1]	$31,480	$34,350	$39,172	$44,317	$47,151	NA	49.80[3]
2008 Average Mill Levy (mills)[1]						60.494	
2008 Total Assessed Valuation (Million $)[1]						$637.5	
Gross Sales Tax (Thousand $)[1]	$80,733	$85,140	$96,803	$137,792	$155,140	$173,821	115.3

[1] Wyoming Department of Administration and Information 2008.

[2] Wyoming Department of Employment 2008.

[3] 2003 to 2007.

Table 3-19 Average Weekly Wage for Counties Crossed by the Greencore Project

County and Sector	Dollars					
	2003	2004	2005	2006	2007	2008
Fremont						
Construction	532	551	565	610	639	694
Mining	1,045	1,189	1,215	1,276	1,212	1,313
Natrona						
Construction	617	650	695	736	835	949
Mining	925	1,009	1,135	1,267	1,453	1,572
Johnson						
Construction	562	583	669	791	804	860
Mining	671	706	760	876	966	1,057
Campbell						
Construction	658	721	768	864	944	1065
Mining	1,129	1,189	1,205	1,328	1,368	1,399
Powder River						
Construction	311	299	244	330	310	341
Mining	NA	NA	NA	NA	NA	NA

Source: Wyoming Department of Employment (2008); Montana Department of Labor (2008).

In addition to the oil, gas, and mining economic base in Natrona County, the city of Casper is currently considered a statewide regional trade center. Casper has experienced growth in retail sales and services over the past several years despite a declining population. Johnson County strongly depends upon ranching. The economy as a whole has improved, as evidenced by a 43 percent increase in personal income from 2003 to 2008 (Wyoming Department of Administration and Information 2008).

Campbell County depends more on coal mining than oil and gas production; coal has been a stabilizing economic force in Campbell County. The county has experienced a dramatic 68 percent increase in personal income from 2003 to 2008 (Wyoming Department of Administration and Information 2008).

Powder River County, Montana, is primarily rural and agricultural, although significant reserves of oil and gas do exist in the county. The majority of the county is grazing land and farm acreage fluctuates between 1.54 and 1.72 million acres. While the number of ranches has decreased, the size of ranches has increased. From 2003 to 2008, personal income increased 5 percent (Bureau of Economic Analysis [BEA] 2008).

All five counties depend to some extent on the tourist industry, which is reflected in the retail trade and service sectors.

3.11.3 Income

Tables 3-15 through **3-19** show estimated personal and per capita income for each of the five counties in the Project area. All five counties show increases in county-wide personal income from 2003 to 2008. Average weekly wages in the mining and construction sectors are shown in **Table 3-20**. Wage rates in both sectors have increased through the period. Energy production is considered the highest paying sector for wage and salary employment.

Table 3-20 Temporary Housing Accommodations for the Greencore Project

Type/Location of Accommodation	Number of Locations	Number of Units	Number of Tent Sites	Number of Trailer Sites	Dates Available
Hotel/Motel, Casper	23	2,003	NA	NA	NA
Hotel/Motel, Buffalo	15	471	NA	NA	NA
Hotel/Motel, Edgerton-Midwest	1	20	NA	NA	NA
Hotel/Motel, Kaycee	4	36	NA	NA	NA
Hotel/Motel, Gillette	19	1,488	NA	NA	NA
Hotel/Motel, Lander	8	328	NA	NA	NA
Hotel/Motel, Riverton	14	531	NA	NA	NA
Hotel/Motel, Jeffrey City	1	10	NA	NA	NA
Hotel/Motel, Shoshoni	2	37	NA	NA	NA
Campground, Casper	9 (4 private, 2 BLM, 3 county)		185	296	4 year-round, 5 seasonal
Campground, Kaycee	3 (3 private)		26	18	3 year-round
Campground, Buffalo	8 (3 private, 5 FS)		97	207	3 year-round, 5 seasonal
Campground, Lander	12 (6 private, 1 BLM, 5 USFS)		168	198	5 year-round, 7 seasonal
Campground, Riverton	2 (2 private)		16	70	2 year-round
Campground, Gillette	2 (2 private)		75	75	2 year-round

Source: Wyoming Travel and Tourism (2009); Delorme (2003).

3.11.4 Employment

Total employment throughout the area has increased from 2003 through 2008. As shown in **Tables 3-15** through **3-19**, total non-agricultural employment has increased by 12.6 percent in Fremont County; 16.6 percent in Natrona County; 19.7 percent in Johnson County, 30.2 percent in Campbell County, and 3.4 percent in Powder River County from 2003 to 2007. Employment in real estate, mining, and construction showed the greatest increase in most of the affected counties. Data for many of the industries in Powder River County is lacking, due to the sensitive nature of the data. Employment in other industries fluctuated during the period, with decreases in the manufacturing sector in all counties except Campbell County, and increases in the trade sector in all four counties.

Unemployment rates in the five counties have generally trended down between 2003 and 2007. Fremont, Natrona, and Johnson counties experienced a slight increase in 2008.

3.11.5 Housing

Towns and municipalities in close proximity to the Project include Casper, Lander, Natrona, Midwest, Kaycee, and Gillette. Casper and Gillette are the largest municipalities and are centrally located to the Project. Given the short duration of the construction period, it is expected that the majority of workers from outside the area would use temporary accommodations in campgrounds/RV parks and hotels/motels.

Table 3-20 shows temporary housing available in close proximity to the Project. Hotels/motels and campgrounds with RV sites are available in all study area communities. Similarly, demand for these accommodations also may be greater in these communities, particularly during peak tourist seasons such as during the summer months and during hunting seasons.

The average monthly rent for a two-bedroom apartment in Natrona County is $702, as of the second quarter, 2008. For a two to three-bedroom single family home, the average rental rate is $1,088 per month, and the average rental rate for a mobile home is $548 per month (Wyoming Department of Administration and Information 2008).

3.11.6 Local Government Facilities and Services

Fremont, Natrona, Johnson, Campbell, and Powder River county governments all provide a wide array of governmental services including general county government, law enforcement, fire protection, road and bridge infrastructure, solid waste disposal, medical and ambulance, and education. Public facilities and services in the major towns, namely Casper and Gillette, adequately serve the existing population and could support housing and services to pipeline personnel,

3.11.7 Local Fiscal Conditions

As shown in **Tables 3-15** through **3-19**, gross sales tax receipts have increased in all five study area counties during the period 2003-2008. Properties assessed by the state, including pipelines, are assessed, and taxed on 4 percent of value (AECOM 2010d). Property taxes are a primary source of county and school district revenue. Tax revenues are allocated to county funds, school districts, special districts, and municipalities.

3.12 Environmental Justice

Since publication of EO 12898, Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations in the Federal Register on February 11, 1994 (59 FR 7629), federal agencies have been developing a strategy for implementing the Order. Currently, the federal agencies rely on the Environmental Justice Guidance under the NEPA prepared by the CEQ (the guidance) (USEPA1997), in implementing EO 12898 in preparing NEPA documents.

Pursuant to EO 12898 on Environmental Justice, federal agencies shall make the achievement of environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations, low-income populations, and Indian tribes, and allowing all portions of the population an opportunity to participate in the development of, compliance with, and enforcement of federal laws, regulations, and policies affecting human health or the environment regardless of race, color, national origin, or income. EO 12898 requires identifying whether an area potentially affected by a proposed federal action may include minority populations and low-income populations and seek input accordingly.

3.12.1 Minority Populations

Projects or programs that are proposed, funded, or licensed by federal agencies must take into account impacts on minority or low-income populations. A description of the population types (i.e., races) residing within the counties that would be crossed by the Project is presented in **Table 3-21**. This information is based on U.S. Census Bureau data. The table also includes the percent of the population whose income lies below the poverty level.

The guidance states that “a minority population may be present if the minority population percentage of the affected area is ‘meaningfully greater’ than the minority population percentage in the general population or other ‘appropriate unit of geographic analysis’ (USEPA 1997).” For the purpose of this EA analysis, the “affected area” is defined as any county that the Project crosses.

Table 3-21 Race and Poverty Characteristics of Affected Counties in the Greencore Project Area

State/County	Race as a % of Total Population (estimated) [1,2]						Population at or Below Poverty Level, % 2008[1]	Median Household Income, $ 2008[1]
	White 2009	Black or African American 2009	American Indian and Alaska Native 2009	Asian 2009	Two or More Races 2009	Hispanic or Latino Origin 2009[2]		
Wyoming								
Fremont	76.1	1.0	20.3	0.5	2.1	5.9	13.5	45,708
Natrona	94.7	1.6	1.4	0.7	1.5	6.4	8.8	51,486
Johnson	97.8	0.1	0.6	0.1	1.3	3.5	8.3	51,162
Campbell	95.7	0.7	1.4	0.7	1.4	6.2	5.8	75,244
Average for Entire State	**93.5**	**1.4**	**2.6**	**0.8**	**1.5**	**8.1**	**9.5**	**54,735**
Montana								
Powder River	97.4	0.0	2.0	0.1	0.5	1.1	13.0	36,933
Average for Entire State	**90.3**	**0.7**	**6.4**	**0.7**	**1.8**	**3.1**	**14.1**	**43,968**

[1] U.S. Census Bureau 2010.

[2] People who identify their origin as Hispanic or Latino may be of any race. Thus, the percent Hispanic or Latino should not be added to the race as percentage of population categories.

The Project would pass through five counties, including Fremont, Natrona, Johnson, and Campbell counties in Wyoming, and Powder River County in Montana. Most of the Project area is sparsely populated and dotted with numerous oil well fields and sprawling cattle ranches. There are eight communities that are within 5 miles and could be affected by the project. These communities are Lost Cabin, Lysite, Arminto, Waltman, Powder River, Natrona, Linch, and Sussex. According to the most recent U.S. Census Bureau data, the 2000 population of Powder River was 51 (U.S. Census Bureau 2000). Population data for the other affected communities were not available.

Minority population percentages were available through the U.S. Census Bureau for the county level and are detailed in **Table 3-21**.

According to estimated 2009 U.S. Census Bureau statistics, the populations of all the affected counties were primarily white. The largest minority population in Powder River County, Montana, was American Indian, followed by those of Hispanic or Latino Origin. The largest minority population for most of the affected counties in Wyoming was Hispanic or Latino. The outlier was the American Indian population in Fremont County, which at 20.3 of the county population, was well above the Wyoming state average of 2.6 percent. This large American Indian population can be attributed to the Wind River Indian Reservation, which is within Fremont County. Approximately 5 miles, or 2 percent of the Project, lies within Fremont County. The Project is not located within the boundaries of the Reservation.

3.12.2 Low-Income Populations

The guidance recommends that low-income populations in an affected area be identified using the annual statistical poverty thresholds from the Bureau of Census. In identifying low-income populations, agencies may consider a community as either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure. For the purpose of this EA analysis, the “affected area” is defined as any county that the Project crosses.

As stated previously, the Project would pass through a rural and sparsely populated area. Median household incomes for all the affected Wyoming counties, with the exception of Campbell County, were slightly below the state average. The median household income for Powder River County, Montana was 16 percent below the Montana state average of $43,978.

The poverty threshold was based on a 3-person household. The U.S. Census Bureau 2008 poverty threshold definition for a 3-person household was $17,163 (U.S. Census Bureau 2008). The 2008 median household income for all of the affected counties indicates a general level of income that was well above the poverty threshold.

3.13 Transportation

Four major federal highways and two state highways would be crossed by the Project. I -25 would be crossed at approximately MP 86.5, which connects south to Casper, Cheyenne, and Denver and north to Buffalo. I-25 is a four-lane, divided highway developed to Interstate Systems standards. The Project intersects I-90 at approximate MP 149. I-90 connects east to Rapid City and west to Sheridan and Billings, Montana. It also is a four-lane, divided highway developed to Interstate System standards. U.S. Highway 20/26 would be crossed approximately 5 miles east of the town of Powder River, and then crossed again 3 miles east of Natrona. U.S. Highway 20/26 connects west to Shoshoni, Riverton, and Thermopolis and east to Casper. U.S. Highway 20/26 is a paved, two-lane, primary highway. State highways that would be crossed by the Project are WY 192 and 59. WY 192 is a paved, two-lane, secondary highway connecting Kaycee at I-25 with WY 387 northeast of Edgerton. WY 59 is a paved, two-lane highway originating in Douglas, passing north through Gillette, and terminating in Montana. **Table 3-22** lists traffic levels on the major highways.

Table 3-22 Traffic Levels for Major Highways Crossed by the Greencore Project, 2008

Highway	Location	2008 Traffic Counts			
		AADT[1]		Total Annual[2]	
		Total Traffic	Trucks	Total Traffic	Trucks
U.S. Highway 20/26	Between Powder River and Natrona, near Powder River Road (MP 33.1)	2,560	480	934,400	175,200
I-25	Near Exit 235 (MP 86.4)	1,540	380	562,100	138,700
WY 192	Near Sussex (MP 107.0)	160	30	58,400	10,950
I-90	Near Exit 102 (MP 148.8)	2,050	440	748,250	160,600
U.S. Highway 14/16	North of Road 23 (MP 178.9)	1,620	230	591,300	83,950
WY 59	North of Weston (MP 201.2)	470	90	171,550	32,850

[1] Annual Average Daily Traffic.

[2] Extrapolated from AADT.

Source: Wyoming Department of Transportation (2008).

Areas between the major highways are served by an irregular, complex network of unpaved roads ranging from unmaintained 4-wheel drive trails to gravel-surfaced county roads. In certain energy development areas, the networks are fairly dense, having been constructed for resource development purposes. Notable access points include Thirty-three Mile Road (MP 64), Sussex Field Road (MP 100.5), Buffalo Cut across Road (MP 143.5), Trail Creek Road (MP 218), and Ranch Creek Road (MP 226).

The Project has rail service via the Burlington Northern Railroad, which passes through the cities of Casper and Gillette.

3.14 Cultural Resources/Native American Concerns

3.14.1 Cultural Resources

Federal historic preservation laws provide a legal environment for documentation, evaluation, and protection of cultural resources that may be affected by federal undertakings, or by private undertakings operating under federal license, or on federally-managed lands. NEPA states that federal undertakings shall take into consideration impacts to the natural environment with respect to an array of resources, and that alternatives to the proposed federal action must be considered. The courts have made clear that cultural resources are regarded as part of the natural environment. The NHPA of 1966, as amended, established the ACHP and the National Register of Historic Places (NRHP). The NHPA mandates that federal agencies consider an undertaking's effects on cultural resources that are listed or eligible for listing on the NRHP. Section 106 of the NHPA establishes a review process by which these resources are given consideration during the conduct of federal undertakings. Cultural resources that are listed or eligible for listing on the NRHP are referred to as historic properties.

A PA currently is being developed between the BLM and Wyoming and Montana SHPOs. A copy of the PA is provided in **Appendix B**. The PA outlines mitigation treatment plan requirements and procedures for mitigating potential impacts to identified and unidentified cultural resources. Protection measures identified in the PA include protective fencing between the ROW and selected sites, narrowing of the ROW at selected sites, OTI for evidence of buried cultural deposits, and treatment of unanticipated discoveries, including human remains.

3.14.2 Eligibility Criteria for Listing Cultural Resources on the NRHP

The NRHP, maintained by the National Park Service (NPS) on behalf of the Secretary of the Interior, is the nation's inventory of significant cultural resources. The NPS has established three main standards that a resource must meet to qualify for listing on the NRHP: age, integrity, and significance. To meet the age criteria, a resource generally must be at least 50 years old. To meet the integrity criteria, a resource must "possess integrity of location, design, setting, materials, workmanship, feeling, and association" (36 CFR 60.4). Finally, a resource must be significant according to one or more of the following criteria:

- Criterion A – Be associated with events that have made a significant contribution to the broad patterns of our history; or
- Criterion B – Be associated with the lives of persons significant in our history; or
- Criterion C – Embody the distinctive characteristics of a type, period, or method of construction or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction; or
- Criterion D – Have yielded, or may be likely to yield, information important in prehistory or history.

3.14.3 Area of Potential Effect

For the Project, the analysis area for cultural resources includes the area of potential effect (APE). Under Section 106 of the NHPA, the APE is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking" (36 CFR 800.16[d]).

The APE should include the following:

- All alternative locations for all elements of the Project;
- All locations in which the Project might result in ground disturbance;
- All locations from which elements of the Project (e.g., a facility or land disturbance) might be visible;
- All locations in which the Project might change traffic patterns, land use, public access, etc.; and
- All areas in which direct or indirect effects might occur.

The APE for direct and indirect impacts encompasses the pipeline ROW, pipe and contractor yards, access roads requiring upgrade, ATWS, and ancillary facilities. Where applicable, the APE for visual impacts includes those ancillary facilities, or other elements of the Project, visible from historic properties in which setting contributes to their NRHP eligibility.

<u>Cultural Resources Investigations</u>

Class III field inventories currently are being conducted to locate and document cultural resources along the Project ROW, existing access roads requiring upgrades, ATWS, and ancillary facilities. Prior to the field inventories, a files search was completed through the Wyoming and Montana SHPOs to identify all previously conducted archaeological investigations and previously recorded cultural resources within 0.5 mile on either side of the Project centerline, along existing access roads requiring upgrade, and within the footprint of ATWS and ancillary facilities. General Land Office (GLO) maps also were reviewed to assist in the identification of historic resources (e.g., roads, trails). As a result of the files search and map review, a total of 919 sites were identified within the files search study area. The majority of these previously documented sites are prehistoric camps and prehistoric lithic scatters, followed by historic debris scatters and multi-component sites containing both prehistoric and historic components.

The Class III field inventory of the Project ROW is being conducted within a 200-foot-wide survey corridor. Approximately 210 miles (91 percent) of the ROW is collocated with existing utility corridors. Where the ROW is collocated with an existing utility corridor, the 200-foot-wide survey corridor extends 50 feet from the existing utility centerline to the Project centerline, and 150 feet from the Project centerline on the other side. Where the ROW is not collocated with an existing utility corridor, the survey corridor is 200 feet wide centered on the Project centerline. The Project would be restricted to a nominal 150-foot-wide construction ROW. A 100-foot-wide corridor is being inventoried for access roads requiring upgrade. Inventory of two probable future Natrona Hub locations included a 10-acre area.

At this time, Class III inventories have been completed for approximately 230.4 miles of the 231-mile-long pipeline ROW, all currently identified access roads and ATWS, and six ancillary facilities, including two future Natrona Hub locations, midpoint, endpoint, Upton pipeyard, and Casper pipeyard. Any remaining unsurveyed pipeline ROW, ATWS, access roads, and ancillary facilities would be surveyed prior to the Project construction and with enough lead time to allow for evaluation of sites located during the inventories, assessment of impacts, and mitigation, if necessary.

To date, a total of 123 sites and 76 isolated finds have been recorded within the Project and access road survey corridors and ancillary facilities. The isolated finds include 70 prehistoric, 5 historic, and 1 multi-component isolates. Of the 123 sites, 69 are prehistoric, 44 are historic, and 10 are multi-component. In sum, 21 of the sites are recommended or currently determined as eligible for the NRHP and 102 are not eligible (**Table 3-23**). The Project crosses 12 NRHP-eligible linear resources, 2 of which are contributing segments. The types of NRHP-eligible sites located in the Project APE and their management recommendations are listed in **Table 3-24**. It should be noted that three prehistoric sites (48JO938, 48NA1431, 48NA4073) recommended or currently determined as eligible for the NRHP are located outside of, but close to, the Project APE. As such, pre-construction fencing is recommended to ensure protection of these sites.

Table 3-23 Summary of Site Types and Eligibility

Site Type	Eligible	Not Eligible	Total
Prehistoric	7	62	69
Historic	13	31	44
Multi-component	1	9	10
Total	**21**	**102**	**123**

Source: Metcalf 2010.

Table 3-24 NRHP-Eligible Sites Located Within the Project APE

Site Number	Site Type	Project Element	Management Recommendation
48CA265	Historic Railroad	ROW	Non-contributing/NFW
48CA1473	Historic Texas Trail	ROW	Non-contributing/No physical trace/NFW
48CA2785	Historic Black and Yellow Road; State Highway 14/16 route	ROW	Non-contributing/NFW
48JO134	Historic Bozeman Trail – route from Fort Fetterman	ROW, access road	Contributing/No adverse effects (no physical evidence of the trail)/NFW

Table 3-24 NRHP-Eligible Sites Located Within the Project APE

Site Number	Site Type	Project Element	Management Recommendation
48JO1599	Historic Bozeman Trail – route from Deer Creek Station and Richards Bridge	ROW	Non-contributing/Revisit in spring 2011 to confirm no physical trace; if trace is visible, conduct pre-construction recordation/Restrict and fence ROW/Post-construction restoration
48JO3059	Historic Fort Fetterman to Fort McKinney Telegraph Line	ROW, access road	Non-contributing/Presumed destroyed/NFW
48NA242	Historic North South Railroad	Access road	Contributing/Access road would be restricted to light-duty trucks/NFW
48NA631	Historic Chicago and Northwest Railroad – Sodium, Wyoming, crossing	ROW, access road	Non-contributing/NFW
48NA631	Historic Chicago and Northwest Railroad – Powder River, Wyoming, crossing	ROW	Non-contributing/Narrow and fence ROW
48NA1014	Prehistoric open camp/historic debris scatter	ROW, access road	Non-contributing/Fence south side of access through site
48NA1035	Prehistoric open camp	ROW	Non-contributing/NFW
48NA1425	Prehistoric open camp	ROW	Avoid or data recovery
48NA1428	Prehistoric open camp	ROW	Non-contributing area/NFW
48NA1800	Prehistoric open camp	ROW	Currently listed as eligible for the NRHP; re-evaluated as not eligible/NFW
48NA1968	Prehistoric open camp	ROW	Non-contributing/NFW
48NA1975	Historic Yellowstone Highway 20 – Hells Half Acre Crossing	ROW	Non-contributing/NFW
48NA1975	Historic Yellowstone Highway 20 – Sodium, Wyoming, crossing	ROW	Non-contributing/NFW
48NA2561	Historic Chicago, Burlington & Quincy Railroad – Arminto, Wyoming, crossing	ROW, access road	Non-contributing/NFW
48NA2561	Historic Chicago, Burlington & Quincy Railroad – Sodium, Wyoming, crossing	ROW, access road	Non-contributing/NFW
48NA4837	Prehistoric stone circles	ROW	Non-contributing/Features avoided/Restrict and fence ROW
48NA4838	Prehistoric open camp	ROW	Avoid or data recovery

NFW = No Further Work.

Source: Metcalf 2010.

Avoidance is recommended for two of the NRHP-eligible prehistoric open camps (48NA1425, 48NA4838). If avoidance is not feasible, data recovery (i.e., archaeological excavation) would be conducted at the sites to mitigate impacts associated with the Project construction. Currently, a historic properties treatment plan is being prepared in the event the two sites cannot be avoided by the Project construction.

3.14.4 Native American Concerns

Native American traditional, religious, and cultural concerns include archaeological sites and areas and materials important to Native Americans for religious and/or traditional use. Sensitive resources could include prehistoric sites, features (e.g., stone circles/cairns), artifacts, contemporary sacred areas, burial sites, traditional use areas, and sources for materials used in the production of sacred objects and traditional tools. In 1992, the NHPA was amended to explicitly allow that "properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization may be determined to be eligible for inclusion on the NRHP." To date, two prehistoric stone circles and two prehistoric cairns have been documented during the Class III inventory.

It is the responsibility of all federal agencies to comply with the requirements of Section 106 and the ACHP's regulations when planning and carrying out their undertakings. In doing so, they are required to consult with Native American groups or other interested parties depending on the specifics of the undertaking. Such consultation with Native American groups or other interested parties is central to the Section 106 process. Consultation is defined in the ACHP's regulations as "the process of seeking, discussing, and considering the views of other participants, and, where feasible, seeking agreement with them regarding matters arising in the Section 106 process" [36 CFR § 800.16(f)].

As part of the Section 106 compliance process, a certified/registered letter was sent to all federally recognized Native American groups either residing in or with cultural ties to the Project area. The letter informed these groups of the proposed undertaking and solicited their concern/comments regarding possible historical and traditional ties to the area or the presence of sites of cultural and religious importance. A total of six applicable Native American groups were contacted: Northern Cheyenne, Blackfeet, Crow, Eastern Shoshone, Northern Arapaho, and Ute. In addition, the tribes were informed of the ongoing archaeological surveys and current number of NRHP-eligible prehistoric sites located during surveys. A field visit to site 48NA905, a NRHP-eligible site consisting of stone circles, a stone cairn, historic dugout, and water well, was organized by the BLM. Of the six tribes, only the Crow participated in the field visit. Subsequent to the field visit, the Project ROW was rerouted to avoid the site.

Any specific information provided by tribal members concerning Native American traditional use and/or sites of cultural and religious importance in or near the Project area would remain confidential. At this time, consultation with the Native American groups is ongoing and would continue up to and including the Project construction.

4.0 Environmental Consequences

Chapter 4.0 of this EA provides an analysis of the potential environmental impacts that could result from implementation of the Proposed Action and No Action alternative. Narrative descriptions of potential impacts under the Proposed Action are provided for each environmental resource in Sections 4.1 through 4.15. The impacts of the No Action Alternative are discussed in Section 4.15. No other alternatives were analyzed for this EA.

4.1 Climate and Air Quality

4.1.1 Climate

Since the necessary compression for transporting the CO_2 gas in the pipeline would be generated by electrically powered equipment, and GHG are emitted during the generation of electricity, the power requirements of the Project have an indirect contribution to the emission of GHG. The continuous power requirements to operate the pump stations and other ancillary equipment are estimated to be approximately 20.1 MW. The continuous generation of this electricity amount is estimated to release 177,000 tons of CO_2e per year, and is comparable to the emissions from the electricity use of nearly 17,000 homes for 1 year. This level of CO_2e emissions is less than 0.001 percent of the total annual emissions of CO_2e in the U.S. from fossil fuel combustion.

The Project would provide for the capture and injection of CO_2 that would otherwise be vented to the atmosphere under normal operations. Initially, approximately 50 mmcf/d of CO_2 would be captured and transported in the pipeline to the Bell Creek oilfield where the CO_2 would be injected in an EOR operation. The enhanced production attributed to the CO_2 EOR operation would store more CO_2 than would be generated by burning the oil produced from the process. This process would provide for net storage of CO_2 into the underground formation.

4.1.2 Air Quality

National Ambient Air Quality Standards and Wyoming Ambient Air Quality Standards are presented in **Table 4-1**. Concentrations of these pollutants in the ambient air may not exceed these levels. In addition, the emissions from the Project and construction activities may not cause or contribute to exceeding these levels.

Table 4-1 Applicable Ambient Air Quality Standards

Pollutant (Units)	Averaging Period	Ambient Air Quality Standards[1]	
		National[2]	Wyoming[3]
NO_2 (µg/m^3)	1-hour	188[10]	--
	Annual[4]	100	100
PM_{10} (µg/m^3)	24-hour[5]	150	150
	Annual[4]	--[11]	50
$PM_{2.5}$ (µg/m^3)	24-hour[6]	35	65
	Annual[4]	15	15

Table 4-1 Applicable Ambient Air Quality Standards

Pollutant (Units)	Averaging Period	Ambient Air Quality Standards[1]	
		National[2]	Wyoming[3]
SO_2 (µg/m^3)	1-hour	196[12]	--
	3-hour[7]	1,300	1,300
	24-hour[7]	365	260
	Annual[6]	80	60
CO (µg/m^3)	1-hour[7]	40,000	40,000
	8-hour[7]	10,000	10,000
Ozone (ppm)	1-hour[8]	0.12	--
	8-hour[9]	0.075	0.075

1 Due to the lack of an identified regional issue for lead, it will not be analyzed as part of this study.

2 Source: http://www.epa.gov/air/criteria.html#3.

3 Source: http://deq.state.wy.us/aqd/stnd/Chapter2_2-3-05FINAL_CLEAN.pdf.

4 Not to be exceeded.

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

6 24-hour average of the 98th percentile concentrations (effective December 17, 2006).

7 Not to be exceeded more than once per year.

8 USEPA revoked the 1-hour ozone standard in all areas, although some areas have continuing obligations under that standard. The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is $\leq$1.

9 To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm.

10 The 3-year average of the 98th percentile of the daily maximum 1-hour average is not to exceed this standard.

11 The annual PM_{10} NAAQS of 50 µg/m^3 was revoked by USEPA on September 21, 2006; see FR volume 71, number 200, 10/17/06.

12 The annual PM_{10} NAAQS of 50 µg/m^3 was revoked by USEPA on September 21, 2006; see FR volume 71, number 200, 10/17/06.

The Project construction activities would result in short-term emissions from the operation of construction vehicles and the generation of fugitive dust. The daily exhaust emissions for construction were estimated by multiplying emission factors and the number and type of construction equipment anticipated for the Project. The equipment-specific emission factors are from the California Environmental Quality Act, Air Quality Handbook (South Coast Air Quality Management District 1993). The total emission estimates are shown in **Table 4-2**.

The Project construction operations also would generate fugitive dust emissions from earth-moving activities and wind erosion of disturbed acreage. The assumed average daily pipeline construction progress of up to 6,000 feet per day in conjunction with an estimated disturbance width of 100 feet yields a total disturbed acreage of approximately 13.8 acres per day. The average daily fugitive dust emissions for a typical pipeline spread are estimated to be 1,100 pounds per day using an emission factor of 1.2 tons PM_{10} per acre per month for construction activities (USEPA 1985). It is estimated that as much as half of the total disturbed acreage along the Project route (231 miles x 100 feet) would be exposed to wind erosion at any one time. With a maximum exposed area of 1,400 acres, the predicted emissions from wind erosion are 2,900 pounds per day using the emission factor of 0.38 tons PM_{10} per acre per year (USEPA 1985).

Table 4-2 Construction Emissions Estimates

Source	CO		VOC		NO_X		SO_2		PM_{10} and $PM_{2.5}$	
	lbs./ day	total tons	lbs./ day	total tons	lbs./ day	total tons	lbs./ day	total tons	lbs./ day	total tons
Construction Equipment Operations	486	34.0	148	10.4	1,303	91.2	1.46	0.10	55	3.8
Vehicular Operations	42	2.9	4	0.3	4	0.3	0.05	0.00	0.45	0.03
Construction Fugitive Dust	-	-	-	-	-	-	-	-	1,102	77
Wind Erosion Dust	-	-	-	-	-	-	-	-	2,915	204
Total Construction Emissions	**528**	**37**	**152**	**11**	**1,308**	**92**	**1.5**	**0.1**	**4,072**	**285**

Assumptions: Types and quantity of equipment are shown in the POD. Total time for pipe laying would be approximately 81 days. Operation time of construction equipment would be 12 hours/day.

CO = carbon monoxide, VOC = volatile organic compounds; other pollutant descriptions are provided as footnote in **Table 4-1**.

Altogether, the particulate emissions from construction equipment, surface disturbance, and windblown dust for 10 feet of pipeline is equivalent to about 2.0 pounds of dust becoming airborne each day from a length of 10 feet of the Project ROW. The resulting concentrations of dust averaged over a 24-hour period would be less than the daily standard of 150 $\mu g/m^3$ at a distance of 1.5 miles from the ROW.

These emissions would result in minor short-term impacts on local air quality. These impacts would be restricted to the brief construction period along each stretch of the Project route. The construction impacts would diminish once construction activities end and after disturbed areas are reclaimed. Best management practices would be used to minimize construction impacts (**Table 2-3**). Vehicular exhaust and crank case emissions from gasoline and diesel drivers would comply with applicable USEPA mobile emission regulations (40 CFR 85).

Air quality impacts due to operation of the Project would be minimal. Minor transient emissions would occur from maintenance activities along the Project ROW. Emissions would include exhaust from maintenance vehicles and equipment, as well as fugitive dust from maintenance activities, wind erosion, or vehicular traffic. Emissions from operation of the Project would be infrequent and short-term resulting in no significant impact to air quality.

Abandonment of the Project would result in short-term emissions from the operation of vehicles and the generation of fugitive dust. Fugitive dust emissions also would be generated from earth-moving activities and wind erosion of limited disturbed areas from surface facility removal. The Project abandonment operations would be relatively small in scale, spread out at various locations along the Project, and short-term, resulting in no expected significant impact to air quality.

4.2 Geology and Soils

4.2.1 Geology

Construction

Construction activities would include disturbances to the topography along the Project ROW and at aboveground facilities in northern Campbell County due to grading and trenching activities that would result in slope instability. Although the Project does not cross mapped landslide areas, construction activities could result in instability to occur through undercutting of slopes or changes in drainage and surface flow. The construction techniques proposed by Greencore would be sufficient to reduce impacts due to slumping and mass wasting (see POD, Appendix E, SWPPP).

Blasting potentially would adversely impact the geologic and physiographic environment. Limited blasting may be required in areas where shallow bedrock or boulders were encountered that could not be removed by conventional excavation with a trackhoe trencher, ripping with a bulldozer followed by trackhoe excavation, or hammering with a trackhoe-mounted hydraulic hammer followed by excavation. Blasting is not anticipated for the Project. If hard bedrock is encountered it can be disaggregated by using rippers, trenchers, or other equipment. However, in the event blasting is necessary, Greencore would prepare a blasting plan for the Project.

Operation

No concerns associated with geological resources were identified with operation of the proposed facilities. Operation of the Project would not materially alter the geological and physiographic conditions.

Since there are no identified active faults along the Project route, no impacts due to ground deformation due to fault movement are expected. The Project is in an area not likely to experience strong ground motion during a maximum credible earthquake, therefore impacts due to ground motion are not anticipated.

4.2.2 Soils

The Project construction would create surface disturbance to soils associated with:

- ROW clearing and grading;
- Access trail and road maintenance;
- Ancillary facility construction; and
- Additional temporary work space (ATWS).

Land disturbance would result in:

- Vegetation removal;
- Compaction of soil by construction equipment;
- Accelerated runoff due to a reduction in pore space and infiltration associated with soil compaction;
- Alteration of the soil profile within the excavated trench area of the pipeline, on hillside cuts in steep-sloping areas, and in borrow areas for roads;
- A potential reduction in soil stability on steep side hill areas; and
- A temporary reduction in soil productivity and quality.

In total, an estimated 2984 acres located within the Project ROW contain sensitive soils. The types and locations of these sensitive soils are listed in **Appendix C**.

Accelerated wind and water erosion would occur where land has been disturbed. Reclamation and erosion control would be difficult on soils that occur on steeper sloping areas (15 percent or more), particularly those steeper sloping areas over shallow soils (20 inches or less to bedrock). Soils with unfavorable properties, including thin topsoil layers, moderate to strong salinity and alkalinity, clayey or sandy surface and subsoils, and shallow depths over bedrock are common and would present problems for erosion control and revegetation.

Soil compaction and rutting would likely result from the movement of heavy construction vehicles along the construction ROW, facilities, ATWS, and on temporary access roads. The degree of compaction would depend on the moisture content and texture of the soil at the time of construction. Compaction would be most severe where heavy equipment operates on moist to wet soils with high clay contents. Detrimental compaction also can occur on soils of various textures and moisture contents if multiple passes are made by equipment. If soils

are moist or wet where trenchline only topsoil trenching has occurred, topsoil would likely adhere to tires and/or tracked vehicles and be carried away.

Typically soils that are compaction prone also are prone to rutting or displacement when saturated. Rutting occurs when the soil strength is not sufficient to support the applied load from vehicle traffic. Rutting affects the surface hydrology of a site as well as the rooting environment. The process of rutting physically severs roots and reduces the aeration and infiltration of the soil, thereby degrading the rooting environment. Rutting also disrupts natural surface water hydrology by damming surface water flows, creating increased soil saturation upgradient from ruts, or by diverting and concentrating water flows thereby causing accelerated erosion and gullying. Rutting is most likely to occur on moist or wet fine textured soils, but also may occur on dry sandy soils due to low soil strength.

Greencore plans to minimize or mitigate potential impacts to soils by implementing the soil protection measures identified in **Table 2-3** and the Project POD. The erosion control BMPs, reclamation, and revegetation programs and SWPPP (Appendix E in the POD), would provide an effective program that would ensure successful erosion control and reclamation of all land disturbance. Greencore would follow the reclamation plans described in the POD when operating on BLM and State of Wyoming lands, and would comply with soil protection and land use goals identified by the landowner on private lands.

Most of the impacts to soil resources would be short-term, since all disturbed areas not needed for operations would be reclaimed within 1 year of construction. Most reclamation would be completed within a few months of disturbance. However, soil impacts may occur if revegetation is not successful or adverse weather conditions (mainly heavy rainstorms) occurred during construction or before reclamation and erosion control measures could be implemented.

Some unquantifiable soil loss resulting from accelerated wind and water erosion would occur until erosion measures were implemented (measures will be implemented within 1 year). In addition to the sensitive areas outlined in **Appendix C**, a few small unquantifiable areas (mainly abrupt steep slopes and localized areas with soil containing unfavorable physical and chemical properties) would be subject to accelerated erosion and require intensive and continuing follow-up erosion control measures.

With effective use of POD erosion control/revegetation procedures, understory vegetation on sites without soil limitations is expected to return to near preconstruction conditions within 5 years after construction. Problem areas may require replanting and/or use of special revegetation techniques, if revegetation does not respond in one to two growing seasons. In areas of limited precipitation (less than 9 inches), and where there are shallow soils and/or low permeability soils, reclamation techniques that enhance permeability and conserve moisture would increase the potential for successful revegetation. Impacts to overstory vegetation would be long-term with shrubs and trees taking several years to become re-established (e.g., 10 to 20 years for sagebrush, 20 to 30 years for desert shrub vegetation, and 50 to 75 years for coniferous woodland tree species) (BLM 2001).

As described above, some soil loss would result from wind and water erosion until erosion control measures referenced above begin to take effect. Very small scale, isolated surface disturbance impacts, resulting in accelerated erosion, soil compaction, spills, and related reductions in the productivity of desirable vegetation could result from pipeline maintenance traffic and incidental repairs. Impacts related to excavation and topsoil handling are not likely to occur. However, if they do occur, they will be limited to small areas where certain pipeline maintenance activities take place. During operation, these types of impacts would be addressed with the affected landowner or land management agency and a mutually agreeable resolution reached.

Potential effects of fuel spills on soils would include contamination at the spill site. In addition, BMPs incorporated into the Project POD would be implemented to minimize fuel spills.

4.3 Mineral and Paleontological Resources

4.3.1 Mineral Resources

Construction

As shown in **Table 3-4**, the Project crosses numerous oil and gas fields. In addition, the Project may cross aggregate resources in alluvial valleys and river terraces. Nevertheless, construction would have very minor and short-term impact on current mineral extraction activities due to the temporary and localized nature of pipeline construction activities.

It is possible that oil and gas wells may be close to the Project area. Construction activities potentially could damage wells, associated underground fluid lines and pipelines, and disrupt normal operations and routine maintenance. Also, damage to oil and gas facilities, should it occur, could present severe health and safety and contamination hazards. Abandoned wells also could be impacted since construction potentially could remove existing abandoned well markers and damage near surface cement plugs. Because oil and gas are produced at depths considerably deeper than the excavation depth, construction of the Project would not be expected to affect the oil and natural gas producing formations. Rather, any construction-related impacts would be limited to surface or near-surface components of the wells and gathering systems, which would temporarily disrupt production until repairs are made.

Construction of the Project is not expected to impact mining operations.

Operation

The primary issues of concern regarding mineral resources and operation of the pipeline are the potential for reduced access to underlying minerals and interference with future mineral extraction operations.

Long-term operation of a pipeline has the potential to preclude access to mineral resources. However, much of the Project ROW would be in an existing pipeline corridor and would not hinder access to mineral resources. Overall, the Project does not pose a hindrance to access to oil and gas resources. Although the Project is within an area of potential exploitable minerals (coal and uranium), no current plans to mine such resources across the ROW were identified.

Operation of the Project would not have a significant added impact on current or future mineral recovery operations in the area because most of the Project ROW would follow existing ROWs that have already precluded mineral development through the corridor. Additionally, impacts on future mineral development would not constitute a significant loss of mineral resource or mineral availability because of the narrow, linear nature of the pipeline ROW relative to the expanse of areas with mineral resource potential. It is anticipated that the pipeline trench would be backfilled with materials derived from the trench excavation, and it might be necessary to obtain some construction sand and gravel from local, existing commercial sources for use as pipe padding, road base, or surface facility pads. These demands for sand and gravel would not affect the long-term availability of construction materials in the area.

4.3.2 Paleontological Resources

Construction

The issue of concern with regard to paleontological resources is the potential damage and loss of scientifically important fossils from ROW clearing, grading, trench excavation, and construction of other pipeline facilities. Potential impacts to fossil localities during construction would be both direct and indirect. Direct impacts to or destruction of fossils would occur from trenching or facility construction activities conducted through significant fossil beds. Indirect impacts during construction would include erosion of fossil beds due to slope re-grading and vegetation clearing or the unauthorized collection of scientifically important fossils by construction workers or the public due to increased access to fossil localities along the ROW.

Protective measures should be implemented where specific paleontological resources have either been identified during field survey or where the geologic unit is rated as having a high level of sensitivity for paleontology. The protection measures vary in intensity depending on underlying geological unit anticipated to be disturbed by surface grading and trench excavation. **Table 2-3** lists some of the measures that should be implemented. The final report should contain the results of the mitigation work conducted, including an accession list of fossil specimens collected and listed by locality.

Operation

The major impact for paleontological resources during pipeline operations is potential damage and loss of scientifically important fossils from maintenance activities. Any potential effects to fossils from maintenance activities would be isolated due to the probable dispersed nature of those activities.

Normal operation of the Project is not expected to disturb important paleontological resources. If there are maintenance activities that would result in surface disturbance, it would occur within previously disturbed ROW and not likely to affect paleontological resources. Therefore, there would be no impacts to paleontological resources during operation of the Project.

4.4 Water Resources

4.4.1 Surface Water

Impacts to surface water would depend on construction techniques employed and the physical characteristics of the streams and watersheds crossed by the route. Temporary impacts are generally expected from land disturbance during construction of the Project. Temporary impacts would be most likely to occur during open-cut construction at flowing perennial streams and other streams that flow at the time of construction. Water for hydrostatic testing, dust abatement, HDD drilling, and other construction uses would temporarily impact surface water through depletions of streams during water withdrawals. Potential leaks or spills of petroleum products or other hazardous materials from construction and operation equipment and vehicles might impact surface water.

Trench excavation across perennial streams (see **Table 3-8** for list of perennial streams crossed) and intermittent streams with streamflow at the time of construction would result in increases of sediment available for transport by the water. This would temporarily result in elevated levels of total suspended sediment (TSS) and increases in turbidity at and downstream from the stream crossing. TSS and turbidity levels would be expected to recover within several days after the completion of in-stream construction activities.

Two perennial waterbodies (the Little Powder River and Horse Creek) and Wild Horse Creek (extended wetland) would be crossed utilizing the HDD method, which would eliminate surface disturbance within or near the channels of these streams. See Section 2.2.3.7 for additional discussion on waterbody crossing methods. The proponent prefers to use the open cut (dry flume) crossing method is preferred for construction across all other stream crossings.

Areas of disturbance adjacent to and directly upslope of streams also might contribute to temporary impacts of surface water through increased rates of erosion that contribute sediment to the streams during storm runoff events. BMPs contained in the SWPPP (POD, Appendix E) would be utilized during construction and reclamation to minimize these impacts. Specific areas of potential bank erosion would be identified during the detailed design phase.

Water usage for construction purposes would total approximately 18,670,680 gallons (57.3 acre-feet). This includes 18,300,000 gallons for hydrostatic testing and 370,680 gallons (1.1 acre-feet) for HDD. Water would be obtained through Temporary Use Agreement with current water users approved by the WSEO. Hydrostatic testing would occur in 4 pipeline spreads as they are completed during the 2-year construction period. It is anticipated 2 spreads will be tested each year, equaling approximately half the volume of water per year. A commercial water source has been identified in Gillette, Wyoming, that would include water hauling to the test segments. Additional water would be obtained from the Little Powder River, sources at the pipeline terminus,

and potentially the DEM Ranch Limited Partnership at the beginning of the pipeline. Water would not be obtained from the North Platte River basin. Test water would be discharged into a dispersion device as described in the SWPPP (POD, Appendix E).

Water quality could be impacted if construction or operation equipment and vehicles leaked or spilled petroleum products or other hazardous materials into or near any streams or waterbodies. Protective measures are presented in **Table 2-3** and the SWPPP.

In summary, temporary construction impacts to surface water resources would occur only at or near flowing stream crossings as a result of the introduction of sediment to the streams. This temporary impact would dissipate downstream of the pipeline crossing and within several days of the completion of in-stream construction activities. Water for hydrostatic testing would be obtained under WYSEO-approved Temporary Water Use agreements and would be disposed of according to applicable federal, state, and local regulations. Therefore, impacts to surface water resources due to construction of the pipeline are not expected to be significant.

If a pipe leak or rupture were to occur at a stream crossing, most of the CO_2 would bubble through the water and vent into the atmosphere; however, CO_2 is soluble in water as carbonic acid and could influence the alkalinity of the stream but the impacts would be temporary, persisting only until the pipeline was depressurized and would only occur a short distance downstream due to mixing.

Upon abandonment of the pipeline, all surface facilities would be removed, and the resulting disturbed ground would be reclaimed. The pipe would be abandoned in-place. Therefore, no disturbance of surface streams is anticipated. The impact to surface water resources due to abandonment of the pipeline would not be significant.

4.4.2 Groundwater

The trench excavated for pipe placement is above the water table along the Project route with the possible exception of alluvial aquifers along perennial streams. Portions of the route in the immediate vicinity of perennial streams may encounter shallow groundwater during excavation. Following backfill of the trench, these areas would be returned to their original condition, and groundwater impacts would not be expected. No groundwater would be encountered at the Little Powder River, Horse Creek, and Wild Horse Creek (extended wetland) crossings since directional drilling would be used. Water from permitted water wells or CBM produced water may be used for hydrotest or construction purposes. No unpermitted withdrawals of groundwater will occur. Therefore, impacts to groundwater resources due to construction of the Project are not expected to be significant.

4.5 Vegetation, Wetlands, Agriculture, and Range Resources

4.5.1 Vegetation and Wetlands

Construction activities would affect vegetation communities in a variety of ways, from temporary herbaceous compaction and partial removal of aboveground plant cover to permanent vegetation removal. Clearing, trenching, grubbing, blading, and herbaceous vegetation compaction would occur within the Project areas. Temporary impacts would be limited to the agriculture, developed, grassland, and wetland/waterbody vegetation cover types within the construction ROW. Long-term impacts (greater than 20 years) would be limited to the upland forest/woodland vegetation cover type within the construction ROW. Although long-term, the disturbance associated with the upland forest/woodland and shrubland vegetation cover type would be considered temporary in nature. Permanent impacts as a result of pipeline operation and maintenance activities would be limited to vegetation communities located within the permanent aboveground ancillary footprints. Woody species present within the shrubland and upland forest/woodland vegetation cover type would be allowed to re-establish within the 50-foot permanent ROW; however, trimming would be conducted to maintain aerial observation of the ROW. Trees greater than 10 inches in diameter would not be allowed to

re-establish within the permanent ROW, resulting in a long-term loss of this vegetation type. **Table 4-3** summarizes temporary and permanent acreage impacts to each vegetation cover type within the Project area.

Table 4-3 Summary of Temporary and Permanent Impacts per Vegetation Cover Type Within the Project Area

Vegetation Type	Temporary Impacts (acres)	Permanent Impacts (acres)
Grassland/shrubland	1,732.4	1,372.7
Wetlands/waterbodies	11.3	6.7
Developed	11.7	8.2
Agriculture	13.0	11.6
Upland forest/woodland	7.1	4.6
Total	**1,775.6**	**1,403.8**

Indirect impacts as a result of Project implementation may include the establishment of undesirable plant species; and, where reclamation is unsuccessful or prolonged, higher soil erosion rates and reduced forage production.

To minimize environmental impacts and ensure site stabilization and revegetation, Greencore would follow the construction procedures detailed within the Project POD (Appendix J, Reclamation Plan, and Appendix E, the SWPPP).

To further minimize environmental impacts, Greencore has committed to avoiding wetlands and other sensitive water features where ever possible. Where there is no reasonable access to the ROW except through wetlands, Greencore would implement measures to limit impacts as described in **Table 2-3**, Environmental Protection Measures, and the Project POD (Appendix J, Reclamation Plan, and Appendix E, the SWPPP).

Direct spills of fuels, drilling fluids, or other hazardous materials would saturate soils and adversely affect vegetation resources. To minimize the potential for spills, Greencore would implement the measures outlined in **Table 2-3**, Environmental Protection Measures, and the SWPPP (Appendix E of the POD).

4.5.2 Noxious Weeds

The prevention of the spread of noxious weed species is a high priority throughout Wyoming and Montana. Vegetation removal and soil disturbance during construction creates optimal conditions for the establishment of invasive, non-native species. As shown in Greencore's Noxious Weed Management Plan (POD, Appendix K, Table 1), 42 noxious weed populations were identified via on-site surveys and through agency consultation within the Project area.

To control the spread of noxious weed species along the pipeline route and access roads, weed control measures would be implemented in accordance with existing regulations, jurisdictional land management agency and landowner agreements, and Greencore's Noxious Weed Management Plan.

Substantial increases in weed prevalence are not anticipated; however, despite efforts to prevent the proliferation of noxious weeds, it is possible that pipeline construction, operation, and maintenance activities would result in the spread or introduction of noxious weed species along the ROW or that weed species would be transported into areas that were relatively weed-free. Implementation of measures within the Noxious Weed Management Plan and the POD (Appendix J, Reclamation Plan) for the Project would minimize the spread of undesirable weed species.

4.5.3 Agriculture and Range Resources

Impacts to agriculture vegetation communities would be consistent with those detailed in Section 4.5.1, Vegetation and Wetlands. In summary, impacts on agriculture vegetation communities would be temporary, as the vegetation would generally be re-established within 2 years of restoration depending on climatic conditions.

The primary issues associated with range resources include direct and indirect impacts associated with the loss of acreage, palatable forage, and active AUMs by allotment; potential impacts to existing water sources and range improvements; and potential impacts to seasonal livestock movement within grazing allotments. Impacts to range resources could result from physical surface disturbance and human activities associated with Project implementation and may include, but are not limited to, soil and vegetation loss during construction activities, potential disruption of calving/lambing periods, effectiveness of reclamation activities, weed control, dust control from roads and other barren surfaces, vehicle collisions with livestock, damage to fences and other range improvements, and increased access for recreational use by the public. These types of impacts may result in reduced forage availability (loss of AUMs), direct mortality to livestock, or increased costs and difficulty for managing livestock on the affected allotments.

Indirect impacts would include the spread of noxious weed species, fugitive dust emissions, and fragmentation of allotments. Following surface disturbance activities, noxious weed species may readily spread and colonize areas that typically lack or have minimal vegetation cover or areas that have been recently disturbed. An increase in traffic volume could lead to fugitive dust, which could decrease available forage and impact livestock health. The construction of the pipeline, aboveground ancillary facilities, and access roads, if applicable, could lead to increased fragmentation of individual grazing allotments.

The direct surface impacts and indirect impacts described above also have the potential to increase grazing pressure on undisturbed sections of grazing allotments. As disturbed portions of the grazing allotment become unavailable for grazing, the grazing pressure on the rest of the undisturbed portions of the allotment could increase. Depending on the seasonal timing of the disturbances, the length of time disturbed areas are unavailable, and the current grazing management, the undisturbed portions of the individual allotments potentially could be over-utilized, leading to further decreases in forage and potential reductions in stocking rates.

Direct impacts to rangeland improvements/facilities would include potential damage to fences, gates, and cattleguards, resulting in the accidental release of livestock. Water sources could be damaged, displaced, or drained due to construction and operation activities. Water quality in ponds and reservoirs could be impacted as a result of erosion from construction activities. Due to the semi-arid climate and lack of reliable water sources, the loss or damage to rangeland water sources and/or decreases in water quality could reduce the areas available for grazing. Without a reliable water source, many areas currently available for grazing would not be able to support livestock. This could lead to further fragmentation of the grazing allotment and/or impacts the ability of livestock operators to maintain current operations.

Table 4-4 summarizes acreage of temporary and permanent disturbance and approximate loss of AUMs within each grazing allotment within the Project area. In summary, approximately 1,497.1 acres of vegetation and 69 associated AUMs would be temporarily removed as a result of surface disturbance-related activities within portions of 62 grazing allotments contained wholly or partially within the Project area. In further, approximately 1,211.3 acres of vegetation and 54 associated AUMs would be permanently removed as a result of operation and maintenance-related activities associated with the permanent pipeline ROW and aboveground facilities. **Table 4-5** lists 5 range improvements on BLM grazing allotments that could potentially be directly removed or disturbed as a result of surface disturbance related activities.

Table 4-4 Carrying Capacity Impacts by Allotment Within the Greencore Project Area

Grazing Allotment Name	Total Allotment Acreage	Total Allotment Active AUMs[1]	Temporary Impacts		Permanent Impacts	
			Allotment Acreage	Projected Active AUM	Allotment Acreage	Projected Active AUM
33 Mile SDW	38,755.8	0.0	32.4	0	27.5	0
Beck Place	29,767.6	1,550.0	48.1	3	38.7	2
Brown Kennedy Ranch	32,541.0	501.0	36.8	1	27.8	0
Burke	69,421.5	3,693.0	27.9	1	18.5	1
Camel's Hump	10,948.6	447.0	31.1	1	21.7	1
Castle Creek	19,833.8	1,026.0	17.5	1	10.9	1
Crenshaw Hill	5,853.8	87.0	10.8	0	9.4	0
Crooked Creek	26,578.1	2,694.0	33.2	3	30.5	3
Daly Livestock Co	55,446.8	1,107.0	69.9	1	55.0	1
Dead Horse Creek Oilfield	6,390.1	216.0	43.5	1	33.0	1
Deadhorse II	10,543.2	286.0	16.7	0	12.4	0
Dry Trail Creek	4,855.4	389.0	22.4	2	16.5	1
Duck Creek 2	4,299.9	220	30.0	2	28.5	1
Dugout Creek	13,647.5	2,434.0	50.2	9	29.6	5
East Spring Draw	25,192.8	550.0	29.5	1	24.8	1
Eccles	13,815.0	1,286.0	30.7	3	25.2	2
Eighty-Five Divide	12,827.1	713.0	15.5	1	12.5	1
Falxa	40,007.6	1,546.0	27.1	1	19.5	1
Flying U Ranch	22,739.9	819.0	56.7	2	47.0	2
Government Draw	4,098.6	380.0	10.4	1	7.2	1
Gowin	14,662.8	260.0	13.5	0	8.8	0
Hines	3,641.4	24.0	19.3	0	15.0	0
Hoe Ranch	35,254.3	1,676.0	56.8	3	45.8	2
Horse Creek/Pipeline	1,281.4	8.0	9.1	0	6.8	0
Kingsbury/Wild Horse	7,204.1	33.0	18.9	0	14.2	0
Little Willow	24,060.8	823.0	42.2	1	38.6	1
Madden Ranch Past	5,529.2	170.0	2.0	0	0.6	0
Meadow Creek	10,074.5	248.0	39.4	1	31.9	1
Miller	10,150.8	312.0	10.7	0	7.1	0
Mumma Draw	9,229.3	54.0	16.7	0	11.3	0
North Mitten	2,542.5	**21**	1.2	0	1.4	0
North Of Tracks	17,788.9	2,205.0	27.8	3	24.0	3

Table 4-4 Carrying Capacity Impacts by Allotment Within the Greencore Project Area

Grazing Allotment Name	Total Allotment Acreage	Total Allotment Active AUMs[1]	Temporary Impacts		Permanent Impacts	
			Allotment Acreage	Projected Active AUM	Allotment Acreage	Projected Active AUM
Okie Trail	45,862.8	3,064.0	8.4	1	38.9	3
Paul Place	3,305.9	202.0	18.0	1	13.4	1
Pine Mountain	13,861.8	641.0	20.4	1	17.7	1
Pine Ridge	3,552.8	27.0	11.3	0	9.8	0
Potter	17,773.2	2,448.0	14.8	2	10.8	1
Powder River Draw	6,366.6	229.0	20.7	1	20.2	1
Pumpkin Creek	28,999.5	1,454.0	42.2	2	32.7	2
Railroad	19,863.9	1,477.0	53.7	4	49.1	4
Ryan	3,738.8	46.0	6.7	0	5.5	0
SF Holler Draw	4,107.2	26.0	18.2	0	16.8	0
Shamrock	5,876.1	569.0	24.7	2	15.4	1
Skidmore Estate	4,571.0	9.0	6.6	0	3.6	0
Smoky Gap-H. Jarra	6,524.9	262.0	12.2	0	7.9	0
South Carpenter Draw	2,612.7	11.0	34.0	0	19.7	0
South Cave Gulch	14,810.5	395.0	38.1	1	31.1	1
South Fork Casper	3,867.0	236.0	4.9	0	3.6	0
Springsteen	1,319.6	679.0	0.3	0	0.3	0
St. Clair South Pa	4,955.5	814.0	6.2	1	2.8	0
Sullivan	19,863.9	2,299.0	27.9	3	24.1	3
Summer Brewer	8,745.1	374.0	16.3	1	8.0	0
Swartz, Edward H.	15,045.3	496.0	17.0	1	15.1	0
Trail Creek	30,178.8	2,629.0	18.2	2	13.9	1
Ttt-Scotts Place	8,888.1	589.0	27.3	2	20.0	1
Tuttle Draw	1,598.6	92.0	5.2	0	4.3	0
Tuttle Draw/Deep Creek	8,618.2	154.0	8.4	0	6.9	0
Waltman	6,363.9	205.0	4.4	0	3.2	0
Weidt	3,336.5	221.0	14.8	1	8.4	1
Wormwood Ranch	117,764.8	2,491.0	30.0	1	43.0	1
Wyatt Draw	1,629.2	11.0	12.1	0	8.1	0
TOTAL	**1,002,986.3**	**47,928.0**	**1,421.0**	**69**	**1,156.0**	**54**

Table 4-5 Summary of Range Improvements Potentially Impacted Within the Greencore Project Area

Grazing Allotment Name/Range Improvement per Allotment	Approximate Location of Range Improvement (20100720 CL)
Crooked Creek	
Crooked Creek Stock Facility	MP 92.4 to MP 93.2
Dugout Creek	
Dugout Pipeline	MP 91.6 to MP 92.4
Hoe Ranch	
Jepson Draw Stockwater Well	MP 120.8 to MP 121.2
Horse Creek/Pipeline	
Magnuson Stockwater Pipeline	MP 198.8 to MP 199.9
Pumpkin Creek	
Culp Divide Fence	MP 135.8 to MP 136.8

Source: AECOM 2010d.

To minimize impacts to range resources, ensure site stabilization and revegetation, and minimize the potential for the introduction and spread of noxious weed species, Greencore would follow the construction procedures detailed within the Project POD and the stipulations outlined within the Noxious Weed Management Plan (Appendix K), Reclamation Plan (Appendix J), and SWPPP (Appendix E).

4.5.4 Threatened, Endangered, Candidate, and Sensitive Plant Species

Project development may result in direct and indirect impacts to special status plant species. Disturbances within or near suitable habitats may subject these species to: 1) introduction of plant species that could compete with desired species for available habitats, 2) accidental burial, and 3) destruction of individuals or populations from herbicide application.

Impacts to special status plant species as a result of operation and maintenance activities would be limited to the 50-foot permanent ROW, as such; no further special status species habitat loss is anticipated. Individual and habitat loss from weed control measures during ROW maintenance would be avoided by consultation between the special status plant species jurisdictional agency and the weed control specialists. Species-specific impact summaries and applicant-committed environmental protection measures for the protection of these species are presented below.

4.5.4.1 Federally Listed Plant Species

Blowout Penstemon

As summarized in Section 3.5.4, marginally suitable habitat (i.e., small dune complexes insufficient for viable populations), occupying approximately 37.3 acres was identified during 2010 species-specific surveys along the pipeline ROW. Given the comprehensive survey effort and the resulting absence of documented individuals or populations, no loss of individuals is anticipated. Based on the environmental protection measures outlined in **Table 2-3**, suitable habitat loss as a result of surface-disturbance activities would be temporary in nature, resulting in no net loss of species and their associated habitat.

Based on the presence of marginally suitable habitat and lack of documented individuals, the BLM has determined that the Project would result in a “May Affect, Not Likely to Adversely Affect” impact determination

for the federally endangered blowout penstemon in accordance with the Section 7 process under the Endangered Species Act. As a result of this affect determination informal consultation will be completed with the USFWS.

Ute's Ladies'-tresses Orchid

As summarized in Section 3.5.4, a total of 17 locations were identified as containing potentially suitable habitat (i.e., moist, subirrigated or seasonally flooded soils in valley bottoms, gravel bars, old oxbows, or floodplains bordering springs, lakes, rivers, or perennial streams) based on a species-specific habitat suitability model. Suitable habitat was further defined based on species-specific surveys conducted on August 2, 2010, and August 16 through 18, 2010. These surveys determined that only two locations (Little Powder River and Horse Creek) contained suitable habitat, which occupy approximately 2.4 acres.

Factors that disqualified suitable habitat include:

- Key plant associations;
- Inadequate hydrology;
- Heavy clay soils;
- Strongly alkaline soils;
- Sites heavily disturbed by highway ROWs, in-stream rip-rap, or previous topsoil stripping;
- Steep stream banks;
- Standing water with cattails, bulrushes, or emergent aquatic vegetation;
- Herbaceous vegetation dominated by dense rhizomatous species; and
- Overgrazing.

Key plant associations, as defined by (AECOM 2009) and Fertig (2005), were not encountered at the 15 disqualified locations. Key plant associates identified by Hazlett (AECOM 2009) include white sweet clover (*Melilotus albus*), arrowgrass (*Triglochin maritima*), meadow lousewort (*Pedicularis crenulata*), and red top (*Agrostis stolonifera*). None of the key plant associates and/or factors listed above were encountered at the 15 disqualified locations during these surveys. Among the dominant riparian plant species encountered at the 15 disqualified locations were prairie cordgrass (*Spartina pectinata*), foxtail barley (*Hordeum jubatum*), and alkali bulrush (*Bolboschoenus maritimus*). These species are widespread and are very tolerant of alkaline soils.

Although no individuals or populations were identified at the two suitable habitat locations, it is possible that individuals may be present within the project area given the species flowering phenology. As described in Section 2.2.3.7, the Little Powder River and Horse Creek will be crossed by HDD. The HDD construction method for these two stream crossings are described in Section 3.8.1 of the POD. Based on the HDD crossing method at these two stream crossings, and the environmental protection measures outlined in **Table 2-3**, no impacts to the Ute's ladies'-tresses orchid would be anticipated as a result of the Project.

Based on the lack of documented individuals during field surveys and Greencore's committed protections measures, the BLM has determined that the Project would result in a "May Affect, Not Likely to Adversely Affect" impact determination for the federally threatened Ute's ladies'-tresses orchid in accordance with the Section 7 process under the Endangered Species Act. As a result of this affect determination informal consultation will be completed with the USFWS.

4.5.4.2 BLM Sensitive Plant Species

Porter's Sagebrush

As summarized in Section 3.5.4, suitable habitat (i.e., semi-barren, low desert shrub communities on dry, whitish, ashyclay hills, gravelly-clay flats, and shaley erosional gullies of the Wind River, Wagon Bed, and Frontier formations) was identified during 2010 species-specific surveys along the pipeline ROW. The Project crosses approximately 338.2 acres of suitable habitat for Porter's sagebrush. Given the comprehensive survey effort and the resulting absence of documented individuals or populations, no loss of individuals is anticipated. Based on the environmental protection measures outlined in **Table 2-3**, suitable habitat loss as a result of surface-disturbance activities would be temporary in nature resulting in no net loss of species and their associated habitat.

The total estimated population of the Porter's sagebrush is not known; however, based on reviews of previously documented occurrences, suitable habitat within the Project represents less than 1 percent of the total potential habitat in Wyoming. As a consequence, the temporary loss of suitable habitat from the Project would result in localized effects; however, it is not expected that the overall habitat would be affected. Furthermore, reclamation plans outlined in the Project POD (Appendix J) would ensure that suitable habitat would be reclaimed to pre-construction conditions. These procedures include, but are not limited to, the following: recontouring, topsoil segregation and distribution, seedbed preparation, seed mix application, and follow-up monitoring.

Persistent Sepal Yellowcress

As summarized in Section 3.5.4, suitable habitat (i.e., sparsely vegetated, moist sandy to muddy banks of streams, stock ponds and man-made reservoirs near the high water line), occupying approximately 1.2 acres was identified during 2010 species-specific surveys along the pipeline ROW. Given the comprehensive survey effort and the resulting absence of documented individuals or populations, no loss of individuals is anticipated. Based on the environmental protection measures outlined in **Table 2-3**, suitable habitat loss as a result of surface-disturbance activities would be temporary in nature resulting in no net loss of species and their associated habitat.

The total estimated population of the Persistent Sepal Yellowcress is not known; however, based on reviews of previously documented occurrences, suitable habitat within the Project represents less than 1 percent of the total potentially suitable habitat in Wyoming. As a consequence, the temporary loss of suitable habitat from the Project would result in localized effects; however, it is not expected that the overall habitat would be affected. Furthermore, reclamation plans outlined in the Project POD (Appendix J) would ensure that suitable habitat would be reclaimed to pre-construction conditions. These procedures include, but are not limited to, the following: recontouring, topsoil segregation and distribution, seedbed preparation, seed mix application, and follow-up monitoring.

In the event that individuals are identified during construction activities, appropriate avoidance measures would be developed in consultation with the BLM, the USFWS, and other jurisdictional agencies. These measures may include, but are not limited to, the following: 1) species transplantation or relocation to adjacent suitable habitat, 2) horizontal boring beneath the population, or 3) route realignment in areas where individuals occur within or across the ROW. The potential for a route realignment would depend on constructability and site-specific conditions. Greencore would coordinate with the BLM and the USFWS to determine if additional mitigation measures would be required to reduce potential impacts to the affected species.

4.6 Wildlife Resources

Wildlife species and related issues for this analysis were determined through consultation with the BLM, WGFD, MFWP, and USFWS. The primary issues related to wildlife species include the loss or alteration of native habitats, increased habitat fragmentation, animal displacement, and direct loss of wildlife.

Potential impacts to wildlife species from the Project can be classified as short-term and long-term. Short-term impacts consist of temporary habitat removal and activities associated with construction, and long-term impacts consist of changes to wildlife habitats. The extent of both short-term and long-term impacts would depend on factors such as the sensitivity of the species, seasonal use patterns, type and timing of the Project activities, and physical parameters (e.g., topography, cover, forage).

The Project would result in both direct and indirect impacts to wildlife species. Direct and indirect impacts include wildlife mortalities or displacement related to pipeline construction and operation; habitat loss, alteration, and fragmentation; and increased levels of noise, activity, and human presence.

A total of five habitat types are found along the Project route. Impacts from the Project construction would include the disturbance of 3,104.5 acres of grassland/shrubland, 11.7 acres of upland forest/woodland, 24.6 acres of agriculture, 18 acres of wetland/waterbodies, and 20.1 acres of developed lands.

4.6.1 Recreationally and Economically Important Species and Nongame Wildlife

4.6.1.1 Big Game Species

Impacts to big game species (e.g., mule deer, pronghorn, and elk) include the short-term loss of potential forage and cover (native vegetation and previously disturbed vegetation) and an increase in habitat fragmentation within the Project surface disturbance area. However, this loss of vegetation would represent a small percentage (less than one percent) of the overall available habitat within the Project region. The loss of available woody/shrubby vegetation would be long-term (greater than 20 years). However, herbaceous species may become established within three to five years, depending on reclamation success, coupled with future weather conditions, and grazing management practices in the Project region. In most instances, suitable habitat adjacent to disturbed areas would be available for big game species until grasses and woody vegetation were re-established within the disturbance areas.

Additional impacts to big game species would result from increases in noise levels and human presence during surface disturbance activities. Studies have shown that big game species tend to move away from areas of human activity and roads, therefore, reducing habitat utilization near disturbance areas (Cole et al. 1997; Sawyer et al. 2006; Ward 1976). Mule deer and pronghorn appear to be more tolerant of human activity than elk. For mule deer, displacement distances ranged from 330 feet to 0.6 mile, depending on the presence of vegetative cover (Ward 1976). However, disturbance associated with construction activities would be short-term, and it is assumed that animals would return to the area following the completion of the Project construction.

To avoid impacts to big game species during sensitive periods, Greencore has committed to specific environmental protection measures to minimize potential impacts to wintering big game species, primarily pronghorn (**Table 2-3**). The committed construction constraint periods and associated mileposts for sensitive big game ranges are presented in **Table 4-6**. These constraints would include avoiding construction activities within crucial winter/yearlong range from November 15 to April 30. Based on these environmental protection measures, impacts to big game species would be minimal, limited primarily to displacement from areas of human activity and habitat alteration.

In addition to impacts to big game species, implementation of the Project may result in impacts to sensitive big game seasonal habitat (e.g., crucial winter range). These impacts would include the loss of potential cover and forage consisting or primarily woody/shrubby vegetation such as sagebrush, bitterbrush, and winterfat. Loss of available forage (e.g., woody shrubs, such as sagebrush) would result in a long-term (greater than 20 years) impact to wintering big game species. **Table 4-6** summarizes the designated big game seasonal ranges crossed by the Project, which coincides with the seasonal ranges shown in **Table 3-14**. Pipeline construction would result in a short-term disturbance to vegetation on 266.3 acres of pronghorn crucial winter/yearlong range. Pronghorn crucial winter/yearlong range is important to maintain pronghorn populations in Wyoming. However, this disturbance acreage represents a relatively small percentage of the crucial winter/yearlong range available in the Project region.

Table 4-6 Constraint Periods for Big Game Crucial Winter/Yearlong Range Crossed by the Greencore Project

Species	Habitat Type[1]	Mileposts	Miles Crossed	Constraint Period
Pronghorn	Crucial Winter/Yearlong	1.0 – 3.3	2.3	November 15 to April 30
		3.5 – 3.7	0.2	
		5.0 – 6.4	1.4	
		10.3 -10.9	0.6	
		18.2 – 19.3	1.1	
		39.7 – 54.2	14.5	

[1] Source: WGFD 2010b.

4.6.1.2 Small Game Species

Direct and indirect impacts to small game include wildlife mortalities or displacement related to pipeline construction and operation; habitat loss, alteration and fragmentation; and increased levels of noise, activity and human presence. Project construction would result in the incremental loss of 3,178.9 acres of potential habitat, until reclamation has been completed and vegetation is re-established. However, in most instances, suitable habitat adjacent to disturbed areas would be available for small game species until grasses and woody vegetation become re-established within the disturbance areas. Fragmentation impacts on some small game species have been shown to negatively impact populations. Small game, especially upland game birds, may experience increased mortality rates due to increased public access as a result of new and improved roads (Holbrook and Vaughan 1985). Vehicular traffic may injure or kill individuals, and local populations may experience higher levels of hunting and poaching pressure due to improved public access (Holbrook and Vaughan 1985). These temporary losses would reduce productivity for that breeding season. However, due to the large amount of suitable habitat in the Project region and the timing of construction (August 2011 through December 2011 and August 2012 through December 2012), direct impacts to small game species is expected to be low. The greater sage-grouse is classified as a federal candidate species as well as a BLM sensitive species and, therefore, is discussed further in Section 4.6.2, Threatened, Endangered, Candidate, and Sensitive Wildlife Species.

Impacts to waterfowl would include the incremental loss of 18 acres of wetland and riparian habitats within the Project surface disturbance areas. As discussed in **Table 2-3**, Greencore has committed to minimizing impacts to bird species protected under the MBTA by avoiding construction from May 15 to June 30. According to the Wyoming Partners in Flight (PIF) Bird Conservation Plan (Nicholoff 2003), the primary dates for most breeding grassland bird species in Wyoming are May 15 to June 30. Should removal of habitat be required during this period, Greencore would coordinate with the BLM and USFWS to conduct breeding bird surveys and implement appropriate mitigation, such as buffer zones around occupied nests, as needed. Overall, impacts to nesting waterfowl are expected to be low, as the extent of wetland and riparian habitats is primarily limited to the Powder River, Little Powder River, and small perennial creeks (e.g., Salt Creek and Horse Creek). As a result, no take of waterfowl is expected to occur as a result of the Project.

4.6.1.3 Nongame Species

Direct and indirect impacts to nongame species include wildlife mortalities or displacement related to pipeline construction and operation; habitat loss, alteration and fragmentation; and increased levels of noise, activity and human presence. Project construction would result in the incremental loss of 3,178.9 acres of potential habitat, until reclamation has been completed and vegetation is re-established. Construction activities may result in mortalities of less mobile or burrowing nongame species (e.g., small mammals, and reptiles) within the ROW, as a result of crushing from construction vehicles and equipment.

Impacts also may include temporary displacement of more mobile species (medium sized mammals, adult birds) from the Project ROW, due to the short-term loss of vegetation. The temporary displacement of some species would result until herbaceous vegetation returns to pre-construction conditions (approximately 3 to 5 years). For those species dependent on the sagebrush-steppe habitat, displacement would occur until sagebrush shrubs become re-established (greater than 20 years).

A number of raptor species (e.g., bald eagle, golden eagle, ferruginous hawk, prairie falcon, red-tailed hawk, Swainson's hawk, great-horned owl, and burrowing owl) seasonally occupy the habitats crossed by the Project. Impacts to raptor species can result from the loss or alteration in habitat, reduction in prey base, and increased human disturbance. The loss of native habitat to human development has resulted in declines of hawks and eagles throughout the West (Boeker and Ray 1971; Schmutz 1984). In some cases, habitat changes have not reduced numbers of raptors but have resulted in shifts in species composition (Harlow and Bloom 1987). Impacts to small mammal populations due to habitat loss and fragmentation can result in a reduced prey base for raptors, resulting in lower raptor densities. Thompson et al. (1982) and Woffinden and Murphy (1989) found that golden eagles and ferruginous hawks had lowered nesting success where native vegetation had been lost and was unable to support jackrabbit (prey) populations. Furthermore, raptors have a high potential of being disturbed from nests and roosts, thereby leading to displacement and reduced nesting success (Holmes et al. 1993; Postovit and Postovit 1987; Stalmaster and Newman 1978). Noise levels and human activity also can preclude otherwise acceptable raptor habitat from use. To minimize the potential impact to nesting raptors and their habitat, raptor nest sites identified within the areas of disturbance would be avoided to prevent their removal. If construction were to extend into the breeding season, Greencore has committed to conducting aerial and/or pedestrian nesting raptor surveys, as applicable, through areas of suitable habitat to identify active nest sites along the Project route, prior to construction (**Table 2-3**). Since a number of variables (e.g., nest location, species' sensitivity, breeding, phenology, topographical shielding) would determine the level of impact to a breeding pair, appropriate protection measures, such as seasonal constraints and establishment of buffer areas, would be implemented at active nest sites on a species-specific and site-specific basis, in coordination with the jurisdictional agencies (e.g., BLM, WGFD, or USFWS). As a result of these committed environmental protection measures, construction-related impacts to raptor species would be anticipated to be low and no take is expected as a result of the Project activity.

Other avian species that may be impacted by construction activities include nesting passerines or songbirds that use the various habitats crossed by the Project. Direct and indirect impacts to other avian species include mortalities or displacement related to pipeline construction and operation; habitat loss, alteration and fragmentation; and increased levels of noise, activity and human presence. The Project construction would result in the incremental loss or alteration of 3,178.9 acres of potential habitat. In addition to habitat loss, reductions in bird population densities in both open grasslands and woodlands also may be attributed to a reduction in habitat quality produced by elevated noise levels (Reijnen et al. 1997, 1995). Although visual stimuli in open landscapes may add to density effects at relatively short distances, the effects of noise appear to be the most critical factor since breeding birds of open grasslands (threshold noise range of 43 to 60 decibels on the A-weighted scale [dBA]) and woodlands (threshold noise range of 36 to 58 dBA) respond very similarly to disturbance by traffic volume (Reijnen et al. 1997). Reijnen et al. (1996) determined a threshold effect for bird species to be 47 dBA, while a New Mexico study in a pinyon-juniper community found that impacts of gas well compressor noise on bird populations were strongest in areas where noise levels were greater than 50 dBA. However, moderate noise levels (40 to 50 dBA) also showed some effect on bird densities in this study (LaGory et al. 2001). As discussed in **Table 2-3**, Greencore has committed to minimizing impacts to nesting bird species protected under the MBTA by avoiding construction from May 15 to June 30. According to the Wyoming PIF Bird Conservation Plan (Nicholoff 2003), the primary dates for most breeding grassland bird species in Wyoming are May 15 to June 30. Should removal of habitat be required during this period, Greencore would coordinate with the BLM and USFWS to conduct breeding bird surveys and implement appropriate protection measures, such as buffer zones around occupied nests, as needed. Therefore, construction related impacts to breeding migratory birds resulting primarily from alterations of habitat along the pipeline corridor, are anticipated to be low.

Similar to the other nongame species discussed above, impacts to reptiles as a result of the Project would include mortalities or displacement related to pipeline construction and operation and habitat loss, alteration, and fragmentation. Construction activities may result in direct mortalities as a result of crushing of burrows from vehicles and equipment. However, due to suitable habitat adjacent to the disturbed areas and the temporary nature of Project construction, impacts to these species is expected to be minimal, limited primarily to disturbed areas within the construction ROW.

In summary, impacts to game and nongame wildlife associated with the Project are anticipated to be minimal, as: 1) only a small portion of the potentially suitable, available habitat would be impacted by the Project construction activities; 2) established topsoil handling techniques and subsequent reseeding of disturbed areas would aid in the re-establishment of habitats; 3) the committed environmental protection measures would minimize potential impacts to species during the breeding season and minimize the impacts to their breeding territories; and 4) the short-term nature of the Project would minimize the length of time that wildlife would potentially avoid habitats along the Project ROW.

4.6.2 Threatened, Endangered, Candidate and Sensitive Wildlife Species

This section focuses on the impact analyses of federally listed, federally proposed, federal candidate, and other sensitive species that were identified for the Project by the BLM, WGFD, and WYNDD. Listed and other sensitive species were identified based on available habitat and results of surveys conducted along the Project route in 2009 and 2010 (AECOM 2010a,b,c).

Environmental protection measures were developed for the Project to minimize potential construction-related impacts to sensitive species. These measures are presented in **Table 2-3**.

4.6.2.1 Mammals

White-tailed Prairie Dog (BLM Sensitive) and Black-tailed Prairie Dog (BLM Sensitive)

Impacts to prairie dog species may result in direct mortalities of individuals, as a result of crushing from construction activities, vehicles, and equipment. Additional impacts may result from increased habitat fragmentation and human presence and noise. Based on the results of the field surveys, a total of 6 white-tailed prairie dog colonies and 12 black-tailed prairie dog colonies occur within the Project ROW. Approximately 12 acres of active white-tailed prairie dog colonies and 21.4 acres of active black-tailed prairie dog colonies would be impacted by construction activities (**Table 4-7**).

Table 4-7 Prairie Dog Colonies Impacted by the Greencore Project

Species	BLM FO	Activity Status	Estimated Surface Disturbance (acres)[1]
White-tailed Prairie Dog	Lander	Active	5.4
	Casper	Active	6.6
Black-tailed Prairie Dog	Buffalo	Inactive	0.6
	Buffalo	Active	21.4
	Miles City	NA[2]	0.0

[1] Includes construction ROW, extra temporary workspace, and ancillary facilities.

[2] No black-tailed prairie dog colonies are crossed by the ROW within the Miles City FO.

Source: AECOM 2010c.

However, it is not anticipated that construction activities would permanently alter prairie dog colonies that would be crossed by the Project, and installation of the pipeline would not restrict the colonization of the ROW by prairie dogs. In fact, habitat disturbance may encourage future colonization in the short-term, based on the availability of soft, permeable soils that would occur along the ROW subsequent to the Project construction.

Swift Fox (BLM Sensitive)

Impacts to breeding swift fox, if present, would result from abandonment of den sites and the potential loss of adults and young from the compaction of dens during the Project construction. If swift fox are present, impacts would include the short-term loss of 3,104.5 acres of potentially suitable breeding habitat along the ROW. Additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction activities. However, based on the rarity of the species and the current construction schedule occurring outside of the breeding season (August 2011 through December 2011 and August 2012 through December 2012), no direct impacts to breeding swift fox would be expected due to Project construction activities.

Bat Species (BLM Sensitive)

A number of BLM sensitive bat species also may be impacted by the Project construction. Four sensitive bat species including long-eared myotis, fringed myotis, spotted bat, and Townsend's big-eared bat may potentially occur along the Project route. No impacts to communal roosts (e.g., hibernacula, nursery colonies, bachelor roosts) would be anticipated from the Project construction, based on review of bat literature for Wyoming and the lack of suitable roost trees, buildings, underground structures, or mines within the Project corridor. The Project construction would result in the short-term loss of 3,178.9 acres of potentially suitable foraging habitat for these bat species until reclamation has been completed and the plant communities have been re-established.

4.6.2.2 Birds

Bald Eagle (BLM Sensitive)

Impacts to bald eagles generally would be the same as described for raptors in Section 4.6.1.3. Impacts specific to bald eagles, if present, would result in the incremental loss of 18 acres of potentially suitable breeding habitat (e.g., wetland/riparian habitats) and 3,178.9 acres of suitable foraging habitat. Additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction activities. Based on the results of the 2010 breeding raptor survey, three active nests are located along the Powder River (within 0.5 mile of the Project route). To avoid impacts to breeding bald eagles, Greencore has committed to avoiding construction during the bald eagle nesting period. Consequently, no impacts to nesting bald eagles are anticipated as a result of the Project construction.

As discussed in Section 3.6.2.2, one potential winter roost has been identified within 1.5 miles of the Project route along the Powder River; however, bald eagles have been observed along the entire Powder River corridor in Wyoming during the winter months (BLM 2009c). To avoid bald eagle winter roosts along the Project route, Greencore has committed to not constructing during the bald eagle winter roosting period. Consequently, no impacts to roosting bald eagles are anticipated as a result of the Project construction.

Ferruginous Hawk (BLM Sensitive)

Impacts to ferruginous hawks generally would be the same as described for raptors in Section 4.6.1.3. Impacts specific to ferruginous hawks, if present, would result in the incremental loss of 3,104.5 acres of potentially suitable upland habitats. Additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction activities. Based on the results of the 2010 breeding raptor survey, two active nests are located in the vicinity of the Project route but do not occur within the construction ROW. To avoid impacts to breeding ferruginous hawks, Greencore has committed to avoiding construction during the ferruginous hawk nesting period. Consequently, no impacts to nesting bald eagles are anticipated as a result of the Project construction.

Burrowing Owl (BLM Sensitive)

Impacts to burrowing owls generally would be the same as described for raptors in Section 4.6.1.3. Impacts specific to burrowing owls, if present, would result in the incremental loss of 3,149.2 acres of potentially suitable habitats that would be crossed by the Project ROW. Additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction activities. To avoid direct impacts to breeding burrowing owls, Greencore has committed to conducting pedestrian nesting burrowing owl surveys through areas of potentially suitable habitat (e.g., prairie dog colonies) to identify active nest sites along the Project route, prior to construction (**Table 2-3**). In the event that an active nest were located, appropriate protection measures, including seasonal constraints and establishment of buffer areas, would be implemented on a site-specific basis, as necessary.

Greater Sage-grouse (Federal Candidate, BLM Sensitive)

Impacts to greater sage-grouse, if present, would result in the short- to long-term (depending on the ecological site characteristics) loss of potentially suitable breeding habitats (**Table 4-8**). Impacts to greater sage-grouse include increased habitat fragmentation impacts as a result of increased noise levels and human presence, dispersal of noxious weeds and invasive plant species, and dust effects from unpaved road traffic. Impacts would also include increased collision potential associated with powerlines and vehicle traffic as well as increased predation by raptors, corvids, and coyotes.

Table 4-8 Greater Sage-grouse Breeding Habitat Impacted by the Greencore Project

BLM FO	Lek Buffer/Habitat Type[1]	Estimated Surface Disturbance (acres)[2]
Lander	0.6 Mile (Core Area)	0.0
	0.25 Mile (Non-core Area)	0.0
	Nesting Habitat (Core-Area)	0.0
	Nesting Habitat (Non-core Area)	34.7
Casper	0.6 Mile (Core Area)	0.0
	0.25 Mile (Non-core Area)	0.0
	Nesting Habitat (Core Area)	409.8
	Nesting Habitat (Non-core Area)	178.5
Buffalo	0.6 Mile (Core Area)	12.7
	0.25 Mile (Non-core Area)	0.0
	Nesting Habitat (Core Area)	49.3
	Nesting Habitat (Non-core Area)	870.0
Miles City	0.25 Mile	0.0
	Nesting Habitat[3]	76.2
	Total	**1,631.2**

[1] Lek buffers taken BLM Instruction Memorandum 2010-012, Wyoming Executive Order 2010-4, and BLM (2000b). Nesting habitat data obtained from the BLM Buffalo FO and also collected during the 2010 field season within 0.5 mile of the Project centerline (AECOM 2010c).

[2] Includes construction ROW, extra temporary workspace, and ancillary facilities.

[3] Montana does not manage greater sage-grouse using a “Core Area” concept.

Recent studies on greater sage-grouse have shown that development can negatively impact populations as a result of increased noise and increased human disturbance (Walker et al. 2007; Holloran 2005). Greater sage-grouse have been observed to abandon lek sites in areas with increased road development (Walker et al. 2007; Holloran 2005; Braun 1986). Furthermore, greater sage-grouse hens that utilized nesting habitats further from roads had greater brood survivorship than those hens utilizing habitat near roads (Lyon and Anderson 2003).

As described in Section 3.6.2.2, a total of 69 occupied leks were identified within 4 miles of the Project ROW. To avoid potential impacts to breeding greater sage-grouse, Greencore has committed to not constructing during the breeding season and implementing a permanent 0.6 mile NSO buffer around occupied leks in Core Areas and a 0.25 mile NSO lek buffer in Non-core Areas (**Table 2-3**), unless authorized by the BLM. In addition, Greencore has committed to not placing aerial pipeline markers within 0.6 mile of greater sage-grouse leks. This will minimize the potential for increased predation on greater sage-grouse during the breeding season by limiting raptor perches.

It is important to note that **Table 4-8** shows 12.7 acres of breeding habitat disturbance within the 0.6-mile NSO lek buffer within the Buffalo FO. This surface disturbance does not meet the requirements of BLM Instruction Memorandum 2010-012. However, in order to avoid unnecessary habitat disturbance to “greenfield” sagebrush habitat, the Project would maintain the route that follows an existing pipeline ROW and road rather than reroute around the 0.6-mile lek NSO.

As discussed in Section 3.6.2.2, one potential winter concentration area has been identified within 1 mile of the Project; however, greater sage-grouse are known to gather in large flocks during the winter months in suitable wintering habitats in the vicinity of the Project. To better determine winter concentration areas along the Project route, Greencore has committed to conducting two additional aerial surveys during the winter. Based on the results of the winter concentration area surveys, appropriate protection measures, such as seasonal constraints and establishment of buffer areas, would be implemented at winter concentration areas on a site-specific basis, in coordination with the jurisdictional agencies (**Table 2-3**). Consequently, impacts to wintering greater sage-grouse as a result of Project construction are anticipated to be low.

Brewer’s Sparrow, Loggerhead Shrike, Sage Sparrow, Sage Thrasher (BLM Sensitive)

Impacts to Brewer’s sparrow, loggerhead shrike, sage sparrow, and sage thrasher generally would be the same as described for migratory birds in Section 4.6.1.3. Impacts specific to Brewer’s sparrow, loggerhead shrike, sage sparrow, and sage thrasher, if present, would occur as a result of the short-term loss of 1,631.2 acres of potentially suitable upland habitats that would be crossed by the Project. Additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction activities. As discussed in **Table 2-3**, Greencore has committed to avoiding construction during the breeding period for grassland bird species in Wyoming. Should removal of habitat be required during this period, Greencore would coordinate with the BLM and USFWS to conduct breeding bird surveys and implement appropriate protection measures, such as buffer zones around occupied nests, as needed. Therefore, impacts to breeding birds would be low.

Long-billed Curlew (BLM Sensitive)

Impacts to long-billed curlews, if present, would occur as a result of the short-term loss of 18 acres of potentially suitable wetland habitat that would be crossed by the Project. Additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction activities. As discussed in **Table 2-3**, Greencore has committed to avoiding construction during the breeding period for grassland bird species in Wyoming. Should removal of habitat be required during this period, Greencore would coordinate with the BLM and USFWS to conduct breeding bird surveys and implement appropriate protection measures, such as buffer zones around occupied nests, as needed. Therefore, impacts to breeding long-billed curlews would be low.

Mountain Plover (Proposed as Federally Threatened, BLM Sensitive)

Impacts to mountain plovers, if present along the Project route, would occur as a result of the incremental loss of 36.1 acres of potentially suitable nesting (**Table 4-9**). Additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction activities. To avoid impacts to breeding mountain plovers, Greencore has committed to avoiding construction during the mountain plover nesting period. In addition, Greencore has committed to not placing aerial pipeline markers within 0.25 mile of suitable mountain plover habitat. This will minimize the potential for increased predation during the breeding season by limiting raptor perches. Therefore, impacts to breeding mountain plovers would be low.

Table 4-9 Suitable Mountain Plover Nesting Habitat Impacted by the Greencore Project

BLM FO	Estimated Surface Disturbance (acres)[1]
Lander	0.7
Casper	21.0
Buffalo	14.5
Miles City	0.0[2]

[1] Includes construction ROW, extra temporary workspace, and ancillary facilities.

[2] No suitable mountain plover nesting habitat is crossed by the ROW within the Miles City FO.

Source: AECOM 2010c.

If the mountain plover was listed as a federally threatened species, prior to, or during construction, Greencore would consult with the USFWS and BLM to determine appropriate protection measures within suitable habitat. As a result of these committed environmental protection measures, potential impacts to potentially suitable nesting habitat for mountain plover would be low.

Yellow-billed Cuckoo (BLM Sensitive)

Impacts to yellow-billed cuckoos, if present along the Project route, would occur as a result of the short-term loss of 18 acres of potentially suitable wetland/riparian habitats that would be crossed by the Project. Additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction activities. Committed environmental protection measures for minimizing impacts to wetland/riparian habitats are described in **Table 2-3** and the Project SWPPP (POD, Appendix E). As discussed in **Table 2-3**, Greencore has committed to avoiding construction during the breeding period for bird species in Wyoming. Should removal of habitat be required during this period, Greencore would coordinate with the BLM and USFWS to conduct breeding bird surveys and implement appropriate protection measures, as needed. Therefore, impacts to breeding yellow-billed cuckoos would be low.

4.7 Aquatic Resources

Aquatic species and related issues for this analysis were determined through consultation with the BLM, WGFD, MFWP, and USFWS. The primary issues related to aquatic species includes the loss or alteration of native habitats, increased sedimentation, potential toxicity related to fuel spills and pipeline ruptures/leaks, and issues associated with water management.

Impacts to fish and other aquatic communities from construction of the Project would depend upon the physical characteristics of the streams (e.g., flow, bottom substrate, channel configuration, and gradient), construction technique, and time of year. Direct impacts to aquatic communities and habitat in Horse Creek, Little Powder River, Donner Reservoir, and Wild Horse Creek (extended wetland) would be minor, since HDD techniques would be used. However, a potential rupture or leak under these waterbodies during drilling may

accidentally release drilling muds (called a “frac-out”) or disturb bottom sediments in a localized area near the rupture site. The release of drilling muds (primarily bentonite and cellulose) may cause localized increases in sediment loads and may fill interstitial gaps in the streambed, smothering habitat for benthic invertebrates, larval fish, and eggs. The amount of area impacted by a release of drilling muds would be relatively small since the consistency of the drilling muds would limit widespread dispersal along the streambed. See the Frac-Out Contingency Plan (Appendix H of the POD) for additional information. Construction of the HDD crossings would not impact aquatic habitat because the areas disturbed by the HDD equipment would be located outside the ordinary high water mark of the streambed. Vegetation and soil disturbance would occur in one area on each side of the river. However, no overhanging cover would be disturbed. Slight increases in sedimentation would occur due to bridge placement and storm water runoff entering the river. Erosion control structures would be used to minimize sediment input into Horse Creek and the Little Powder River, as described in the SWPPP (Appendix E of the POD).

Trenching (open cut construction method) would occur at 16 perennial streams. Direct impacts resulting from trenching across waterbodies would include increased sedimentation, substrate removal or alteration, and possible removal or disturbance to streamside vegetation. The effects of these changes on aquatic biota could include the following: reductions in the abundance and diversity of plant and macroinvertebrate species, displacement of fish, and alteration of habitat (Waters 1995). Trenching could cause direct mortalities to macroinvertebrates in these streams, as substrate is removed or altered. Macroinvertebrate communities likely would recolonize the disturbed area within 2 to 6 months (Robinson 1979). Stream flow would be maintained during construction by installing a flume pipe or utilizing the dam and pump construction method. In general, most of the aquatic species would be able to tolerate short-term increases in sediment as a result of trenching. If trench dewatering is required, the trench would be dewatered in a manner that would prevent silt-laden water from flowing into wetlands or waterbodies.

As discussed in **Table 2-3**, hazardous materials, chemicals, fuels, etc., would not be stored within 100 feet of wetlands or waters of the U.S. Other setbacks would include at least 50 feet for all equipment staging areas and 10 feet for temporary storage of spoil material. Therefore, potential fuel or other petroleum product spills would not impact aquatic resources.

Water withdrawal (total of approximately 56.2 acre-feet) for hydrostatic testing would not impact aquatic resources, including sensitive species. Hydrostatic test water would be discharged through straw bale structures, with final discharge to locations identified in the Project POD (Appendix I). Water quality in the discharge water would meet National Pollution Discharge Elimination System requirements. Additional consumptive water use would be required for directional drilling and dust abatement. Approximately 370,680 gallons (1.1 acre-feet) would be obtained from a permitted source for mixing with bentonite during directional drilling at the four HDD crossings. Additional water would be obtained from permitted sources (irrigation companies or municipal sources) for dust abatement.

Impacts of pipeline operation on aquatic communities would include possible leaks or ruptures. A rupture or leak in a perennial stream could cause limited fish and macroinvertebrate mortalities in a localized area due to asphyxiation. As CO_2 is released, the gas stream could reduce oxygen levels and reduce pH. It is expected that most fish would avoid the area in the immediate vicinity of the rupture or leak. The duration of this impact would be short-term due to the installation of block valves at 15- to 20-mile intervals along the entire Project route (see **Table 2-2**).

Maintenance activities also would remove vegetation within the permanent 50-foot ROW. Maintenance activities near waterbodies would remove a small amount of riparian vegetation. The removal of grasses and small shrubs near the stream crossings would represent a relatively small portion of streamside cover for aquatic resources. Repairs in areas near waterbodies could result in temporary increased erosion. Erosion control procedures, as part of the Project SWPPP and Reclamation Plan would be implemented as part of the Project to minimize any erosion in disturbed areas.

As discussed in **Table 2-3**, Greencore has committed to not constructing aboveground facilities and staging areas within wetlands, riparian areas, or other waters of the U.S. Therefore, no new disturbance or impacts would occur for aquatic resources. Abandonment of the Project would involve leaving the pipeline in place.

Potential impacts to special status aquatic species, including the northern leopard frog and Great Basin spadefoot, may include direct mortalities of individuals from construction activities, ground compaction, and vehicle traffic within suitable habitat. Impacts also may result from the incremental long-term reduction of potential habitat until reclamation is completed and vegetation has been re-established. The Project may impact individuals but would not likely cause a trend towards federal listing or loss of viability. These two amphibian species have a broad geographic range and impacts would be considered negligible based on suitable habitat present in the Project vicinity.

4.8 Land Use and Recreation

This section evaluates the beneficial and adverse effects of the Project within the context of land use and recreation changes in the study area. Calculations of impacts were based on known characteristics of the study area, and supporting BLM RMPs. Specifics regarding short and long-term acreage disturbance can be found in Section 3.5.1.

Approximately 4.7 miles of the Project (from approximately MP 0.0 to MP 4.7) would be constructed within the BLM Lander FO. Approximately 4.7 miles (100 percent) of the Project in the Lander FO area would parallel the West Wide Energy Corridor (MP 0.0 to MP 4.7). The Project would not cross designated ACECs or special designations such as the Oregon/Mormon/Pony Express trails. BLM RMP restrictions would be satisfied and no conflicts with the Plan are expected.

Approximately 82.7 miles of the Project (from approximately MP 4.7 to MP 87.4) would be constructed within the BLM's Casper FO. The majority of the Project in the Casper FO area would parallel existing utility corridors and the general corridor along U.S. Highway 20/26. The West Wide Energy Corridor would be paralleled between approximately MP 4.7 and MP 38.0, and the general Highway 20/26 corridor would be paralleled between approximately MP 32.0 and MP 46.0. The Wind River Basin Management Area near Waltman, Wyoming, would be crossed by the project ROW. The goal of this management area is to facilitate oil and gas exploration and development, as such, development in this area will comply with nondiscretionary laws, such as the Endangered Species Act and the National Historic Preservation Act, but timing stipulations regarding greater sage-grouse nesting habitats, raptor nesting habitats, mountain plover nests, and crucial winter range will not be applied (BLM 2007a). The Project would not adversely affect the Wind River Basin Management Area. RMP restrictions would be satisfied, and no conflicts with the Plan are expected.

Approximately 134.8 miles (from approximately MP 87.7 to MP 222.5) would be constructed within the BLM's Buffalo FO. The majority of the Project in the Buffalo FO area would parallel existing utility corridors. None of the proposed route would cross designated ACECs. RMP restrictions would be satisfied, and no other plan conflicts are expected.

Approximately 9.1 miles of the Project (from approximately MP 222.5 to MP 231.1) would be constructed within the BLM’s Miles City FO. The majority of the Project in the Miles City Office Area would parallel an existing utility corridor. The Project would not cross designated ACECs. RMP restrictions would be satisfied, and no other plan conflicts are expected.

Construction of the Project would have no impacts on any developed recreational facilities. Scenic views would be temporarily affected during construction until revegetation blends the colors and textures of the ROW into the surrounding landscape. Areas of high visual sensitivity for the remainder of the Project are further discussed in Section 4.10 (Visual Resources and Noise). Impacts to urban and dispersed recreation resources are expected to be minimal due to the short-term population increase (456 workers and dependents) during construction.

Portions of the Project would cross several elk, pronghorn, and mule deer hunting units in the Lander, Casper, and Buffalo FO areas. The recreational enjoyment of wildlife (such as hunting during big game hunting seasons) may be temporarily affected by construction activities, depending on season and location. However, this effect would be short-term.

Long-term impacts may include use of the disturbed right of way by OHV users and hunters. The Project will address this on a case by case basis and implement mitigation such as signage, fencing, and cabled posts.

The incremental work force size during operations (after construction) for the Project is estimated to be eight pipeline personnel. After disturbed areas are reclaimed to pre-construction conditions, there would be no impacts to land use or recreation resources.

BLM standard stipulations would be followed as part of the abandonment process. At Project termination, all surface facilities would be removed, and the disturbed areas would be reclaimed. Section 2.2.5 contains more details regarding Project abandonment.

4.9 Wilderness

Construction of the Project would not impact the wilderness characteristics of the two WSAs within 50 miles of the Project because none of the activity would occur within either of the WSA boundaries. The BLM's management guidelines for these WSAs would not be violated. Construction-related impacts, which would be located outside of the WSA boundaries, would be temporary, and the disturbed areas would be reclaimed and revegetated in accordance with applicable regulations and permit requirements as discussed in Chapter 2.0.

Operation of the Project would not impair the wilderness characteristics of the two WSAs within 50 miles of the Project. Surface traffic along the Project route would be limited to workers performing periodic pipeline and valve maintenance and emergency repairs to the pipeline or corrosion protection devices. The only aboveground facilities that would be located within 50 miles of the two WSAs are the Project block valves. These facilities would not impair the WSAs' suitability for preservation as wilderness.

4.10 Visual Resources and Noise

4.10.1 Visual Resources

The assessment of the Project's impacts to visual resources is based on an evaluation of the changes to the existing visual environment that would result from Project construction and operation.

Ratings at each KOP of existing and Project contrast and dominance were made on the basis of field observation, photo documentation, and study of other project information. Visual contrast rating forms were prepared to document the level of contrast and the VRM Class of the Project landscape. Representative photos were taken at each KOP.

In determining the extent and implications of the visual changes, a number of factors were considered:

- The specific changes in the affected environment's composition, character, and any outstanding valued qualities;
- The context of the affected visual environment;
- The extent to which the affected environment contains places or features that have been designated in plans and policies for protection or special consideration; and
- The numbers of viewers, their activities, and the extent to which these activities are related to the visual qualities affected by proposed changes.

The BLM VRM methodology was used for determination of potential impact significance. If impacts meet applicable VRM class objectives, they are considered less than significant. If they do not meet the VRM

objectives, they are considered potentially significant. Based on the VRM Class II, III, and IV objective criteria, the overall impacts of the Project on VRM Class III areas are considered less than significant based on a number of specific significance criteria.

Views of the Project would occur from all KOPs. Construction activities, equipment, and vehicles would be visible from these KOPs. Construction activities would disturb the ground surface by removing low-growing vegetation, shifting soil, and altering drainage patterns. Surface disturbances would affect visual resources by creating exposed soil across the construction area with a different texture and color and by creating land barren of vegetation and topsoil. A visually strong edge of vegetation would appear along the corridor. The disturbance corridor would visually divide the landscape due to absence of vegetation and the altered lines of topography.

Construction activities would affect visual resources due to dust originating from the movement of vehicles, from excavation work, and from wind blowing across exposed soil. Construction activities would use lights for safety and illumination of work areas.

Glare and glint from reflective surfaces of construction equipment and vehicles would be seen by casual viewers. The intensity and amount of glare would vary throughout the day and also would depend on atmospheric conditions and the presence of construction equipment and vehicles. The construction activities would affect visual resources by adding a noticeable level of activity to an area with little present land use activity. The color of construction equipment and vehicles would not resemble the muted tans, browns, greys, and greens of the terrain and vegetation. For all KOPs (road crossings), the degree of contrast would be temporarily moderate to strong, involving changes to vegetation patterns and the lack of screening elements to block direct views of the Project. Viewer groups affected by these impacts include roadway users (southwest to northeast along the ROW) on the South Bighorns Backcountry Byway, U.S. 20, I-25, Wyoming SH 192, Bozeman Trail crossings (2), I-90, U.S. 14/16, and Wyoming SH 59. The I-25 corridor has been defined as a sensitive viewshed due to the high volume of traffic. Construction activities, vehicles, and equipment at the Project site, as well as en route to the Project site, would be visible to these viewers.

The continuous line of ROW disturbance would reduce the openness of the landscape by visually dividing views from KOPs. Although the homogenous texture of vegetation would mimic the texture of other pipeline corridors, it would not resemble the texture of any other landscape element. Although views of the Project originate from each KOP in the foreground-middle ground distance zone, visible extents of the Project vary by KOP.

Visual contrasts for all eight KOPs (please refer to Visual Contrast Rating Forms in **Appendix F** and photography in **Figures 3-6** through **3-13**) would be weak to moderate for changes in the color of vegetation and none to moderate for changes in form, line, and texture of landform and structures. As reclamation progresses, the moderate contrasts for color of vegetation eventually would become weak. These contrasts would meet the objectives for VRM Class II, III, and Class IV landscapes.

The Project's overall effects on visual conditions during hours of both daylight and darkness would be low. Some nighttime lighting would be required for operational safety and security at the compressor station. However because of other minimal manmade sources of light in these remote areas, when viewed from nearby offsite locations, the overall change in ambient lighting conditions at the Project site may be moderate to substantial.

The Project likely would create a weak to moderate visual contrast in VRM Class II, III, and Class IV rangeland and riparian landscapes and a weak visual contrast in agricultural croplands landscapes. This contrast would be more apparent in visually sensitive areas such as backcountry byways and the Powder River corridor, which are both recognized for their scenic surroundings. However, it is not anticipated that impacts would be significant. With application of reclamation measures suitable for the soils and climate of the Project area, croplands would achieve visual compatibility in the first or second season, while rangeland and riparian landscape would require three to five years for the ROW disturbance to blend with the surrounding grassland

landscape and a longer time to blend with sagebrush landscapes. The Project's operation phase impacts on visual resources are described below and considered less than significant.

KOP-1 South Bighorns Backcountry Byway

Visual contrasts caused by the Project at this KOP are in the range of weak to moderate for form, line, color, and texture. There is a ROW swath apparent in the view in the foreground, caused by the existing pipeline corridor. A newly formed ROW swath my draw increased attention to the existing ROW swath. This visual contrast would have an increased effect at this KOP, as scenic views are the primary appeal of backcountry byways. As such the visual impact associated with Project would be moderate (see **Figure 3-6**).

KOP-2 U.S. 20

Visual contrasts caused by the Project at this KOP are in the range of none to weak for form, line, color, and texture. There is a ROW swath apparent in the view in the foreground, caused by the existing pipeline corridor. As such the visual impact associated with Project would be negligible (see **Figure 3-7**).

KOP-3 I-25

Visual contrasts caused by the Project at this KOP would be moderate for form, line, color, and texture. There would be a new ROW swath in the view in the foreground that would cause moderate visual impacts to a large number of viewers within this sensitive viewshed until successful reclamation of the disturbance area (see **Figure 3-8**).

KOP-4 SR 192

Visual contrasts caused by the Project at this KOP are in the range of none to weak for form, line, color, and texture. There is a ROW swath apparent in the view in the foreground, caused by the existing pipeline corridor. As such the visual impact associated with Project would be negligible (see **Figure 3-9**).

KOP-5 Bozeman Trail

Visual contrasts caused by the Project at this KOP are in the range of none to weak for form, line, color, and texture. There is a ROW swath apparent in the view caused by the existing pipeline corridor. As such the visual impact associated with Project would be negligible (see **Figure 3-10**).

KOP-6 I-90

Visual contrasts caused by the Project at this KOP are in the range of none to weak for form, line, color, and texture. There is a ROW swath apparent in the view caused by cultural activities. As such, the visual impact associated with Project would be negligible (see **Figure 3-11**).

KOP-7 U.S. 16/14

Visual contrasts caused by the Project at this KOP are in the range of none to weak for form, line, color, and texture. There are linear elements apparent in the view caused by cultural activities. As such, the visual impact associated with Project would be negligible (see **Figure 3-12**).

KOP-8 SR 59

Visual contrasts caused by the Project at this KOP are in the range of none to weak for form, line, color, and texture. There are linear elements apparent in the view caused by cultural activities, as well as major structural elements. As such, the visual impact associated with Project would be negligible (see **Figure 3-13**).

4.10.2 Noise

The nearest noise receptor (private residence) is 0.25 mile from the ROW and measurement facilities. No operation-related noise impacts would be anticipated as a result of the project. Noise resulting from construction activities would be short-term (2 to 3 weeks) in duration and limited to daylight hours. Based on

construction noise analyses conducted for other proposed pipeline projects (USEPA 1974), noise levels of 60 A-weighted decibels or above could extend perpendicular to the centerline of the pipeline up to 12,000 feet (2.5 miles). These levels could occur sporadically over the construction period, and the zone of impact will be limited to the local area of construction activities as the construction chain moves along the Construction ROW. The terrain along portions of the pipeline route is more diverse and occasionally will pass through areas where the terrain enhances the noise levels during construction. Because of the short duration of construction (approximately 4 to 5 months), the daylight-only construction period, and generally rural alignment of the Construction ROW, noise levels should not be overly disruptive to other activities in the vicinity.

4.11 Socioeconomics

This section evaluates the beneficial and adverse effects of the Project within the context of social and economic changes in the study area. Calculations of impacts were based on known characteristics of the study area, supported by professional planning standards and empirical data from other projects studied in Wyoming.

The three construction spreads would require an average of 156 workers to construct the Project, equating to a total of 468 workers.

Local and non-local labor forces have been estimated based on skilled and unskilled labor availability, primarily from the areas that surround Casper and Gillette. Work force availability in Casper and Gillette may contribute to the percentage of local workers. A local worker is identified as a worker who is able to commute to and from his permanent place of residence on a daily basis. A non-local worker is identified as a worker who has moved into the construction area for the duration of the Project. As discussed in Section 3.11, both Natrona and Campbell counties have a fairly large construction employment sector from which the labor force would be drawn. The labor force is assumed to be composed of 25 percent (39 workers per spread) local labor during construction. Local employment opportunities initiated by the Project construction would be considered beneficial to the local area economies.

Because of the short duration of construction, it is assumed that only a small percentage of the non-local work force would bring their families. Based on information from the 1979 Pipeline Construction Workers and Community Impact Surveys Reports, only 0.3 dependents per worker are estimated (Mountain West, Inc. 1979). Using these criteria, the 351 non-local workers would bring an estimated 105 dependents, for a total temporary increase in population of approximately 456 people. Adverse social, economic, and community infrastructure impacts of construction personnel are considered minimal because of the quick pace and short duration of the construction schedule. The number of workers would be very small relative to the regional population. Assuming half of the workforce lodges in the Casper area and the other half in the Gillette area, the largest population increase that could occur would be no greater than 0.44 percent in the Casper area and 0.85 percent in the Gillette area.

The estimated labor cost for contract construction in 2010 dollars is $107.9 million. This cost would be spread over the construction period and includes salaries for contract supervisors' wages, benefits and overtime for skilled and unskilled labor, and rental on labor force trade equipment. The average monthly payroll is estimated at $11 million. A portion of this total income would be spent in the area and would result in increased sales tax receipts. Local spending is estimated to be $2,750,000 per month.

Increased spending in the local areas would result in increased retail sales to merchants, as well as increased sales tax to local taxing jurisdictions. The overall impact of this local spending and tax generation would be positive.

In addition to construction worker local expenditures, other income generated by construction would include local material purchases paid by contractor(s) and other support personnel. It is assumed that the contractor would locally purchase as many materials as possible. These expenditures would include tools, fuel, oil, parts, and repairs. Smaller communities would benefit from fuel sales and repair expenditures.

The Project construction work force would not be large enough to place a permanent demand on local services such as police, medical facilities, fire or educational services; nor would the construction population cause any detrimental effects to community social well-being due to the short time frame of the construction period. No significant impact on the existing infrastructure would occur.

Because construction would be short in duration, housing demand would be of a temporary nature. It is generally accepted that pipeline workers prefer to stay in accommodations closest to the pipeline that offer adequate housing and amenities. Based on typical pipeline construction, it is assumed that housing for the non-local pipeline work force would be divided among rental units, hotels/motels, RVs, and other accommodations. A U.S. Census Bureau estimate from 2006 to 2008 identified approximately 140 and 479 unoccupied rental units in Campbell and Natrona counties, respectively. It is anticipated that the majority of workers would share a motel room or apartment. Welders are most likely to bring their own RVs to the area (Mountain West, Inc. 1979).

A potential effect of the construction work force on housing would be competition with travelers and recreationists for temporary accommodations. Since peak construction would not occur during peak tourist season, travelers seeking accommodations are not anticipated to be impacted. However, in some areas, where hunting activity is typically high, competition for accommodations with construction workers may be increased, as construction may occur during big game hunting seasons. Apartment rental units would be most available in larger cities such as Casper or Gillette. Adequate accommodations exist throughout the study area, within commuting distance of the Project.

The permanent work force for operation would be an incremental increase of 8 full time positions, probably stationed at Gillette and Casper, Wyoming. Maintenance would be done with local contractors specializing in this type of work. The annual cost of pipeline operation and maintenance is expected to range from $3,750,000 to over $4,500,000 per year in 2010 dollars.

The estimated Project-related assessed valuation for the first year of operations is compared with 2009 county-wide assessed valuation in **Table 4-10**. Each county and school district would benefit from the increased tax base. Tax revenues for the first year are estimated in **Table 4-10**, based on a 2009 average county-wide tax rate. The largest increases in the tax base attributed to the Project would occur in Natrona and Powder River counties.

Abandonment of the Project would decrease the tax bases of those counties through which it passes. At the time of abandonment, tax receipts in each county would be reduced from the pipeline's in-service date due to depreciation. Total decreases in tax receipts cannot be quantified at this time.

4.12 Environmental Justice

The estimates on minority population percentages and median household income for the five counties affected by the Project indicate there are no minority and/or low-income populations living within the "affected area," with the exception of Fremont County and Powder River County, respectively. The Wind River Indian Reservation lies within Fremont County, contributing to a Native American population that is significantly higher than the state average; however, only 2 percent of the Project falls within Fremont County, and the Project is not located within the boundary of the Reservation. Powder River County, Montana, has a median household income 16 percent below the Montana state average; however, the Project would help low income families by potentially offering employment opportunities as well as contributing to the local tax base. Therefore, it is anticipated no environmental justice issues concerning minority and/or low-income populations are expected to occur as a result of the construction and operation of the Project.

Table 4-10 Contribution to Tax Base for the Greencore Project

County	Miles of Pipeline	2008 Tax Rate[1,2,7] (mills)	Estimated Valuation of Pipeline and Facilities[3,4,5] ($)	2008 Total County Accessed Valuation[2] (Thousands $)	Pipeline Percent of Total County-wide Assessed Valuation[4,7]	Estimated Property Tax Receipts From Pipeline and Facilities[4,6] ($)
Fremont	4.1	74.399	385,200	1,135,628	0.0005%	28,660
Natrona	83.1	71.337	11,523,900	1,287,932	0.009%	822,080
Johnson	54.0	66.338	7,479,300	1,823,851	0.007%	496,160
Campbell	80.8	61.767	11,202,900	5,710,554	0.22%	691,970
Powder River	9.1	695.25	1,508,700	133,962	0.33%	1,048,925
Total	**231.1**	**NA[7]**	**32,100,000**	**10,091,927**	**NA[7]**	**3,087,795**

1 Estimated county-wide tax rate, may not reflect actual tax rate applied to pipeline.

2 Source: Wyoming Department of Revenue 2009, Montana Department of Revenue 2009. Estimated valuation based on first year of operation.

3 Pipeline mileage percent of total cost by county.

4 Source: Denbury 2009. Estimated annual taxes based on first year valuation and 2010 average mill rate.

5 Estimated valuation based on first year of operation.

6 Estimated annual taxes based on first year valuation and 2010 average mill rates.

7 Due to the nature of the analysis, data is not totaled.

4.13 Transportation

Construction of the Project would generate traffic increases from rail and truck transport of pipe and construction materials, and from commuting by construction workers. Load limit restrictions on roads, bridges, and highways would be observed at all times to prevent surface and structural damage. Oversize loads would comply with special permit requirements of the Wyoming and Montana Department of Transportation and county highway departments.

The pipe and most construction material would be shipped by truck or rail to areas near Casper and Gillette where the construction headquarters and a material staging yard would be established for the Project. The rail activity would not be great enough to adversely affect other rail traffic or highway traffic on intersecting roads to any measurable degree. Temporary increased traffic would occur on Highway 20/26, I-25, I-90, and the heavy-duty access roads due to the transport of pipe and materials to the ROW during the construction periods.

The routes used would change as construction progressed along the Project route, but existing traffic levels on all major highways are sufficiently low that this incremental increase would have no appreciable effect on levels of service or travel times on area highways. Traffic generated during peak construction would be approximately 15 to 20 vehicles per day, most of which would be heavy trucks. An additional 101 vehicle trips per spread would be generated in the morning and the evening by construction workers commuting to and from the site. Effects on traffic flows would be minor, although the increase in heavy trucks could create some queuing delays on hilly or curved road segments where passing is restricted.

Effects of traffic increases on county road traffic are difficult to quantify. Generally, existing traffic levels are very low on such roads; therefore, the overall effects on traffic flow would be minor. An individual motorist using one of these roads regularly may experience delays, but even individual effects would be short term, lasting no more than a few weeks on any particular road.

Project-related effects on traffic accidents would be expected to be minor. The total number of accidents in the Project area could increase approximately in proportion to the increase in travel. There is no reason to believe, however, that the vehicle accident probability, commonly expressed as the number of accidents per million vehicle miles, would increase beyond state average levels (Planning Information Corporation [PIC] 1988). Increased local traffic congestion during the construction period would tend to increase accident probability above the current low levels, but an increase in the proportion of professional bus and truck drivers in overall traffic flow would tend to counter this effect (PIC 1988).

Increased heavy truck traffic would tend to accelerate deterioration of road surfaces. This effect would be minimal on state and U.S. highways built to accommodate such traffic. Maintenance requirements on unpaved county roads may be notably increased during the brief periods of heavy usage for access to particular segments of the Project route. The degree of increase in maintenance needed would depend on weather conditions and the quality of the existing roadway.

Traffic delays on roads and highways intersecting the Project route would be minimal. All major highway crossings would be bored; therefore, traffic interruptions would be limited to equipment and personnel crossing the road (see Chapter 2.0).

Operation of the Project would have no measurable effect on transportation in the Project vicinity. Long-term traffic increases would be negligible. Occasional maintenance or repair requirements would cause activity similar to construction but only for very brief periods and generally on a much smaller scale than those that would be experienced during the construction period.

Abandonment of the Project would result in only minor transportation effects as most of the Project would be abandoned in place.

4.14 Cultural Resources/Native American Concerns

4.14.1 Cultural Resources

4.14.1.1 Potential Effects

The NHPA and 36 CFR 800 require consideration of all cultural resources that may be affected by direct surface-disturbing activities and indirect effects from such operations. Archaeological investigations have been conducted for the Project to identify and evaluate cultural resources. These included pedestrian surveys, testing, and on-site inspections. At this time, approximately 230.4 miles of the 231-mile-long proposed pipeline ROW, all currently identified access roads and ATWS, and six ancillary facilities have been surveyed for cultural resources. Any remaining surveys would be completed as necessary prior to the Project construction and with enough lead time to allow for evaluation of sites, assessment of impacts, and mitigation, if necessary. If possible, significant sites would be avoided by surface-disturbing activities. Mitigation of adverse effects would be required in cases where avoidance is not possible.

The cultural resources inventories conducted for the Project identified 21 prehistoric and historic sites along the Project ROW and access roads that are recommended or currently determined as eligible for inclusion in the NRHP. Potential impacts to these cultural resources primarily would result from construction-related activities. Impacts would be considered significant if any information were lost that impeded efforts to reconstruct the prehistory or history of the region.

Only those sites that are eligible for inclusion in the NRHP under the criteria for eligibility defined in 36 CFR 60.4, sites of cultural and religious importance to tribal groups, or sites with the potential to preserve significant cultural information or heritage values require avoidance, mitigation, or special consideration once an area has been inventoried. Of the 21 prehistoric and historic sites eligible for inclusion in the NRHP, 2 sites would require avoidance or, if avoidance is not possible, data recovery. Potential adverse effects to 4 of the NRHP-eligible sites would be mitigated by narrowing and fencing the ROW or through pre-construction recordation and post-construction restoration. The Project would cross two segments of the Bozeman Trail.

One of the segments contributes to the site's overall NRHP eligibility but would not be adversely affected by the Project. No physical trace of the other segment was found during inventory; however, the segment would be revisited in spring 2011 to confirm whether any trace of the trail is evident. If a physical trace is evident, the trail segment would be protected by narrowing the Project ROW and construction footprint for a distance of approximately 660 feet either side of where the ROW crosses the trail segment, and by fencing the ROW during construction. No further work is recommended for the remaining NRHP-eligible sites. Management recommendations for the 21 NRHP-eligible sites are listed in **Table 4-11**.

Table 4-11 Management Recommendations for Eligible Sites Located Within the Project APE

Site Number	Site Type	Management Recommendation
48CA265	Historic Railroad	Non-contributing/NFW
48CA1473	Historic Texas Trail	Non-contributing/No physical trace/NFW
48CA2785	Historic Black and Yellow Road; State Highway 14/16 route	Non-contributing/NFW
48JO134	Historic Bozeman Trail – route from Fort Fetterman	Contributing/No adverse effects (no physical evidence of the trail)/NFW
48JO1599	Historic Bozeman Trail – route from Deer Creek Station and Richards Bridge	Non-contributing/Revisit in spring 2011 to confirm no physical trace; if trace is visible, conduct pre-construction recordation/Restrict and fence ROW/Post-construction restoration
48JO3059	Historic Fort Fetterman to Fort McKinney Telegraph Line	Non-contributing/Presumed destroyed/NFW
48NA242	Historic North South Railroad	Contributing//Access road would be restricted to light-duty trucks/NFW
48NA631	Historic Chicago and Northwest Railroad – Sodium, Wyoming, crossing	Non-contributing/NFW
48NA631	Historic Chicago and Northwest Railroad – Powder River, Wyoming, crossing	Non-contributing/Narrow and fence ROW
48NA1014	Prehistoric open camp/historic debris scatter	Non-contributing/Fence south side of access through site
48NA1035	Prehistoric open camp	Non-contributing/NFW
48NA1425	Prehistoric open camp	Avoid or data recovery
48NA1428	Prehistoric open camp	Non-contributing area/NFW
48NA1800	Prehistoric open camp	Currently listed as eligible for the NRHP; re-evaluated as not eligible/NFW
48NA1968	Prehistoric open camp	Non-contributing/NFW
48NA1975	Historic Yellowstone Highway 20 – Hells Half Acre Crossing	Non-contributing/NFW
48NA1975	Historic Yellowstone Highway 20 – Sodium, Wyoming, crossing	Non-contributing/NFW
48NA2561	Historic Chicago, Burlington & Quincy Railroad – Arminto, Wyoming, crossing	Non-contributing/NFW
48NA2561	Historic Chicago, Burlington & Quincy Railroad – Sodium, Wyoming, crossing	Non-contributing/NFW

Table 4-11 Management Recommendations for Eligible Sites Located Within the Project APE

Site Number	Site Type	Management Recommendation
48NA4837	Prehistoric stone circles	Non-contributing/Features avoided/Restrict and fence ROW
48NA4838	Prehistoric open camp	Avoid or data recovery

NFW = No further work.

Source: Metcalf 2010.

The potential for undiscovered cultural resource sites, such as deeply or shallowly buried cultural materials and/or features, does exist despite previous archaeological investigations. Part of the mitigation procedures to be undertaken in conjunction with the Project includes an OTI of the entire 231-mile-long Project based on the high potential to encounter buried cultural deposits. The OTI is defined as: Inspection of the trench after it has been dug, but before pipe has been laid in the trench. If a site were discovered in the trench wall, the features and stratigraphy of the site would be mapped prior to excavating the feature and collecting of sediment and feature fill. Testing to define and evaluate the eligibility of the site would be conducted through excavation of a 1x2m test unit near the feature and extending to the bottom of the feature. Additional testing, such as another 1x2m test unit and/or auger holes on a grid, may be warranted depending on the results of the initial testing. These measures would be necessary to define the extent of the site and determine whether data recovery is needed. The OTI would be conducted in accordance with the provisions of the PA (**Appendix B**) and agreed upon by the BLM, SHPO, and Denbury. If human remains were discovered during the Project construction, construction would be halted within 328 feet of the discovery and the find reported to the BLM Authorized Officer. The discovery would be evaluated and treated in accordance with the provisions of the Project's PA. Work would not be reinitiated in the vicinity of the discovery until authorized by the BLM.

Operation and abandonment of the Project would not result in additional impacts to cultural resources. These activities would not involve any additional land disturbance; therefore, no additional impacts to cultural resources along the Project route are anticipated.

4.14.2 Native American Concerns

Places of traditional, cultural, and religious importance to Native Americans include, but are not limited to, burials, sacred sites, stone cairns, stone circles/alignments, or locations where medicinal and subsistence resources are gathered. To date, two prehistoric stone circles and two prehistoric stone cairns have been documented during the Class III inventory. If a place of traditional, cultural, and religious importance is identified by tribal representatives, no surface disturbance would occur within or immediately adjacent to the boundary of the property prior to completion of all consultation required by law. If data recovery or other form of mitigation is required at a place of traditional, cultural, and religious importance, a data recovery or mitigation plan would be reviewed and approved by the BLM and SHPO. Tribal representatives would be asked to participate in the development of any such data recovery or mitigation plan.

If human remains were discovered during the Project construction, construction would be halted within 328 feet of the discovery, and the BLM authorized officer notified. The discovery would be evaluated by the BLM authorized officer in accordance with the provisions of the Project's PA. Treatment of any human remains located on federal land would be handled in accordance with the Native American Graves Protection and Repatriation Act; human remains found on private land would be handled according to the provisions of appropriate state laws. Work would not be reinitiated in the vicinity of the discovery until authorized by the BLM.

Consultation with the six contacted Native American groups currently is ongoing and would continue up to and including the Project construction.

4.15 No Action Alternative

Under the No Action Alternative, the Project would not be constructed. As a result, the natural and human resource impacts and benefits identified under the Proposed Action would not occur. Without the development of the Project, EOR of the Bell Creek oil field would not occur, thereby reducing the amount of oil recovered and transported to markets. In addition, CO_2 currently being vented at the Lost Cabin Gas Plant would continue to be emitted to the atmosphere rather than be used by the Project.

Tax revenues would not be received by the State of Wyoming, State of Montana, or counties crossed by the Project. In addition, the construction and operation work force payroll would not be available for purchase of local goods and services. Royalties and payments to the federal and state governments for recovered oil would not be realized.

5.0 Residual and Cumulative Impacts

5.1 Commitment of Resources

Some resources may be adversely affected for the short term (less than 3 to 5 years), and others may be adversely affected for the long term (greater than 20 years). Many of the impacts associated with the Project would cease to be adverse after the disturbed ROW is reclaimed. No significant decrease in resource productivity would be expected as a result of construction-related impacts. Operation of the EOR program at the Bell Creek oil field would result in increased incremental production of oil that would not be recoverable by existing operations; recovered oil would be consumed and lost for future use, representing an irreversible impact. **Table 5-1** summarizes the long-term and short-term effects of the Project and indicates whether a resource would be irreversibly or irretrievably affected.

Table 5-1 Resource Commitments Identified for the Greencore Project

Resource	Impacts		Commitment of Resources	
	Short-term	Long-term	Irreversible	Irretrievable
Air Quality	x			
Geology and Soils	x[1]			
Minerals and Paleontological Resources	x	x[2]	x[2]	x[2]
Cultural Resources	x	x[2]	x[2]	x[2]
Water Resources	x[3]			
Vegetation and Agriculture	x[4]	x[4]		
Wildlife	x	x[5]		
Aquatic Resources	x			
Land Use and Recreation	x	x[6]		
Wilderness	None			
Visual Resources and Noise	x	x[7]		
Socioeconomics	x	x		
Transportation	x			

[1] Accelerated erosion would occur during construction and continue until the ground is stabilized. Understory vegetation is expected to return to preconstruction conditions within 3 to 5 years.

[2] There would be some gain in information for both cultural and paleontological resources as a result of the Project; however, there could also be some long-term inadvertent irreversible and irretrievable commitment of resources.

[3] Increased sedimentation would occur downstream of perennial stream crossings during construction. Preconstruction conditions would be established upon completion of the crossing and stabilization of any disturbed banks.

[4] Vegetation community structure and forage production would be lost on disturbed land for 3 to 5 growing seasons until grasses and forbs were re-established. Re-establishment of shrubs may take greater than 20 years, and trees would not be allowed to grow within 15 feet of the pipeline centerline. This would result in long-term impacts to shrub and woody vegetation.

[5] Loss of potentially suitable greater sage-grouse habitat as sagebrush communities may take greater than 20 years to re-establish.

[6] Long-term impacts may include use of the disturbed ROW by hunters and all terrain vehicle users.

[7] Visual effects of block valves/metering stations would be of long-term duration, but visual objectives would still be met at these locations.

Construction and operation of the Project could irreversibly or irretrievably commit certain environmental or energy resources. An irreversible commitment of resources relates to the loss of future options for those resources; an irreversible impact primarily applies to the effect on the use of nonrenewable resources, such as minerals. The irretrievable commitment of resources means a loss of production, harvest, or use of natural resources for a finite period. Potential irreversible and irretrievable resource commitments for the Project could include paleontological and cultural resources.

5.2 Short-term, Long-term, and Residual Impacts

The residual impacts of the Project are expected to be minimal and primarily short-term, assuming the applicable environmental protection measures (as described in Chapter 2.0, Chapter 4.0, and throughout the POD) are effectively implemented. Some of the residual adverse impacts associated with the Project are considered unavoidable due to the nature of pipeline construction. Most of these impacts are short-term; however, some small surface areas are required during the life of the project for support structures (e.g., block valves). These structures are required for the safe operation of the system.

Unavoidable short-term impacts from the Project would include land surface disturbance resulting in vegetation cover loss and, consequently, loss of wildlife and livestock forage, and an increased potential for erosion. Although grasses and forbs would become re-established in the ROW within 3 to 5 years, shrubs (e.g., sagebrush) may take up to 20 years to become established in the construction ROW. This would result in long-term effects to habitats that contain shrubs and/or woody species. Approximately 0.8 mile (0.3 percent) of the proposed route would traverse the upland forest/woodland vegetation type; therefore long-term impacts to forested areas are considered minimal when compared to the available habitat surrounding the project area. Wildlife also would be temporarily disturbed along the project route during construction, but this is not considered a residual or long-term impact due to the fact that wildlife will return to the project area after construction is completed.

Minor short-term air quality degradation is expected from fugitive dust and construction equipment emissions along the Project ROW. Most traffic effects of the Project would be unavoidable, including increased traffic, the potential for increased accidents, and increased road maintenance requirements. These are not considered long-term or residual impacts.

Construction of the Project is not expected to impact mining operations. The principal impact to mineral resources would be the positive impact on the enhanced recovery of oil in the Bell Creek oil field. Overall, socioeconomic impacts also are expected to be positive.

Long- and short-term impacts to visual resources are expected due to construction-related activities and the visibility of the reclaimed ROW. Short-term visual contrast in excess of the VRM Class II management objectives would be unavoidable. Minor visual contrast caused by noticeably different vegetation patterns and textures in reclaimed areas would be an unavoidable effect. Similar impacts to cultural resources (e.g., historic trails) would result from construction. Potential long-term impacts to cultural sites should be minor and partially offset by the gain in information as a result of the committed protection measures established for the Project.

Greencore has been proactive in regards to implementing reroutes and protective measures to avoid certain resources such as cultural sites, biological resources (e.g., greater sage grouse NSOs), and paleaontological resources. Through consultation with the appropriate regulatory agency, avoidance strategies have been implemented whenever possible in order to reduce, minimize, or completely avoid impacts to known resources. Also, since the Project will be collocated with existing ROWs for greater than 91 percent of its length, separate NEPA analyses for each of these resources have already been conducted for the existing ROWs in these areas, and the results of these analyses have been included in their respective Final EIS/EA documents.

5.3 Cumulative Impacts

Cumulative impacts are defined as “the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time” (40 CFR Part 1508.7). Where impacts are not fully mitigated or compensated, cumulative impacts can result.

Principal past actions that were considered in the evaluation of the cumulative impacts are those that have affected similar resources and for which the effect is still residual in the environment. For example, land disturbing projects that have adversely affected productivity for wildlife or livestock must be considered in the cumulative impact evaluation, if reclamation or off-site habitat enhancement have not compensated for that lost productivity.

Past actions in the vicinity of the Project that may have affected resources for which the effect is still residual include oil and gas development, ranching activities, installation of pipelines and other utilities (including powerlines), and mining. Most cumulative impacts would be to vegetation productivity, visual resources, and any irreversible impacts to resources such as cultural and paleontological sites. Due to the fact that the Project would be constructed to the maximum extent practical within existing utility ROWs and/or previously disturbed corridors (greater than 91 percent of the Project ROW is collocated), cumulative impacts would be minimal. In general, the centerline of the Greencore pipeline would be offset 50 feet from existing utility centerlines, which enables the Project to be built within previously disturbed ROW for the vast majority of the route.

It is difficult to quantify the cumulative impacts for each resource due to uncertainties regarding the location, scale, and/or rate of changes on public and private lands within the vicinity of the Project. Cumulative impacts were evaluated for various resources in the Powder River Basin (PRB) Oil and Gas Final Environmental Impact Statement (BLM 2003b), which encompasses the majority of the Project area. Because the Greencore Project is small (3,228 acres) in comparison to the Powder River Basin (8 million acres) (approximately 0.04 percent), cumulative impacts from the Project would be very small in comparison to the PRB impacts. Cumulative impacts to the following resources were evaluated for the Project, but were determined to be negligible or none based on past and future (planned) actions in the Project area and/or due to the temporary nature of disturbance for the Project:

- Air Quality
- Soils
- Minerals and Paleontological Resources
- Cultural Resources
- Water Resources
- Wetlands
- Agriculture and Range
- Aquatic Resources
- Land Use and Recreation
- Wilderness
- Socioeconomics
- Transportation

Future cumulative actions that are associated with the Project are EOR in the Bell Creek oil field. Construction activities in the Bell Creek oil field would mostly occur within previously disturbed land that is used for oil development. Operation activities would involve the production of oil from the CO_2 injection process. Very few

new roads or maintenance activities would be required for the EOR process. Details regarding resource-specific cumulative impacts are presented below.

5.3.1 Cumulative Impacts for Vegetation and Sensitive Plants

Construction of the Project could have temporary to long-term impacts on vegetation. For example, removal of vegetation and the disturbance of soils during construction would create optimal conditions for the invasion and establishment of invasive, non-native species that could continue for many years after the initial disturbance. However, the amount of vegetation that would be disturbed by the Project is very small compared to the vegetative disturbance projected for oil and gas developments in the Lander, Casper, Buffalo, and Miles City ROD/RMPs and EISs (BLM 2010a,b,c, 2007a, 2001a, 2000a, 1987, 1985a).

There are no known occurrences of threatened, endangered, candidate, or sensitive plant species within the Project area. Construction activities would result in temporary impacts to suitable habitat. An Integrated Pest Management (IPM) approach would be used to control any future noxious weed infestations which could degrade these habitats. Reclamation plans outlined in the Project POD (Appendix J) would ensure that suitable habitat would be reclaimed to pre-construction conditions. These procedures include, but are not limited to, the following: recontouring, topsoil segregation and distribution, seedbed preparation, seed mix application, and follow-up monitoring. Therefore, no cumulative impacts to sensitive plant species and their associated suitable habitats are anticipated.

Cumulative impacts to vegetation caused by the Project would be minimized by implementing protection measures for proper handling of topsoil and spoil, preventative and remedial noxious weed management (pre- and post-construction treatments), collocation with existing disturbed ROW, and reclamation techniques described in Chapter 2.0, Chapter 4.0, and throughout the POD. Implementation of these measures would result in negligible to no cumulative impacts to vegetation.

5.3.2 Cumulative Impacts for Wildlife

Cumulative impacts to wildlife resources would be directly related to habitat loss, habitat fragmentation, animal displacement, and direct mortalities. Long-term surface disturbance incrementally adds to wildlife habitat losses, overall habitat fragmentation, and animal displacement. In areas where development has occurred, habitat fragmentation may have resulted in the disruption of seasonal patterns or migration routes. Historic, current, and future developments in the vicinity of the Project have resulted, or would result, in the reduction of carrying capacities as characterized by the amount of available cover, forage, and breeding areas for wildlife species. Surface disturbance in the Project region primarily results from oil and gas development, including pipelines and seismic exploration, and mining. However, other activities such as livestock grazing, development of recreational facilities, and growth of Wyoming communities also contribute to cumulative impacts on wildlife and their habitats. Big game, especially pronghorn, would be most susceptible to these impacts since encroaching human activities associated with development activities have resulted, or would result, in habitat loss and fragmentation and animal displacement. These impacts may be more pronounced in areas designated as crucial habitat (e.g., crucial winter habitat, parturition areas), which may lead to declines in local big game populations. Other wildlife species, such as raptor species, also would be susceptible to these cumulative impacts since encroaching human activities in the Project region resulted, or would result, in habitat loss and fragmentation and animal displacement in areas that may be at their relative carrying capacity for these resident species. Many of the local wildlife populations (e.g., small game, migratory birds) that occur in the Project region likely would continue to occupy their respective ranges and breed successfully, although population numbers may decrease relative to the amount of cumulative habitat loss and disturbance from incremental development.

Details of the methodology used to assess cumulative impacts to greater sage-grouse are presented below. Based on Instruction Memorandum (IM) WY-2010-012, the following parameters were used to calculate greater sage-grouse habitat disturbance and road/energy development density within greater sage-grouse core population areas crossed by the Project. The analysis area encompassed all known occupied and undetermined leks (buffered by 4 miles) within a 4-mile radius around the Project, clipped to core areas.

All of the area within designated greater sage-grouse core areas was considered greater sage-grouse habitat. Therefore, approximately 465,425 acres of greater sage-grouse habitat occurs within the analysis area. Once all greater sage-grouse habitat within core population areas was mapped within the 4-mile buffer, all leks located with the 4-mile buffer were buffered individually with a 4-mile buffer. This area was then clipped to include only core area habitat. Existing and proposed disturbances resulting in direct habitat loss were then overlaid, and the amount of greater sage-grouse habitat loss was calculated. A variety of data sources were used to determine existing disturbance within the analysis area. Data was gathered primarily from BLM GIS layers, Wyoming State Geologic Survey data, Mineral Resources data, Wyoming Oil and Gas Commission data, and several other online sources. Disturbances considered for this analysis included: 1) highways and improved roads (greater than 10 feet in width); 2) well pads; 3) wind turbines; 4) cities, rest/recreation areas, campgrounds; 5) designated energy corridors; 6) gas plants, compressor stations and substations; 7) gravel pits and mines; and 8) agricultural lands. Features not included in the direct impact analysis because they were determined not to impact greater sage-grouse or had little ground disturbance associated with them included 1) unimproved roads (less than 10 feet in width); 2) reservoirs; 3) met towers; 5) successfully reclaimed disturbances; and 5) distribution lines. Results of this analysis are presented in **Table 5-2**.

Next, existing and proposed energy production and transmission structures were overlaid on the same analysis area (465,425 acres), and the number of energy production and transmission structures per 640 acres was calculated for core population areas. Energy and transmission structures used in this analysis included the following: 1) wind turbines; 2) gas plants; 3) compressor stations and substations; 4) oil and gas wells and associated access roads; 5) power lines; and 6) pipelines. Results of this analysis are presented in **Table 5-3**.

Based on the cumulative disturbance calculations presented in **Tables 5-2** and **5-3**, the Project fulfills the requirements as described in BLM IM WY-2010-012.

Table 5-2 Existing and Proposed Long-term Disturbance Calculations within the Greater Sage-grouse Cumulative Impacts Analysis Area

Feature	Long-Term Disturbance		Notes
Include in 5% Disturbance Calculation	**Existing Disturbance within Core Area (acres)**	**Proposed Action Disturbance within Core Area (acres)**	
Highways, improved roads (crown and ditched; greater than 10 feet in width)	6,612	0	Used TIGER data, minus 2-tracks and 4WD trails.
Well pads	113	0	Digitized from wells in 2010 WYOGCC database.
Wind turbines	0	0	
Cities, rest/recreation areas, etc.	80	0	Town of Powder River, developed area.
Linear energy facilities(including facilities within designated utility corridors)	1,633	923	Digitized from 2009 NAIP imagery with assistance from WYGS dataset.
Gas plants, compressor stations, substations	0	10	Natrona Hub Compressor Station.
Gravel pits, mines	6	0	
Agricultural Lands	4,517	0	Consists of agricultural lands that were converted from sagebrush shrublands/grassland.
Farmsteads	135	0	
Combined Footprint	11,448[1,2]	931[1,2,3]	
Existing Disturbance + Proposed Disturbance		12,381[1]	
Maximum Allowed Disturbance (Total Greater Sage-grouse Habitat * 5%)		23,271[4]	

Table 5-2 Existing and Proposed Long-term Disturbance Calculations within the Greater Sage-grouse Cumulative Impacts Analysis Area

Feature	Long-Term Disturbance		
Include in 5% Disturbance Calculation	**Existing Disturbance within Core Area (acres)**	**Proposed Action Disturbance within Core Area (acres)**	**Notes**
Cumulative Disturbance (Proposed and Existing Facilities) to Greater Sage-grouse Habitat (%)		2.66[4]	
Meets WY IM-2010-012 Requirements?		Yes	BLM WY IM 2010-012 (Pg. 4) states that cumulative disturbance must not exceed 5% of greater sage-grouse habitat within the same 640 acres.

[1] For disturbance calculations, disturbances in core area habitat do not always sum to the total (i.e., combined footprint). This is due to overlapping disturbances not being counted twice.

[2] These cumulative totals include disturbance to all greater sage-grouse habitat types (i.e., entire core area is considered habitat). **Table 4-8** focuses specifically on impacts to breeding habitat.

[3] This acreage was calculated by subtracting the total non-core area Project disturbance (2,247 acres) from the total Project disturbance (3,178 acres).

[4] Based on a total of 465,425 acres of greater sage-grouse habitat within the analysis area.

Table 5-3 Number of Energy Production and Transmission Structures within the Greater Sage-grouse Cumulative Impacts Analysis Area

Feature	Feature Density Calculation	Long-Term Disturbance		Notes
		Existing Facilities within Core Areas	Proposed Action Facilities within Core Area	
Included in Energy Production and Transmission Structures Analysis[1]				
Oil and gas wells	Each well pad location counts as 1.	87	0	Each well pad and associated structure counts as one (e.g., tanks, collection pipeline, etc.).
Power lines	Each power line counts as 1.	9	0	
Pipelines	Each pipeline counts as 1.	11	1	Each pipeline counts as one, unless the pipeline crosses a 0.6 mile lek NSO. If it crosses a lek NSO then each crossing counts as one.
Compressor station or substation	Each compressor station or substation counts as 1.	1	1	
Wind turbines	Each wind turbine counts as 1.	0	0	Individual turbines and associated support structure counts as 1 (e.g., collection system).
Gas Plant/Refinery	Each gas plant or refinery counts as 1.	0	0	
Railroads	Each railroad counts as 1.	1	0	
Roads	Each time a road passes within 0.6 mile lek NSO counts as 1.	53	0	
Total Number of Facilities		162	2	
Existing Facilities + Proposed Facilities			164	
Maximum Allowed Facilities (Total Greater Sage-grouse Habitat / 640 acres)			727[2]	
Proposed Facilities per 640 acres			0.23[2]	

Table 5-3 Number of Energy Production and Transmission Structures within the Greater Sage-grouse Cumulative Impacts Analysis Area

Feature	Feature Density Calculation	Long-Term Disturbance		Notes
		Existing Facilities within Core Areas	Proposed Action Facilities within Core Area	
Meets WY IM 2010-012 Requirements?			Yes	BLM WY IM 2010-012 (Pg. 4) states that cumulative disturbance must not exceed 1 energy production facility per 640 acres of greater sage-grouse habitat.

[1] Not included in Energy Production and Transmission Structures Analysis:
Communication sites
Other disturbances (e.g., O&M buildings, substations, etc.)
Coal mines
Met towers

[2] Based on a total of 465,425 acres of greater sage-grouse habitat within the analysis area.

6.0 Consultation and Coordination

6.1 Public Involvement and Scoping Process

The Project was introduced to individuals and groups between October 5 and October 10, 2009, as required by the CEQ regulations for EA preparation. However, formal scoping meetings have not been conducted as part of the NEPA process due to little public opposition and minimal impact to the environment.

Although no issues or opposition has been raised, the agencies identified information on threatened and endangered species, wildlife, noxious weeds, and cultural resources. This information has been incorporated into the EA as appropriate.

6.2 Coordination

The following agencies, groups, and businesses have provided input and/or will receive copies of the Environmental Assessment:

Federal Agencies

Advisory Council on Historic Preservation
Federal Energy Regulatory Commission
Federal Highway Administration
Soil Conservation Service
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service

Wyoming State Agencies

Department of Environmental Quality
Enhanced Oil Recovery Institute
Game and Fish Department
Governor's Planning Office
Highway Department
Oil and Gas Conservation Commission
State Engineer's Office
State Historical Preservation Office

Montana State Agencies

Department of Environmental Quality
Department of Natural Resources and Conservation
Department of Fish, Wildlife and Parks
State Historical Preservation Office
Department of Transportation

County Agencies

Campbell County
Fremont County
Johnson County
Natrona County
Natrona County Weed District
Powder River County

6.3 Team Organization

Lead Agency – Bureau of Land Management
Casper Field Office
Buffalo Field Office
Lander Field Office
Miles City Field Office

6.4 EA Preparers

As required by NEPA regulations (40 CFR § 1502.17), **Table 6-1** lists the BLM personnel responsible for preparing this Draft EA. The BLM Casper Field Office has retained AECOM as a third-party consultant to assist with the preparation of this EA (**Table 6-2**). AECOM was selected by the lead agency to avoid any conflict of interest. AECOM has certified that it does not have any financial or other interest in the decisions to be made pursuant to this EA.

Table 6-1 BLM Team

Name	EA Responsibility
BLM Project Team	
Patrick Moore	Casper Field Office Assistant Field Manager for Minerals and Land
Neal Ruebush	Project Manager/Realty Specialist
Kathleen Lacko	Purpose and Need/NEPA Review
Chris Arthur	Cultural Resources, Native American Issues
Dora Ridenour	Cultural Resources, Native American Issues
Jim Wright	Fisheries, Wildlife, T&E, Wetlands
Art Terry	Environmental Protection
Julianne Alley	Special Status Species, Vegetation and Range
Denise Oliverius	Land Use/Realty
Scott Jawors	Fisheries, Wildlife, T&E, Wetlands
Leta Rinker	Land Use/Realty
Karina Bryan	Cultural Resources and Native American Issues
Sue Oberlie (Lander)	Fisheries, Wildlife, T&E, Wetlands
Matt Roberts	Range
Tim Eulberg	Surface Compliance

Table 6-2 AECOM EA Team (Third-party Consultant)

AECOM Team Member	Responsibility/Resource	Degree/Certifications	Experience (years)
Scott Patti	Principal-in-Charge	BS Natural Resources Management / Fisheries Biology	26
Peggy Roberts	Strategic/NEPA Advisor	M.S. Public Communications/ Technology BS Journalism/Public Relations	18
Chad Barnes	Project Manager, Project Description, Project Design Measures, Review, QA/QC	BS Botany AAS Plant Biology	16
Janie Castle	Assistant Project Manager, Project Description, Project Design Measures, Review, QA/QC	BS Aquatic Biology BS Environmental Microbiology	14
Courtney Taylor	Air and Climate	MS Atmospheric Science BA Environment, Economics, and Politics	9
Bill Berg	Geology, Minerals, Paleontology and Hazardous Materials	MS Geology BS Geology	30
Chris Dunne	Range Resources	BS Natural Resource Management	12
Kim Munson	Cultural Resources, Native American Concerns	MA Anthropology BA Anthropology	18
Steve Graber	Socioeconomics, Fiscal Effects, Transportation, Environmental Justice, Land Use and Recreation	B.S. Natural Resources Management B.A. Economics	6
Merlyn Paulson	Visual Resource Management Recreation, Special Designation Areas, Land Use	MLA Landscape Architecture II BLA Landscape Architecture & Environment	30
Terra Mascarenas	Soils Resources	BS Soil & Crop Science	13
Allison Grow	Vegetation and Plant Communities	BS Rangeland Ecosystem Science BS Soil & Crop Science	9
David Fetter	Water Resources	BS Watershed Science	7
Matt Brekke	Wildlife/T&E, Aquatics, Wilderness, Review	B.S. Wildlife Biology	4
Jason Thoene	GIS	MS Geographic Information Systems BA Geology	10

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Appendix A
Additional Temporary Work Space Required for Construction of the Greencore Project

Appendix A Additional Temporary Workspace Required for Construction of the Greencore Project

Side	From MP	To MP	Acres
Right	0.01	0.56	3.33
Left	0.01	0.12	0.61
Left	0.12	0.17	0.26
Left	0.53	0.57	0.54
Left	0.58	0.62	0.24
Right	0.86	0.89	0.13
Left	0.88	1.09	0.64
Right	1.27	1.29	0.15
Right	1.31	1.33	0.15
Right	1.51	1.75	1.41
Left	3.17	3.20	0.23
Left	3.22	3.25	0.22
Right	3.48	3.63	0.43
Left	4.08	4.11	0.23
Left	4.12	4.15	0.23
Left	4.60	4.63	0.24
Right	4.62	4.63	0.13
Right	4.63	4.65	0.13
Left	4.64	4.67	0.23
Left	5.12	5.12	0.01
Right	5.12	5.12	0.01
Right	6.33	6.36	0.23
Right	6.36	6.38	0.23
Right	7.74	7.80	0.17
Right	7.80	7.86	0.17
Right	7.90	7.96	0.18
Right	7.96	8.02	0.18
Right	8.13	8.17	0.30
Right	8.17	8.21	0.30
Right	9.05	9.08	0.24
Right	9.09	9.12	0.24
Right	9.60	9.66	0.17
Right	9.66	9.76	0.28
Right	9.76	9.82	0.17
Right	10.12	10.15	0.18
Right	10.44	10.47	0.23
Right	10.47	10.51	0.11

Appendix A Additional Temporary Workspace Required for Construction of the Greencore Project

Side	From MP	To MP	Acres
Right	10.54	10.58	0.11
Right	10.59	10.65	0.17
Right	10.77	10.85	0.24
Right	11.08	11.14	0.17
Right	11.14	11.20	0.17
Right	11.66	11.72	0.17
Right	11.73	11.78	0.17
Right	11.94	11.98	0.30
Right	12.73	12.79	0.32
Right	13.00	13.13	0.83
Right	14.23	14.29	0.17
Left	14.23	14.29	0.52
Left	14.51	14.56	0.52
Right	14.51	14.56	0.17
Right	15.00	15.08	0.23
Right	15.53	15.57	0.11
Right	16.53	16.76	0.72
Right	19.16	19.20	0.27
Right	19.20	19.26	0.48
Right	19.80	19.87	0.21
Left	19.80	19.87	0.08
Right	22.32	22.47	1.19
Right	23.67	23.71	0.54
Right	23.72	23.76	0.43
Right	24.91	24.93	0.17
Right	24.93	24.96	0.17
Right	25.06	25.12	0.70
Right	25.33	25.59	1.98
Right	25.60	25.71	0.84
Right	25.72	26.00	2.21
Right	28.41	28.43	0.15
Right	28.44	28.46	0.15
Right	29.72	29.74	0.17
Right	29.74	29.77	0.19
Right	30.43	30.48	0.35
Right	30.51	30.65	0.86
Left	31.44	31.44	0.01

Appendix A Additional Temporary Workspace Required for Construction of the Greencore Project

Side	From MP	To MP	Acres
Left	31.66	31.70	0.44
Left	31.70	31.75	0.41
Left	32.13	33.03	5.75
Right	32.84	33.03	2.00
Right	33.13	33.15	0.92
Left	34.58	34.60	0.13
Left	34.60	34.75	1.05
Right	35.48	35.53	0.23
Right	35.54	35.59	0.26
Right	35.59	36.46	2.62
Right	36.65	36.67	0.14
Right	36.68	36.70	0.16
Right	36.79	37.11	2.69
Right	37.44	37.79	1.04
Left	38.19	38.22	0.18
Left	38.22	38.25	0.18
Left	39.55	39.57	0.15
Left	39.59	39.82	1.80
Right	41.61	41.64	0.24
Right	41.80	41.88	0.47
Right	44.92	45.07	1.84
Right	45.31	45.38	0.65
Left	45.51	45.55	1.45
Right	45.88	46.02	0.87
Left	46.01	46.04	1.19
Right	48.37	48.40	0.19
Right	48.41	48.44	0.19
Right	49.37	50.51	3.43
Right	51.53	51.57	0.27
Right	51.56	51.84	2.30
Right	52.05	52.66	1.85
Right	54.20	55.57	4.17
Right	55.81	55.85	0.27
Right	55.85	55.89	0.27
Right	55.98	56.02	0.30
Right	56.03	56.07	0.30
Right	56.94	57.07	0.37

Appendix A Additional Temporary Workspace Required for Construction of the Greencore Project

Side	From MP	To MP	Acres
Right	57.12	57.56	1.33
Right	57.73	58.08	1.04
Right	58.15	58.75	1.79
Right	58.75	58.90	0.92
Right	58.91	59.57	1.99
Right	60.27	60.33	0.18
Left	60.28	61.01	2.35
Left	61.00	61.04	0.21
Left	61.37	61.50	1.12
Left	61.49	62.70	6.15
Right	62.63	62.76	0.40
Right	64.40	64.59	1.53
Right	64.60	64.62	0.18
Right	66.65	66.69	0.21
Right	66.68	66.72	0.21
Right	66.93	67.54	1.94
Right	67.54	68.81	4.03
Right	68.81	69.20	1.30
Right	69.38	71.59	8.64
Right	71.67	72.59	5.55
Right	74.06	74.77	4.31
Right	74.88	75.40	3.23
Right	76.43	76.50	0.36
Right	76.50	76.57	0.38
Right	76.57	76.85	3.44
Left	76.62	76.65	0.19
Left	76.64	76.67	0.19
Right	78.53	78.55	0.17
Right	78.55	78.58	0.17
Right	79.13	79.38	1.50
Right	79.53	79.74	0.62
Right	79.96	80.18	0.73
Right	80.47	80.51	0.11
Right	80.70	80.76	0.17
Right	80.77	80.83	0.18
Right	80.95	81.07	1.50
Right	81.09	81.11	0.18

Appendix A Additional Temporary Workspace Required for Construction of the Greencore Project

Side	From MP	To MP	Acres
Right	81.18	81.31	1.04
Right	81.38	81.93	2.30
Right	82.09	82.48	1.20
Right	82.88	82.94	0.33
Right	82.95	83.02	0.46
Right	83.01	83.04	0.18
Right	83.12	83.17	0.36
Right	83.19	83.27	0.35
Right	83.27	83.62	1.28
Right	83.86	84.06	0.59
Right	84.53	84.76	1.35
Right	85.20	85.31	0.56
Left	85.20	85.31	0.67
Left	85.31	85.81	3.02
Right	85.74	85.98	1.42
Right	86.26	86.32	0.62
Left	86.44	86.52	0.68
Right	86.95	86.98	0.22
Right	86.99	87.03	0.24
Right	88.91	89.40	1.50
Left	89.80	89.93	0.37
Right	89.80	89.93	0.45
Right	90.11	90.35	0.73
Left	90.68	90.74	0.20
Right	90.68	90.74	0.11
Right	91.93	91.98	0.26
Left	91.93	91.98	0.45
Right	92.05	92.16	0.35
Left	93.60	93.70	0.82
Left	93.72	93.74	0.06
Left	93.77	93.80	0.06
Left	95.32	95.36	0.02
Right	95.32	95.36	0.16
Left	95.47	95.54	0.35
Right	95.47	95.54	0.19
Right	96.66	96.71	0.13
Left	96.66	96.71	0.22

Appendix A Additional Temporary Workspace Required for Construction of the Greencore Project

Side	From MP	To MP	Acres
Right	96.82	96.93	0.38
Left	96.82	96.93	0.23
Right	97.15	97.20	0.12
Left	97.15	97.20	0.17
Right	97.38	97.43	0.17
Left	97.38	97.43	0.11
Right	97.82	97.87	0.12
Left	97.82	97.87	0.17
Left	98.00	98.09	0.28
Right	98.00	98.09	0.28
Left	98.46	98.54	0.23
Right	98.59	98.70	0.35
Left	98.59	98.70	0.30
Right	99.21	99.30	0.40
Left	99.21	99.30	0.65
Right	99.43	99.59	0.47
Right	99.58	99.61	0.06
Right	99.60	99.63	0.09
Right	99.61	99.63	0.06
Right	99.75	99.84	0.57
Right	100.47	100.68	1.26
Left	100.47	100.68	0.66
Right	101.10	101.18	0.29
Right	101.34	101.41	0.17
Right	102.52	103.91	6.35
Right	103.91	104.11	1.10
Right	104.11	104.19	0.44
Right	104.19	104.79	3.75
Right	104.80	105.55	3.73
Right	106.59	106.64	0.25
Right	106.68	106.72	0.25
Right	108.55	108.88	3.48
Right	109.18	109.31	0.37
Right	110.16	110.23	0.46
Right	110.95	111.18	1.38
Right	113.24	113.39	0.92
Right	117.63	117.66	0.19

Appendix A Additional Temporary Workspace Required for Construction of the Greencore Project

Side	From MP	To MP	Acres
Right	118.50	118.53	0.18
Right	118.53	118.55	0.18
Right	118.65	118.69	0.21
Right	118.69	118.72	0.21
Right	119.49	119.51	0.19
Right	119.51	119.53	0.18
Right	119.65	119.72	0.46
Right	119.72	119.76	0.28
Right	120.03	120.05	0.16
Left	120.03	120.05	0.16
Right	120.05	120.07	0.16
Left	120.05	120.07	0.13
Right	120.57	120.65	0.19
Right	120.93	121.00	0.74
Right	121.73	122.14	1.22
Right	122.51	123.00	1.47
Right	123.24	123.31	0.37
Right	123.31	123.38	0.35
Right	123.42	123.45	0.16
Right	123.45	123.47	0.16
Right	123.79	123.90	0.47
Right	123.89	124.01	0.53
Right	124.29	124.51	0.62
Right	124.83	124.87	0.31
Right	124.87	125.00	0.66
Right	125.37	125.70	0.98
Right	125.83	125.95	0.34
Right	126.06	126.08	0.26
Right	126.08	126.11	0.24
Left	126.24	126.42	0.61
Right	126.24	126.30	0.20
Right	126.36	126.42	0.18
Right	126.82	126.95	0.41
Right	127.97	128.12	1.06
Right	128.12	128.14	0.15
Right	128.18	128.20	0.16
Right	128.20	128.22	0.16

Appendix A Additional Temporary Workspace Required for Construction of the Greencore Project

Side	From MP	To MP	Acres
Right	128.74	129.61	3.08
Right	129.95	130.62	2.02
Right	130.73	130.76	0.19
Right	130.78	131.16	2.42
Right	131.16	131.58	1.40
Right	132.29	132.34	0.23
Right	132.35	132.40	0.34
Right	132.84	132.91	0.18
Right	132.98	133.04	0.17
Right	133.13	133.33	1.32
Right	133.45	133.49	0.23
Right	133.48	133.52	0.17
Right	133.66	133.84	0.56
Right	134.24	135.08	2.67
Right	135.09	135.14	0.30
Right	135.14	135.16	0.31
Right	136.26	136.28	0.13
Right	136.29	136.55	1.59
Right	137.61	137.69	0.26
Right	138.37	138.41	0.28
Right	138.43	138.45	0.14
Right	138.57	139.25	2.03
Right	139.40	139.96	1.74
Right	140.23	140.66	1.31
Right	142.52	142.55	0.18
Right	142.56	142.65	0.81
Right	142.72	143.02	0.89
Right	143.21	143.36	0.46
Left	143.35	143.54	1.40
Right	143.36	143.45	0.54
Left	143.55	143.87	2.47
Right	143.82	143.88	0.42
Right	144.01	144.24	0.69
Right	144.45	144.55	0.31
Right	145.46	145.67	0.63
Right	145.86	146.26	1.24
Right	146.56	147.33	2.20

Appendix A Additional Temporary Workspace Required for Construction of the Greencore Project

Side	From MP	To MP	Acres
Right	147.40	147.48	0.22
Right	147.59	147.62	0.13
Right	147.71	147.86	0.42
Right	148.04	148.14	0.36
Right	148.18	148.28	0.32
Right	148.53	148.66	0.56
Right	148.57	148.63	0.43
Left	148.62	148.64	0.04
Right	148.66	148.77	0.82
Left	148.84	149.21	7.03
Right	148.84	148.99	0.90
Left	149.20	149.29	0.36
Left	149.30	149.33	0.13
Left	149.49	149.59	0.29
Right	149.53	149.59	0.22
Right	150.79	151.49	2.11
Right	152.13	152.39	0.80
Right	152.89	152.91	0.05
Right	152.91	152.93	0.04
Right	152.93	152.96	0.09
Right	154.15	154.38	1.73
Right	154.38	154.49	0.92
Right	156.73	156.76	0.06
Right	156.87	156.90	0.06
Right	157.29	157.83	1.64
Right	158.30	158.33	0.22
Right	158.33	158.53	1.72
Right	158.54	158.60	0.26
Left	158.54	158.60	0.23
Right	158.70	158.92	0.66
Right	159.30	159.46	0.49
Right	159.85	160.17	0.94
Left	160.29	160.42	0.38
Right	160.29	160.42	0.41
Right	161.38	161.50	0.63
Right	161.59	161.62	0.25
Right	161.64	161.67	0.19

Appendix A Additional Temporary Workspace Required for Construction of the Greencore Project

Side	From MP	To MP	Acres
Right	162.05	162.17	0.37
Right	162.32	163.04	2.19
Left	163.02	163.15	0.99
Left	163.14	163.18	0.26
Left	163.38	163.50	0.39
Right	163.42	163.53	0.32
Right	163.60	163.93	1.02
Right	164.09	164.11	0.12
Right	164.30	164.33	0.06
Right	164.33	164.41	0.20
Right	164.66	164.68	0.12
Right	165.06	165.33	0.79
Left	165.55	165.78	0.73
Right	165.55	165.78	0.66
Right	165.81	166.34	1.59
Left	165.82	166.34	1.57
Right	166.80	166.87	0.19
Right	167.10	167.19	0.28
Right	167.50	167.61	0.34
Right	168.16	168.51	1.18
Right	168.96	169.82	2.69
Right	169.82	169.97	1.19
Right	170.34	170.46	0.36
Right	170.69	170.83	0.86
Right	170.83	170.84	0.06
Right	170.84	170.87	0.15
Right	170.87	170.92	0.27
Right	170.92	170.92	0.00
Right	171.35	171.39	0.11
Right	171.51	171.63	0.37
Right	171.85	171.89	0.11
Right	172.34	172.38	0.11
Left	172.35	172.78	1.33
Right	172.76	172.79	0.12
Right	172.95	173.44	1.51
Right	173.63	173.92	0.87
Right	174.29	174.48	0.58

Appendix A Additional Temporary Workspace Required for Construction of the Greencore Project

Side	From MP	To MP	Acres
Right	175.07	175.39	1.65
Right	175.40	175.45	0.32
Right	175.53	175.57	0.11
Right	175.86	175.97	0.69
Right	176.32	176.45	0.41
Right	177.05	177.11	0.16
Right	177.45	177.57	0.35
Left	177.51	177.58	0.17
Left	177.58	177.69	0.35
Left	177.69	177.86	0.52
Right	177.82	177.92	0.32
Left	178.33	178.91	1.77
Left	178.85	178.88	0.00
Left	178.85	178.88	0.76
Left	178.92	179.21	0.87
Left	179.79	179.84	0.17
Right	179.84	179.91	0.27
Right	180.06	180.34	2.12
Right	180.34	180.38	0.25
Right	180.40	180.45	0.21
Right	180.53	181.20	2.00
Right	181.21	181.48	0.81
Right	181.78	182.17	1.24
Right	182.48	182.62	0.95
Right	182.62	182.82	1.57
Right	182.84	182.89	0.43
Right	183.22	183.34	0.34
Right	184.02	184.32	0.95
Right	184.83	184.92	0.28
Right	185.28	185.33	0.23
Right	185.52	185.57	0.12
Right	185.81	185.84	0.15
Right	186.06	186.14	0.23
Left	186.22	186.27	0.12
Right	186.22	186.24	0.07
Left	186.55	186.65	0.30
Right	186.58	186.78	0.60

Appendix A Additional Temporary Workspace Required for Construction of the Greencore Project

Side	From MP	To MP	Acres
Right	186.85	186.99	0.41
Right	187.31	187.50	0.61
Right	187.81	188.00	0.74
Right	187.97	188.16	0.75
Right	188.28	188.52	0.71
Right	188.60	188.67	0.23
Right	189.37	189.49	0.36
Right	189.75	189.81	0.15
Right	189.99	190.15	0.52
Right	190.67	190.73	0.15
Right	190.83	190.99	0.51
Right	192.15	192.27	0.37
Right	192.57	192.72	0.43
Right	193.36	193.48	0.35
Right	194.61	194.67	0.14
Right	194.81	195.59	4.75
Right	196.00	196.08	0.23
Right	196.71	196.88	0.49
Right	196.88	197.08	1.09
Right	198.50	198.53	0.23
Right	198.54	198.57	0.23
Right	198.91	198.94	0.27
Right	198.94	198.97	0.24
Right	199.20	199.48	1.71
Right	199.72	199.79	0.23
Right	200.08	200.15	0.23
Right	200.34	200.47	0.82
Right	200.47	200.51	0.26
Right	200.97	201.15	0.67
Right	201.16	201.33	3.29
Right	202.11	202.17	0.18
Right	202.25	202.31	0.37
Right	202.32	202.36	0.32
Right	202.60	202.68	0.20
Right	202.94	203.06	0.30
Right	203.07	203.09	0.06
Right	203.15	203.20	0.20

Appendix A Additional Temporary Workspace Required for Construction of the Greencore Project

Side	From MP	To MP	Acres
Right	203.77	204.07	0.92
Right	204.12	204.45	0.97
Right	204.57	204.63	0.19
Right	205.79	206.05	0.77
Right	208.35	208.47	0.37
Right	208.89	208.95	0.15
Right	209.05	209.22	0.52
Right	209.80	209.91	0.34
Right	210.03	210.11	0.23
Right	210.34	210.41	0.27
Right	210.55	210.86	0.86
Right	210.99	211.07	0.27
Right	211.37	211.40	0.23
Right	211.40	211.60	1.53
Right	212.00	212.22	0.66
Right	212.46	212.61	0.46
Right	212.90	213.21	0.92
Right	213.70	213.83	0.40
Right	214.09	214.57	1.50
Right	214.72	215.47	2.27
Right	215.87	216.06	0.62
Left	216.04	216.46	1.32
Right	216.41	216.54	0.40
Right	216.82	216.96	0.43
Right	217.92	217.95	0.23
Right	217.95	218.15	1.49
Right	218.26	218.33	0.46
Right	218.34	218.38	0.27
Right	218.49	219.04	3.30
Right	219.16	219.17	0.10
Right	219.18	219.20	0.12
Right	219.47	219.53	0.17
Right	219.80	220.34	1.65
Right	220.81	221.61	2.44
Right	221.61	222.55	2.81
Right	223.60	223.63	0.22
Right	223.64	223.73	0.75

Appendix A Additional Temporary Workspace Required for Construction of the Greencore Project

Side	From MP	To MP	Acres
Right	223.84	224.03	0.57
Right	224.42	224.46	0.28
Right	224.45	224.50	0.27
Right	224.86	224.90	0.09
Right	224.95	224.98	0.14
Right	225.04	225.30	1.59
Right	225.30	225.59	1.71
Right	225.99	226.02	0.21
Right	226.03	226.47	2.07
Right	226.63	228.56	6.22
Right	228.57	228.60	0.23
Right	228.99	229.24	0.75
Right	229.53	229.57	0.26
Right	229.57	229.60	0.26
Right	229.73	229.77	0.28
Right	229.77	229.88	0.93
Right	229.96	230.06	0.20
Right	230.11	230.84	2.26
Right	230.98	231.04	0.15
Right	231.22	231.30	0.22
Right	231.30	231.32	0.04
Right	231.44	231.62	1.05

Appendix B
Programmatic Agreement

[Pending Finalization by the BLM]

Appendix C
Sensitive Soils along the Greencore Project Route

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
0.0	0.3	pH, Water Erosion
0.3	0.5	Water Erosion
0.5	0.7	pH, Water Erosion
0.7	1.2	Water Erosion
1.2	1.2	Shallow Bedrock (Soft), Permeability, Water Erosion
1.2	1.3	Shallow Bedrock (Soft),Water Erosion
1.3	1.5	Sandy, Water Erosion
1.5	1.8	Sandy
1.8	2.8	Sandy, Water Erosion
2.8	4.2	Sandy, Wind Erosion.
4.2	4.4	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
4.4	4.6	Shallow Bedrock (Soft), Sandy, Water Erosion
4.6	5.5	Shallow Bedrock (Soft)Water Erosion
5.5	5.6	Shallow Bedrock (Soft),Permeability
5.6	6.3	Shallow Bedrock (Soft)Water Erosion
6.3	6.4	Shallow Bedrock (Soft), Clayey, Permeability, pH, Sodic, Water Erosion
6.4	6.8	Shallow Bedrock (Soft), Water Erosion
6.8	10.7	Sandy, Water Erosion
10.7	10.8	Shallow Bedrock (Soft), Water Erosion
10.8	12.6	Sandy, Water Erosion
12.6	12.6	Shallow Bedrock (Soft), Water Erosion
12.6	12.9	Sandy, Water Erosion
12.9	13.0	Shallow Bedrock (Soft), Water Erosion
13.0	13.2	Sandy, pH, Sodic, Water Erosion
13.2	13.5	Sandy, Water Erosion
13.5	13.7	Shallow Bedrock (Soft), Water Erosion
13.7	14.1	Sandy, Water Erosion
14.1	14.2	Shallow Bedrock (Soft), Water Erosion
14.2	14.4	Sandy, Water Erosion
14.4	14.6	Shallow Bedrock (Soft), Water Erosion
14.6	14.6	Sandy, Water Erosion
14.6	14.7	Shallow Bedrock (Soft), Water Erosion
14.7	14.7	Sandy, Water Erosion
14.7	15.1	Shallow Bedrock (Soft), Water Erosion
15.1	15.6	Sandy, pH, Sodic, Water Erosion
15.6	15.7	Shallow Bedrock (Soft), Permeability
15.7	15.8	Shallow Bedrock (Soft), Water Erosion

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
15.8	16.0	Shallow Bedrock (Soft), Water Erosion
16.0	16.4	Sandy, Water Erosion
16.4	16.6	Shallow Bedrock (Soft), Water Erosion
16.7	17.0	Sandy, Water Erosion
17.0	17.1	Shallow Bedrock (Soft), Water Erosion
17.1	17.3	Sandy, Water Erosion
17.3	17.4	Shallow Bedrock (Soft), Clayey, Permeability, pH, Sodic, Water Erosion
17.4	17.6	Clayey, Permeability, pH, Sodic, Water Erosion
17.6	18.5	Sandy, Water Erosion
18.5	18.7	Shallow Bedrock (Soft), Clayey, Permeability, pH, Sodic, Water Erosion
18.7	18.8	Sandy, Water Erosion
18.9	19.0	Clayey, Permeability, pH, Sodic, Water Erosion
19.0	19.6	Sandy, Water Erosion
19.6	19.7	Clayey, Permeability, pH, Sodic, Water Erosion
19.7	20.3	Sandy, pH, Water Erosion
20.3	20.7	Clayey, Permeability, pH, Sodic, Water Erosion
20.7	21.0	Shallow Bedrock (Soft), Clayey, Permeability, pH, Sodic, Water Erosion
21.0	22.6	Sandy, Water Erosion
22.6	22.6	Clayey, Permeability, Water Erosion
22.6	23.9	Sandy, Water Erosion
23.9	24.0	Sandy, Permeability, pH, Sodic, Water Erosion
24.0	24.5	Sandy, Water Erosion
24.5	24.6	Sandy, Permeability, pH ,Sodic, Water Erosion
24.6	32.1	Sandy, Water Erosion
32.1	32.3	Shallow Bedrock (Soft)
32.3	32.4	Sandy, Water Erosion
32.4	32.6	Shallow Bedrock (Soft)
32.6	32.6	Sandy, Water Erosion
32.6	32.9	Shallow Bedrock (Soft)
32.9	32.9	Clayey, Water Erosion
32.9	34.6	Sandy, Water Erosion
34.6	34.7	Shallow Bedrock (Soft)
34.7	35.7	Sandy, Water Erosion
35.7	35.7	Sandy, Water Erosion
35.7	36.1	Clayey, Permeability, pH, Water Erosion
36.1	36.6	Sandy, Water Erosion
36.6	36.8	Shallow Water Table, Water Erosion
36.8	37.6	Sandy, Water Erosion

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
37.6	37.7	Shallow Water Table, Water Erosion
37.7	38.6	Sandy, Water Erosion
38.6	39.4	Clayey, Water Erosion
39.4	39.5	Shallow Bedrock (Soft), Clayey, Permeability, pH, Sodic, Water Erosion
39.5	39.7	Clayey, Water Erosion
39.7	39.8	Shallow Bedrock (Soft), Clayey, Permeability, pH, Sodic, Water Erosion
39.8	39.9	Clayey, Water Erosion
39.9	40.2	Clayey, Permeability, pH, Water Erosion
40.2	40.3	Permeability, Water Erosion
40.3	40.3	Clayey, Permeability, pH, Water Erosion
40.3	40.5	Permeability, Water Erosion
40.5	40.7	Clayey, Permeability, pH, Water Erosion
40.7	40.9	Water Erosion
40.9	40.9	Clayey, Permeability, pH, Water Erosion
40.9	41.2	Sandy, Water Erosion
41.2	41.5	Clayey, Permeability, pH, Water Erosion
41.5	41.6	Water Erosion
41.6	42.1	Clayey, Permeability, pH, Water Erosion
42.1	42.3	Water Erosion
42.3	42.3	Clayey, Permeability, pH, Water Erosion
42.3	42.6	Water Erosion
42.6	45.4	Sandy, Water Erosion
45.4	46.0	Clayey, Permeability, pH, Sodic, Water Erosion
46.0	46.8	Sandy, Water Erosion
46.8	47.0	Sandy, Permeability, pH, Sodic, Water Erosion
47.0	50.6	Sandy, Water Erosion
50.6	51.5	Water Erosion
51.5	51.6	Sandy, Water Erosion
51.6	51.7	Water Erosion
51.7	52.1	Sandy, Water Erosion
52.1	52.2	Water Erosion
52.2	52.4	Sandy, Water Erosion
52.4	52.5	Water Erosion
52.5	52.7	Sandy, Water Erosion
52.7	52.7	Water Erosion
52.7	52.8	Sandy, Water Erosion
52.8	52.9	Water Erosion
52.9	52.9	Sandy, Permeability, pH, Sodic, Water Erosion

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
52.9	53.4	Water Erosion
53.4	53.5	Sandy, Water Erosion
53.5	53.7	Water Erosion
53.7	54.0	Sandy, Water Erosion
54.0	55.3	Sandy, Permeability, pH, Sodic, Water Erosion
55.3	55.5	Clayey, Permeability, pH, Sodic, Water Erosion
55.5	55.7	Clayey, Permeability, pH, Water Erosion
55.7	55.8	Sandy, Permeability, pH, Sodic, Water Erosion
55.8	55.9	Clayey, Permeability, pH, Sodic, Water Erosion
55.9	56.9	Sandy, Permeability, pH, Sodic, Water Erosion
56.9	57.1	Clayey, Permeability, Shallow Water Table, Water Erosion
57.1	57.1	Sandy, Permeability, pH, Sodic, Water Erosion
57.1	57.2	Clayey, Permeability, Shallow Water Table, Water Erosion
57.2	57.4	Sandy, Permeability, pH, Sodic, Water Erosion
57.4	57.7	Permeability, Sodic, Water Erosion
57.7	57.8	Clayey, Permeability, Shallow Water Table, Water Erosion
57.8	58.8	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
58.8	58.9	Water Erosion
58.9	59.8	Clayey, Permeability, Shallow Water Table, Water Erosion
59.8	60.1	Clayey, Permeability, Water Erosion
60.1	60.5	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
60.5	61.2	Clayey, Permeability, Water Erosion
61.2	61.8	Sandy, Permeability, pH, Sodic, Water Erosion
61.8	62.7	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
62.7	62.8	Sandy, pH, Water Erosion
62.8	63.5	Sandy, Water Erosion
63.5	63.6	Sandy, Permeability, pH, Sodic, Water Erosion
63.6	63.6	Sandy, Water Erosion
63.6	65.7	Sandy, Permeability, pH, Sodic, Water Erosion
65.7	65.8	Shallow Water Table, Water Erosion
65.8	67.2	Sandy, Permeability, pH, Sodic, Water Erosion
67.2	67.3	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
67.3	67.6	Sandy, Permeability, pH, Sodic, Water Erosion
67.6	67.8	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
67.8	67.9	Sandy, Permeability, pH, Sodic, Water Erosion
67.9	68.4	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
68.4	68.5	Sandy, Permeability, pH, Sodic, Water Erosion
68.5	68.6	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
68.6	68.8	Sandy, Permeability, pH, Sodic, Water Erosion
68.8	68.9	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
68.9	71.0	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
71.0	71.4	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
71.4	71.5	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
71.5	71.7	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
71.7	71.7	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
71.7	72.5	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
72.5	72.7	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
72.7	73.0	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
73.0	73.7	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
73.7	74.9	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
74.9	75.2	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
75.2	75.4	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
75.4	75.5	Permeability, Water Erosion
75.5	75.5	Shallow Water Table, Water Erosion
75.5	76.0	Permeability, Water Erosion
76.0	76.2	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
76.2	76.4	Permeability, Water Erosion
76.4	76.5	Shallow Water Table, Water Erosion
76.5	76.7	Clayey, Permeability, pH, Water Erosion
76.7	77.3	Sandy, Permeability, pH, Sodic, Water Erosion
77.3	78.5	Clayey, Permeability, Water Erosion
78.5	79.3	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
79.3	79.6	Clayey, Permeability, pH, Water Erosion
79.6	80.0	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
80.0	80.7	Clayey, Permeability, pH, Water Erosion
80.7	82.9	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
82.9	83.1	Clayey, Permeability, pH, Water Erosion
83.1	84.1	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
84.1	84.3	Clayey, Permeability, pH, Water Erosion
84.3	86.3	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
86.3	86.4	Clayey, Permeability, Shallow Water Table, Water Erosion
86.4	86.5	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
86.5	86.8	Clayey, Permeability, Shallow Water Table, Water Erosion
86.8	87.0	Shallow Water Table, Water Erosion
87.0	87.4	Shallow Bedrock (Soft), Clayey, Permeability, Sodic, Water Erosion
87.4	87.5	Shallow Bedrock (Soft)

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
87.5	87.7	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
87.7	88.1	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
88.1	88.4	Clayey, Permeability, pH, Sodic, Water Erosion
88.4	88.6	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
88.6	89.6	Clayey, Permeability, pH, Sodic, Water Erosion
89.6	89.8	Clayey, Permeability, Water Erosion
89.8	89.9	Clayey, Permeability, pH, Sodic, Water Erosion
89.9	90.1	Clayey, Permeability, Water Erosion
90.1	90.3	Clayey, Permeability, pH, Sodic, Water Erosion
90.3	91.3	Clayey, Permeability, Water Erosion
91.3	91.3	Shallow Bedrock (Soft), Water Erosion
91.3	91.3	Clayey, Permeability, Water Erosion
91.3	91.4	Shallow Bedrock (Soft), Water Erosion
91.4	91.6	Clayey, Permeability, Water Erosion
91.6	91.6	Shallow Bedrock (Soft), Water Erosion
91.6	91.7	Clayey, Permeability, Water Erosion
91.7	91.7	Shallow Bedrock (Soft), Water Erosion
91.7	92.2	Clayey, Permeability, Water Erosion
92.2	92.8	Sandy, Water Erosion
92.8	93.2	Clayey, Permeability, Water Erosion
93.2	93.6	Sandy, Water Erosion
93.6	93.6	Clayey, Permeability, Water Erosion
93.6	93.7	Clayey, Permeability, pH, Sodic, Water Erosion
93.7	93.8	Sandy, Permeability, pH, Sodic, Water Erosion
93.8	93.9	Shallow Bedrock (Soft)
93.9	94.9	Sandy, Water Erosion
94.9	95.3	Sandy, Permeability, pH, Sodic, Water Erosion
95.3	95.4	Sandy, Water Erosion
95.4	95.4	Shallow Water Table, Water Erosion
95.4	95.4	Permeability
95.4	95.6	Shallow Water Table, Water Erosion
95.6	95.6	Sandy, Permeability, pH, Sodic, Water Erosion
95.6	95.6	Shallow Water Table, Water Erosion
95.6	96.0	Water Erosion
96.0	96.0	Shallow Bedrock (Soft), Water Erosion
96.0	96.1	Sandy, Water Erosion
96.1	96.1	Shallow Bedrock (Soft), Water Erosion
96.10	96.5	Sandy, Water Erosion

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
96.5	96.6	Sandy, Permeability, pH, Sodic, Water Erosion
96.6	96.9	Shallow Water Table, Water Erosion
96.9	97.2	Sandy, Water Erosion
97.2	97.5	Shallow Water Table, Water Erosion
97.5	97.7	Sandy, Water Erosion
97.7	97.7	Shallow Bedrock (Soft), Water Erosion
97.7	98.0	Sandy, Water Erosion
98.0	98.0	Shallow Bedrock (Soft), Water Erosion
98.0	98.2	Sandy, Water Erosion
98.2	98.2	Shallow Bedrock (Soft), Water Erosion
98.2	98.4	Sandy, Water Erosion
98.4	98.9	Shallow Bedrock (Soft), Water Erosion
98.9	99.1	Sandy, Water Erosion
99.1	99.1	Shallow Bedrock (Soft), Water Erosion
99.1	99.1	Sandy, Water Erosion
99.1	99.2	Shallow Bedrock (Soft), Water Erosion
99.2	99.4	Shallow Water Table, Water Erosion
99.4	99.4	Shallow Bedrock (Soft), Water Erosion
99.4	99.9	Sandy, Water Erosion
99.9	100.0	Water Erosion
100.0	100.0	Shallow Bedrock (Soft), Water Erosion
100.0	100.1	Water Erosion
100.1	100.7	Shallow Bedrock (Soft), Water Erosion
100.7	100.7	Sandy, Water Erosion
100.7	100.8	Shallow Bedrock (Soft), Water Erosion
100.8	101.2	Sandy, Water Erosion
101.2	101.3	Shallow Bedrock (Soft), Water Erosion
101.3	101.6	Sandy, Water Erosion
101.6	101.6	Shallow Bedrock (Soft), Permeability, Water Erosion
101.6	102.3	Sandy, Water Erosion
102.3	102.3	Shallow Bedrock (Soft), Water Erosion
102.3	102.6	Sandy, Water Erosion
102.9	102.9	Slope
103.3	103.6	Shallow Bedrock (Soft), Water Erosion
103.7	104.2	Clayey, Permeability, Water Erosion, Slope
104.2	104.3	Clayey, Permeability, Water Erosion
104.3	104.4	Sandy, Water Erosion
104.4	104.5	Clayey, Permeability, Water Erosion

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
104.5	104.9	Sandy, Water Erosion
104.9	104.9	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
104.9	105.0	Shallow Bedrock (Soft)
105.0	105.5	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
105.5	105.6	Clayey, Permeability, Water Erosion
105.6	106.1	Sandy, Water Erosion
106.1	108.0	Clayey, Permeability, Water Erosion
108.0	108.2	Sandy, Water Erosion
108.2	108.2	Clayey, Permeability, Water Erosion
108.2	109.1	Sandy, Water Erosion
109.1	109.4	Clayey, Permeability, Water Erosion
109.4	109.8	Sandy, Water Erosion
109.8	110.4	Clayey, Permeability, Water Erosion
110.4	110.5	Shallow Bedrock (Soft), Water Erosion
110.5	110.7	Clayey, Permeability, Water Erosion
110.7	110.9	Shallow Bedrock (Soft), Water Erosion
110.9	111.1	Clayey, Permeability, Water Erosion
111.1	111.1	Shallow Bedrock (Soft), Water Erosion
111.1	111.2	Clayey, Permeability, Water Erosion
111.2	111.3	Shallow Bedrock (Soft), Water Erosion
111.3	111.4	Clayey, Permeability, Water Erosion
111.4	111.7	Shallow Bedrock (Soft), Water Erosion
111.7	112.1	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
112.1	112.3	Shallow Bedrock (Soft), Water Erosion
112.3	113.2	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
113.2	113.3	Clayey, Permeability, pH, Water Erosion
113.3	113.5	Water Erosion
113.5	113.5	Clayey, Permeability, pH, Water Erosion
113.5	113.6	Water Erosion
113.6	113.7	Sandy, Water Erosion
113.7	114.0	Water Erosion
114.0	115.1	Clayey, Permeability, Water Erosion
115.1	116.4	Sandy, Water Erosion
116.4	116.4	Clayey, Permeability, Water Erosion
116.4	116.5	Sandy, Water Erosion
116.5	116.5	Clayey, Permeability, Water Erosion
116.5	116.6	Sandy, Water Erosion
116.6	117.2	Clayey, Permeability, Water Erosion

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
117.2	117.3	Clayey, Permeability, pH, Sodic, Water Erosion
117.3	117.7	Water Erosion
117.7	118.2	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
118.2	118.7	Shallow Bedrock (Hard), Sandy, Water Erosion
118.7	119.8	Sandy, Water Erosion
119.8	120.3	Shallow Bedrock (Soft), Water Erosion
120.3	120.4	Sandy, Water Erosion
120.4	120.9	Shallow Bedrock (Soft), Water Erosion
121.0	121.0	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
121.0	122.9	Shallow Bedrock (Soft), Water Erosion
122.9	123.3	Water Erosion
123.3	123.4	Sandy, Water Erosion
123.4	123.4	Shallow Bedrock (Soft), Water Erosion
123.4	123.6	Sandy, Water Erosion
123.6	123.8	Clayey, Permeability, Water Erosion
123.8	124.8	Shallow Bedrock (Soft), Water Erosion
124.8	125.3	Sandy, Water Erosion
125.3	127.6	Shallow Bedrock (Soft), Water Erosion
128.0	128.1	Sandy, Water Erosion
128.1	128.8	Water Erosion
128.8	128.9	Shallow Bedrock (Soft), Water Erosion
128.9	129.0	Sandy, Water Erosion
129.0	129.2	Shallow Bedrock (Soft), Water Erosion
129.2	129.3	Shallow Bedrock (Soft), Sandy, Water Erosion
129.3	130.7	Shallow Bedrock (Soft), Water Erosion
130.7	130.7	Water Erosion
130.7	131.1	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
131.1	132.3	Water Erosion
132.3	132.3	Clayey, Water Erosion
133.0	133.4	Water Erosion
133.4	134.0	Sandy
134.0	135.0	Water Erosion
135.0	135.8	Sandy
135.8	136.0	Water Erosion
136.0	136.1	Sandy
136.1	136.3	Water Erosion
136.3	136.6	Sandy
136.6	136.9	Water Erosion

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
136.9	137.1	Sandy
137.1	137.4	Water Erosion
137.4	137.6	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
137.6	137.9	Water Erosion
137.9	138.6	Sandy
138.6	138.8	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion, Slope
138.8	139.0	Water Erosion
139.0	139.0	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
139.0	139.5	Water Erosion
139.5	139.6	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion, Slope
139.6	139.7	Water Erosion, Slope
139.7	139.8	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion, Slope
139.8	140.1	Water Erosion
140.1	140.2	Clayey, Water Erosion
140.2	140.7	Water Erosion, Slope
140.7	140.7	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
140.7	141.4	Water Erosion
141.4	141.4	Shallow Water Table, Water Erosion
141.4	141.5	Water Erosion
141.5	141.6	Shallow Water Table, Water Erosion
141.6	141.9	Water Erosion
141.9	141.9	Shallow Water Table, Water Erosion
141.9	142.5	Water Erosion
142.5	142.6	Permeability, Water Erosion
142.6	142.6	Shallow Water Table, Water Erosion
142.6	142.7	Permeability, Water Erosion
142.7	142.8	Shallow Water Table, Water Erosion
142.8	142.8	Permeability, Water Erosion
142.8	142.9	Shallow Water Table, Water Erosion, Slope
142.9	143.2	Water Erosion
143.2	143.3	Shallow Water Table, Water Erosion
143.3	143.6	Water Erosion
143.6	143.7	Permeability, Water Erosion
143.7	144.1	Water Erosion
144.1	144.2	Shallow Water Table, Water Erosion
144.2	144.4	Water Erosion
144.4	144.5	Shallow Water Table, Water Erosion
144.5	144.7	Water Erosion

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
144.7	144.8	Shallow Water Table, Water Erosion
144.8	144.9	Water Erosion
144.9	145.1	Permeability, Water Erosion
145.1	145.2	Water Erosion
145.2	145.3	Sandy, Wind Erosion
145.3	145.4	Water Erosion
145.4	145.6	Shallow Water Table, Water Erosion, Slope
145.6	145.8	Water Erosion
145.8	146.2	Shallow Water Table, Water Erosion, Slope
146.2	146.6	Water Erosion
146.6	146.6	Shallow Water Table, Water Erosion
146.6	146.7	Water Erosion
146.7	146.7	Shallow Water Table, Water Erosion
146.7	146.8	Water Erosion
146.8	147.2	Shallow Water Table, Water Erosion, Slope
147.2	147.6	Water Erosion
147.6	147.8	Clayey, Water Erosion
147.8	148.4	Water Erosion
148.4	148.7	Clayey, Water Erosion
148.7	148.8	Shallow Water Table, Water Erosion
148.8	149.8	Water Erosion
149.8	149.8	Shallow Water Table, Water Erosion
149.8	149.9	Water Erosion
149.9	149.9	Shallow Water Table, Water Erosion
149.9	150.2	Water Erosion
150.2	150.5	Shallow Water Table, Water Erosion
150.5	151.0	Water Erosion
151.0	151.1	Shallow Water Table, Water Erosion
151.1	151.1	Water Erosion
151.1	151.4	Shallow Water Table, Water Erosion
151.4	151.9	Water Erosion
151.9	152.0	Shallow Water Table, Water Erosion
152.0	152.1	Water Erosion
152.1	152.3	Shallow Water Table, Water Erosion
152.3	152.4	Sandy
152.4	152.4	Shallow Water Table, Water Erosion
152.4	152.7	Sandy
152.7	152.7	Water Erosion

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
152.7	152.8	Sandy
152.8	153.2	Water Erosion
153.2	153.3	Shallow Water Table, Water Erosion
153.3	153.7	Water Erosion
153.7	153.8	Shallow Water Table, Water Erosion
153.8	156.7	Water Erosion
156.7	156.8	Sandy
156.8	157.4	Water Erosion
157.4	157.4	Sandy
157.4	157.9	Water Erosion
157.9	158.0	Sandy, Wind Erosion
158.0	158.0	Sandy
158.0	158.0	Sandy, Wind Erosion
158.0	158.1	Sandy
158.1	159.2	Water Erosion
159.2	159.2	Sandy, Wind Erosion
159.2	159.3	Water Erosion
159.3	159.4	Shallow Water Table, Water Erosion
159.4	159.5	Sandy
159.5	159.9	Water Erosion
159.9	160.1	Shallow Water Table, Water Erosion
160.1	161.2	Water Erosion
161.2	161.3	Shallow Water Table, Water Erosion
161.3	162.2	Water Erosion
162.2	162.3	Clayey, Permeability, Water Erosion
162.3	162.4	Sandy
162.4	162.5	Clayey, Permeability, Water Erosion
162.5	162.7	Shallow Water Table, Water Erosion
163.0	163.1	Shallow Bedrock (Soft), Sandy, Water Erosion
163.1	163.3	Water Erosion
163.3	163.4	Clayey, Permeability, Water Erosion
163.5	163.8	Shallow Water Table, Water Erosion
164.1	164.4	Clayey, Permeability, Water Erosion
164.5	165.1	Water Erosion
165.1	165.9	Shallow Bedrock (Soft), Clayey, Permeability, Water Erosion
172.5	172.5	Slope
177.8	178.2	Clayey, Permeability, Water Erosion
178.2	178.3	Sandy

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
178.3	179.1	Clayey, Permeability, Water Erosion
179.1	179.1	Shallow Water Table, Water Erosion
179.1	179.4	Clayey, Permeability, Water Erosion
179.4	180.4	Permeability, Water Erosion
180.4	180.4	Water Erosion
180.4	180.5	Permeability, Water Erosion
180.5	181.4	Water Erosion
181.4	181.4	Shallow Bedrock (Soft)
181.4	181.5	Water Erosion
181.5	181.7	Shallow Bedrock (Soft)
181.7	182.2	Water Erosion
182.2	182.5	Shallow Bedrock (Soft)
182.5	182.9	Water Erosion
182.9	183.1	Permeability, Water Erosion
183.1	183.2	Water Erosion
183.2	183.3	Permeability, Water Erosion
183.3	183.5	Water Erosion
183.5	183.6	Shallow Bedrock (Soft)
183.6	183.8	Water Erosion
183.8	184.0	Shallow Bedrock (Soft), Permeability, Water Erosion
184.0	184.6	Water Erosion
184.6	184.6	Shallow Bedrock (Soft), Permeability, Water Erosion
184.6	184.9	Water Erosion
184.9	185.1	Sandy
185.1	185.2	Water Erosion
185.2	185.2	Sandy
185.2	185.3	Water Erosion
185.3	185.7	Sandy
185.7	186.4	Shallow Bedrock (Soft), Permeability, Water Erosion
186.4	186.8	Water Erosion
186.8	186.9	Shallow Bedrock (Soft), Water Erosion
186.9	187.2	Shallow Bedrock (Soft), Permeability, Water Erosion
188.9	189.8	Clayey, Permeability, Water Erosion
189.8	190.0	Water Erosion
190.0	190.1	Sandy
190.1	190.3	Water Erosion
190.3	190.5	Shallow Bedrock (Soft)
190.5	190.6	Water Erosion

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
190.6	190.9	Permeability, Water Erosion
190.9	191.7	Water Erosion
191.7	191.8	Shallow Water Table, Water Erosion
191.8	191.9	Water Erosion
191.9	192.1	Sandy, Water Erosion
192.1	192.5	Water Erosion
192.5	192.6	Sandy, Water Erosion
192.6	192.6	Water Erosion
192.6	193.1	Sandy, Water Erosion
193.1	193.1	Water Erosion
193.1	193.3	Sandy, Water Erosion
193.3	193.3	Water Erosion
193.3	193.7	Sandy, Water Erosion
193.7	193.8	Permeability, Water Erosion
193.8	194.0	Sandy, Water Erosion
194.0	194.4	Sandy
194.4	194.6	Sandy, Water Erosion
194.6	194.8	Shallow Water Table, Water Erosion
194.8	195.7	Sandy
195.7	196.0	Water Erosion
196.0	196.2	Sandy
196.2	196.6	Water Erosion
196.6	196.7	Sandy
196.7	198.9	Water Erosion
198.9	199.4	Sandy, Shallow Water Table
199.4	199.7	Permeability, Water Erosion
199.7	200.0	Permeability, Water Erosion
200.0	200.1	Water Erosion
200.1	200.1	Permeability, Water Erosion
200.1	201.0	Clayey, Permeability, Water Erosion
201.0	201.0	Water Erosion
201.0	201.1	Clayey, Permeability, Water Erosion
201.1	201.3	Water Erosion
201.3	201.4	Sandy, Water Erosion
201.4	201.9	Water Erosion
201.9	202.0	Sandy, Water Erosion
202.0	202.0	Water Erosion
202.0	202.4	Sandy, Water Erosion

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
202.4	202.6	Shallow Water Table, Water Erosion
202.6	202.7	Sandy, Shallow Water Table
202.7	202.8	Shallow Water Table, Water Erosion
202.8	203.1	Sandy, Shallow Water Table
203.1	203.3	Clayey, Permeability, Water Erosion
203.3	203.5	Sandy
203.5	204.6	Water Erosion
204.6	204.9	Permeability, Water Erosion
204.9	205.2	Water Erosion
205.2	205.2	Sandy
205.2	205.3	Water Erosion
205.3	205.7	Sandy
205.7	205.8	Water Erosion
205.8	205.9	Shallow Water Table, Water Erosion
205.9	206.0	Sandy, Water Erosion
206.0	206.0	Sandy
206.0	206.1	Sandy, Water Erosion
206.1	206.3	Sandy
206.3	206.3	Water Erosion
206.3	206.8	Sandy
206.8	207.0	Water Erosion
207.0	207.1	Sandy
207.1	208.3	Water Erosion
208.3	208.4	Shallow Water Table, Water Erosion
208.4	211.2	Water Erosion
211.2	211.4	Sandy
211.4	211.4	Water Erosion
211.4	211.6	Sandy
211.6	211.7	Water Erosion
211.7	211.9	Permeability, Water Erosion
211.9	213.2	Water Erosion
213.2	213.5	Sandy
213.5	214.1	Water Erosion
214.1	214.2	Shallow Water Table, Water Erosion
214.2	215.5	Water Erosion
215.5	215.7	Sandy
215.7	215.7	Water Erosion
215.7	215.8	Sandy

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
215.8	215.9	Water Erosion
215.9	216.0	Shallow Bedrock (Soft), Permeability, Water Erosion
216.0	216.2	Water Erosion, Slope
216.2	216.3	Shallow Bedrock (Soft), Permeability, Water Erosion
216.3	217.0	Water Erosion
217.0	217.1	Permeability, Water Erosion
217.1	217.2	Water Erosion
217.2	217.3	Sandy
217.3	217.4	Water Erosion
217.4	217.6	Sandy
217.6	217.9	Water Erosion
217.9	218.0	Clayey, Permeability, Water Erosion
218.0	218.2	Water Erosion
218.2	218.3	Sandy, Shallow Water Table
218.3	218.5	Permeability, Water Erosion
218.5	218.7	Water Erosion
218.7	219.0	Sandy, Water Erosion
219.0	219.2	Sandy
219.2	219.3	Clayey, Permeability, Water Erosion
219.3	219.4	Sandy
219.4	219.6	Water Erosion
219.6	219.7	Sandy
219.7	219.8	Water Erosion
219.8	219.9	Sandy
219.9	220.1	Water Erosion
220.1	220.4	Sandy
220.4	220.5	Clayey, Permeability, Water Erosion
220.5	220.9	Water Erosion
220.9	221.0	Shallow Bedrock (Soft), Permeability, Water Erosion, Slope
221.0	221.0	Water Erosion
221.0	221.1	Sandy
221.1	221.1	Shallow Bedrock (Soft), Permeability, Water Erosion
221.1	221.2	Sandy
221.2	221.4	Shallow Bedrock (Soft), Permeability, Water Erosion
221.4	221.5	Sandy
221.5	221.6	Shallow Bedrock (Soft), Permeability, Water Erosion
221.6	221.6	Water Erosion
221.6	221.8	Sandy

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
221.8	221.8	Shallow Bedrock (Soft), Permeability, Water Erosion
221.8	221.8	Sandy
221.8	221.9	Shallow Bedrock (Soft), Permeability, Water Erosion
221.9	222.0	Sandy
222.0	222.2	Water Erosion
222.2	222.3	Shallow Bedrock (Soft), Permeability, Water Erosion
222.3	222.4	Water Erosion
222.5	222.6	Clayey, Permeability
222.6	222.8	Sandy
223.0	223.0	Clayey, Permeability
223.0	223.1	Sandy
223.1	223.1	Clayey, Permeability
223.1	224.2	Sandy
224.2	224.4	Clayey, Permeability
224.4	224.6	Shallow Bedrock (Soft), Clayey, Permeability
224.6	224.8	Sandy
224.8	224.8	Clayey, Permeability
224.8	224.9	Sandy
224.9	224.9	Permeability, Sodic, Water Erosion
224.9	225.1	Clayey, Permeability
225.1	225.3	Clayey
225.3	226.3	Clayey, Permeability
226.3	227.5	Shallow Bedrock (Soft), Clayey, Permeability, Slope
227.5	227.6	Shallow Bedrock (Soft), Clayey, Slope
227.6	227.7	Shallow Bedrock (Soft), Clayey, Permeability
227.7	227.8	Shallow Bedrock (Soft), Clayey
227.8	228.3	Shallow Bedrock (Soft), Clayey, Permeability
228.3	228.4	Clayey, Permeability
228.4	228.5	Shallow Bedrock (Soft), Clayey, Permeability
228.5	228.5	Clayey, Permeability
228.5	228.5	Shallow Bedrock (Soft), Clayey, Permeability
228.5	228.6	Clayey, Permeability
228.6	228.6	Sandy
228.6	228.7	Clayey, Permeability
228.7	228.7	Shallow Bedrock (Soft), Clayey, Permeability
228.7	228.9	Sandy
228.9	229.0	Clayey, Permeability
229.0	229.3	Sandy

Appendix C Sensitive Soils along the Greencore Project Route

From MP	To MP	Limiting Factor
229.3	229.9	Clayey, Permeability
229.9	230.0	Shallow Bedrock (Soft), Clayey, Permeability
230.0	230.1	Clayey, Permeability
230.1	230.6	Shallow Bedrock (Soft), Clayey, Permeability
230.6	230.8	Clayey, Permeability
230.8	230.9	Sandy
230.9	231.4	Clayey, Permeability
231.4	231.6	Shallow Bedrock (Soft), Clayey, Permeability

Appendix D
Greencore Project Waterbody and Wetland Crossings

Appendix D – Water Quality Classifications of Streams Within the Greencore Project Area

Classification	Description
Wyoming Surface Water Use Classification (WDEQ 2007)	
2AB	Class 2AB waters are those known to support game fish populations or spawning and nursery areas at least seasonally and all their perennial tributaries and adjacent wetlands and where a game fishery and drinking water use is otherwise attainable. Class 2AB waters include all permanent and seasonal game fisheries and can be either “cold water” or “warm water” depending upon the predominance of cold water or warm water species present. All Class 2AB waters are designated as cold water game fisheries unless identified as a warm water game fishery by a “ww” notation in the “Wyoming Surface Water Classification List”. Unless it is shown otherwise, these waters are presumed to have sufficient water quality and quantity to support drinking water supplies and are protected for that use. Class 2AB waters also are protected for nongame fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic value uses.
2C	Class 2C waters are those known to support or have the potential to support only nongame fish populations or spawning and nursery areas at least seasonally including their perennial tributaries and adjacent wetlands. Class 2C waters include all permanent and seasonal nongame fisheries and are considered “warm water”. Uses designated on Class 2C waters include nongame fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic value.
3B	Class 3B waters are tributary waters including adjacent wetlands that are not known to support fish populations or drinking water supplies and where those uses are not attainable. Class 3B waters are intermittent and ephemeral streams with sufficient hydrology to normally support and sustain communities of aquatic life including invertebrates, amphibians, or other flora and fauna that inhabit waters of the state at some stage of their life cycles. In general, 3B waters are characterized by frequent linear wetland occurrences or impoundments within or adjacent to the stream channel over its entire length. Such characteristics will be a primary indicator used in identifying Class 3B waters.
Wyoming Groundwater Use Classification (WDEQ 2005)	
I	Class I Groundwater is suitable for domestic use. The ambient quality of underground water of this suitability does not have a concentration in excess of any of the standards for Class I Groundwater of the State including TDS concentrations of less than 500 mg/L.
II	Class II Groundwater is suitable for agricultural use where soil conditions and other factors are adequate. The ambient quality of underground water of this suitability does not have a concentration in excess of any of the standards for Class II Groundwater of the State including TDS concentrations of less than 2000 mg/L.
III	Class III Groundwater is suitable for livestock. The ambient quality of underground water of this suitability does not have a concentration in excess of any of the standards for Class III Groundwater of the State including TDS concentrations of less than 5000 mg/L.
Montana Surface Water Use Classification (MDEQ 2006a)	
B-2	Waters classified B-2 are to be maintained suitable for drinking, culinary, and food processing purposes, after conventional treatment; bathing, swimming, and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.
Montana Groundwater Use Classification (MDEQ 2006b)	
I	Class I ground waters are those ground waters with a natural specific conductance less than or equal to 1,000 microSiemens/cm at 25ºC. The quality of Class I ground water must be maintained so that these waters are suitable with little or no treatment for the beneficial uses of public and private water supplies, culinary and food processing purposes, irrigation, drinking water for livestock and wildlife, and commercial and industrial purposes.
II	Class II ground waters are those ground waters with a natural specific conductance that is greater than 1,000 and less than or equal to 2,500 microSiemens/cm at 25ºC. The quality of Class II ground water must be maintained so that these waters are at least marginally suitable for the beneficial uses of public and private water supplies, culinary and food processing purposes, irrigation of some agricultural crops, drinking water for livestock and wildlife, and most commercial and industrial purposes.
III	Class III ground waters are those ground waters with a natural specific conductance that is greater than 2,500 and less than or equal to 15,000 microSiemens/cm at 25ºC. The quality of Class III ground water must be maintained so that these waters are at least marginally suitable for the beneficial uses of irrigation of some salt tolerant crops, some commercial and industrial purposes, drinking water for some livestock and wildlife, and drinking, culinary, and food processing purposes where the specific conductance is less than 7,000 microSiemens/cm at 25ºC.

Appendix D – Greencore Project Waterbody and Wetland Crossings

Location						Waterbody Identification				Disturbance		
County	HUC Subbasin	From (MP)	To (MP)	Latitude	Longitude	AECOM Feature ID	Type of Feature	Name[1]	Water Quality Classification[2]	Distance Directly Crossed by CL (feet)	Temporary ROW (acres)	Permanent ROW (acres)
Wyoming												
Fremont	Badwater, Wyoming	1.6	1.6	43.282725	-107.574782	S6AFR001	Intermittent	Sand Creek	3B	59.13	0.21	0.07
Fremont	Badwater, Wyoming	2.7	2.8	43.279224	-107.552595	S_UTM13_01404	Ephemeral			Adjacent	0.14	0.07
Fremont	Badwater, Wyoming	3.3	3.3	43.277878	-107.540920	S_UTM_01405	Ephemeral			10.95	0.03	0.02
Fremont	Badwater, Wyoming	3.5	3.5	43.277731	-107.537589	S_UTM_01407	Ephemeral			13.01	0.05	0.02
Fremont	Badwater, Wyoming	4.0	4.0	43.276788	-107.527916	S_UTM_01409	Ephemeral			20.40	0.05	0.02
Fremont	Badwater, Wyoming	4.4	4.5	43.275436	-107.519571	S1AFR003	Ephemeral			12.75	0.04	0.02
Natrona	Badwater, Wyoming	4.8	4.8	43.274771	-107.513195	S_UTM_01410	Ephemeral			Adjacent	0.01	0.00
Natrona	Badwater, Wyoming	5.0	5.0	43.274314	-107.509977	S1ANA001	Ephemeral			4.37	0.01	0.01
Natrona	Badwater, Wyoming	5.3	5.3	43.271597	-107.504276	S1ANA002	Ephemeral			5.22	0.01	0.01
Natrona	Badwater, Wyoming	5.7	5.7	43.270684	-107.496940	S1ANA003	Ephemeral			2.22	0.00	0.00
Natrona	Badwater, Wyoming	5.8	5.9	43.270319	-107.493701	S1ANA004	Intermittent	South Fork Sand Creek	3B	15.48	0.10	0.02
Natrona	Badwater, Wyoming	6.5	6.5	43.267221	-107.482254	S_UTM_01411	Ephemeral			17.09	0.04	0.02
Natrona	Badwater, Wyoming	7.8	7.8	43.263316	-107.456369	S1ANA005	Intermittent			6.09	0.01	0.01
Natrona	Badwater, Wyoming	7.9	8.0	43.262840	-107.453722	S1ANA006	Intermittent			7.46	0.03	0.01
Natrona	Badwater, Wyoming	8.4	8.5	43.261117	-107.443899	S_UTM_01412	Ephemeral			Adjacent	0.03	0.00
Natrona	Badwater, Wyoming	8.8	8.8	43.260533	-107.436709	S_UTM_01413	Ephemeral			18.28	0.04	0.02
Natrona	Badwater, Wyoming	9.7	9.7	43.405369	-106.899424	S1ANA007	Intermittent			6.06	0.02	0.01
Natrona	Badwater, Wyoming	9.8	9.8	43.257344	-107.417977	S1ANA008	Intermittent			5.98	0.02	0.01
Natrona	Badwater, Wyoming	10.5	10.6	43.254766	-107.404546	S2ANA010	Intermittent			14.87	0.09	0.02
Natrona	Badwater, Wyoming	10.7	10.7	43.254403	-107.402222	S2ANA001	Ephemeral			8.26	0.02	0.01
Natrona	Badwater, Wyoming	11.1	11.1	43.252835	-107.394044	S_UTM13_01418	Ephemeral			Adjacent	0.02	0.00
Natrona	Badwater, Wyoming	11.1	11.2	43.252648	-107.392369	S2ANA003	Ephemeral			20.13	0.09	0.02
Natrona	Badwater, Wyoming	11.7	11.7	43.250336	-107.381991	S2ANA004	Ephemeral			11.28	0.02	0.01
Natrona	Badwater, Wyoming	11.8	11.8	43.250588	-107.381188	S_UTM13_01419	Ephemeral			21.33	0.05	0.02
Natrona	Badwater, Wyoming	12.6	12.6	43.243614	-107.368057	S_UTM13_01420	Ephemeral			19.30	0.06	0.03
Natrona	Badwater, Wyoming	12.9	13.0	43.241270	-107.362723	S10NA001	Ephemeral			15.09	0.08	0.02
Natrona	Badwater, Wyoming	13.1	13.1	43.240056	-107.360402	S10NA002	Ephemeral			159.75	0.43	0.18
Natrona	Badwater, Wyoming	13.2	13.2	43.239289	-107.358957	S_UTM13_01421	Ephemeral			9.20	0.02	0.01
Natrona	Badwater, Wyoming	13.7	13.7	43.234172	-107.352498	S10NA003	Intermittent	Red Creek	3B	23.41	0.05	0.03
Natrona	Badwater, Wyoming	14.0	14.0	43.230788	-107.348362	S_UTM13_01422	Ephemeral			15.85	0.03	0.02
Natrona	Badwater, Wyoming	16.2	16.3	43.207021	-107.318065	S_UTM13_01423	Ephemeral			27.89	0.08	0.04
Natrona	Badwater, Wyoming	16.7	16.7	43.203433	-107.312342	S10NA004	Ephemeral			26.10	0.14	0.03
Natrona	Badwater, Wyoming	17.0	17.0	43.200378	-107.308026	S10NA005	Intermittent			22.97	0.09	0.03
Natrona	Badwater, Wyoming	17.4	17.4	43.196454	-107.302596	S_UTM13_01425	Ephemeral			10.99	0.03	0.01
Natrona	Badwater, Wyoming	17.5	17.5	43.195392	-107.301222	S_UTM13_01426	Ephemeral			18.99	0.04	0.02
Natrona	Badwater, Wyoming	17.5	17.5	43.194801	-107.300511	S_UTM13_01427	Ephemeral			14.16	0.03	0.02
Natrona	Badwater, Wyoming	17.5	17.6	43.194467	-107.300090	S_UTM13_01428	Ephemeral			16.69	0.03	0.02
Natrona	Badwater, Wyoming	18.0	18.0	43.190187	-107.293858	S_UTM13_01429	Ephemeral			27.40	0.06	0.03
Natrona	Badwater, Wyoming	18.2	18.2	43.188376	-107.291313	S6ANA007	Ephemeral			4.82	0.01	0.01

Appendix D – Greencore Project Waterbody and Wetland Crossings

Location						Waterbody Identification				Disturbance		
County	HUC Subbasin	From (MP)	To (MP)	Latitude	Longitude	AECOM Feature ID	Type of Feature	Name[1]	Water Quality Classification[2]	Distance Directly Crossed by CL (feet)	Temporary ROW (acres)	Permanent ROW (acres)
Natrona	Badwater, Wyoming	18.9	18.9	43.180412	-107.281496	S10NA006	Ephemeral			18.40	0.05	0.02
Natrona	Badwater, Wyoming	20.0	20.0	43.169299	-107.267754	S2aNA016	Ephemeral	Alkalie Creek	3B	10.48	0.03	0.01
Natrona	Badwater, Wyoming	20.7	20.8	43.161337	-107.257210	S1ANA009	Ephemeral			Adjacent	0.04	0.03
Natrona	Lower Wind, Wyoming	22.5	22.6	43.141067	-107.236357	W1ANA001	PEM			Adjacent	0.39	0.00
Natrona	South Fork Powder, Wyoming	26.2	26.2	43.099580	-107.192720	S_UTM13_01431	Ephemeral			23.04	0.05	0.03
Natrona	South Fork Powder, Wyoming	30.5	30.5	43.062825	-107.124995	W2ANA002	PEM			114.46	0.25	0.13
Natrona	South Fork Powder, Wyoming	32.3	32.3	43.050542	-107.095554	S2ANA017	Ephemeral			Adjacent	0.00	0.00
Natrona	South Fork Powder, Wyoming	32.4	32.6	43.048964	-107.091382	S2ANA018	Ephemeral			Adjacent	0.05	0.00
Natrona	South Fork Powder, Wyoming	32.8	32.8	43.047360	-107.086640	S1ANA013	Ephemeral			10.62	0.04	0.01
Natrona	South Fork Powder, Wyoming	32.9	32.9	43.046361	-107.084930	S1ANA012	Ephemeral			9.39	0.04	0.01
Natrona	South Fork Powder, Wyoming	35.3	35.3	43.038805	-107.045163	W1ANA002	PEM			Adjacent	0.00	0.00
Natrona	South Fork Powder, Wyoming	36.3	36.3	43.035668	-107.026413	S1ANA014	Ephemeral			10.58	0.04	0.01
Natrona	South Fork Powder, Wyoming	36.7	36.7	43.031382	-107.020193	W6ANA001	PEM		2C	86.09	0.15	0.09
Natrona	South Fork Powder, Wyoming	36.7	36.7	43.031423	-107.020217	S6ANA002	Perennial	South Fork Powder River	2C	23.75	0.04	0.02
Natrona	South Fork Powder, Wyoming	37.0	37.0	43.029184	-107.016561	S6ANA003	Intermittent			9.96	0.04	0.01
Natrona	South Fork Powder, Wyoming	37.7	37.7	43.025236	-107.003825	S1ANA016	Ephemeral			35.20	0.10	0.04
Natrona	Middle North Platte-Casper, Wyoming	43.7	43.7	43.032244	-106.891591	S_UTM13_01433	Ephemeral			24.94	0.05	0.03
Natrona	Middle North Platte-Casper, Wyoming	43.7	43.8	43.032640	-106.889729	S_UTM13_01434	Ephemeral			35.34	0.11	0.06
Natrona	Middle North Platte-Casper, Wyoming	45.4	45.5	43.033659	-106.855993	W1ANA003	PEM			Adjacent	0.29	0.00
Natrona	Middle North Platte-Caspe, Wyoming	46.8	46.8	43.039582	-106.832233	S2ANA019	Ephemeral			13.47	0.03	0.02
Natrona	Middle North Platte-Caspe, Wyoming	47.5	47.5	43.045823	-106.823222	W2ANA003	PEM			Adjacent	0.07	0.00
Natrona	Middle North Platte-Casper, Wyoming	49.9	49.9	43.068396	-106.788904	S_UTM13_01435	Ephemeral			24.90	0.07	0.03
Natrona	Middle North Platte-Casper, Wyoming	55.5	55.7	43.119891	-106.720793	S1ANA017	Ephemeral			Adjacent	0.10	0.02
Natrona	Middle North Platte-Casper, Wyoming	57.0	57.0	43.133972	-106.701635	S1ANA018	Ephemeral			11.43	0.04	0.01
Natrona	Middle North Platte-Casper, Wyoming	57.2	57.2	43.135880	-106.699162	S_UTM13_01436	Ephemeral			20.84	0.07	0.02
Natrona	Middle North Platte-Casper, Wyoming	57.5	57.5	43.138969	-106.694245	W1ANA004	PEM			30.30	0.09	0.03
Natrona	Middle North Platte-Casper, Wyoming	57.8	57.8	43.142114	-106.690291	S1ANA019	Ephemeral			6.18	0.02	0.01
Natrona	Middle North Platte-Casper, Wyoming	57.9	57.9	43.142865	-106.689129	S1ANA020	Ephemeral			5.02	0.02	0.01
Natrona	Middle North Platte-Casper, Wyoming	58.2	58.2	43.146021	-106.684011	S2ANA023	Ephemeral			4.12	0.02	0.01
Natrona	Middle North Platte-Casper, Wyoming	58.3	58.3	43.146960	-106.682458	S2ANA024	Ephemeral			1.02	0.00	0.00
Natrona	Middle North Platte-Casper, Wyoming	58.4	58.4	43.147811	-106.681086	S2ANA025	Ephemeral			2.11	0.01	0.00
Natrona	Middle North Platte-Casper, Wyoming	58.9	58.9	43.153335	-106.673832	S2ANA026	Ephemeral			2.09	0.01	0.00
Natrona	Middle North Platte-Casper, Wyoming	59.0	59.0	43.153588	-106.673128	S2ANA027	Ephemeral			26.17	0.08	0.03
Natrona	Middle North Platte-Casper, Wyoming	59.1	59.1	43.154719	-106.671081	S2ANA028	Ephemeral			38.69	0.07	0.04
Natrona	Middle North Platte-Casper, Wyoming	59.2	59.2	43.155804	-106.669522	S2ANA029	Ephemeral			86.12	0.11	0.05
Natrona	Middle North Platte-Casper, Wyoming	59.4	59.4	43.157486	-106.667118	S2ANA030	Ephemeral			4.10	0.01	0.01
Natrona	Middle North Platte-Casper, Wyoming	59.5	59.5	43.158844	-106.665601	S2ANA031	Ephemeral			17.47	0.07	0.02
Natrona	Middle North Platte-Casper, Wyoming	59.9	59.9	43.162197	-106.660062	S2ANA032	Ephemeral			3.06	0.01	0.00
Natrona	Middle North Platte-Casper, Wyoming	60.1	60.1	43.164450	-106.656302	S2ANA033	Ephemeral			7.86	0.02	0.01
Natrona	Middle North Platte-Casper, Wyoming	60.2	60.3	43.165355	-106.653478	S2ANA034	Ephemeral			37.48	0.06	0.03

Appendix D – Greencore Project Waterbody and Wetland Crossings

Location						Waterbody Identification				Disturbance		
County	HUC Subbasin	From (MP)	To (MP)	Latitude	Longitude	AECOM Feature ID	Type of Feature	Name[1]	Water Quality Classification[2]	Distance Directly Crossed by CL (feet)	Temporary ROW (acres)	Permanent ROW (acres)
Natrona	Salt, Wyoming	62.0	62.0	43.174281	-106.625094	S2ANA035	Intermittent			56.44	0.20	0.06
Natrona	Salt, Wyoming	62.5	62.5	43.181282	-106.620410	S2ANA036	Ephemeral			15.08	0.05	0.02
Natrona	Salt, Wyoming	65.8	65.8	43.222306	-106.587631	S2ANA037	Ephemeral	Trib Castle Creek	(not listed)[2]	5.90	0.01	0.01
Natrona	Salt, Wyoming	66.4	66.4	43.229510	-106.581405	S2ANA038	Ephemeral			3.44	0.01	0.00
Natrona	Salt, Wyoming	67.1	67.1	43.237856	-106.575252	S2ANA039	Ephemeral			9.12	0.03	0.01
Natrona	Salt, Wyoming	67.2	67.2	43.240142	-106.574134	S2ANA040	Ephemeral			10.63	0.03	0.01
Natrona	Salt, Wyoming	67.3	67.3	43.240982	-106.573985	S2ANO041	Ephemeral			19.01	0.05	0.02
Natrona	Salt, Wyoming	67.4	67.4	43.243121	-106.572853	S2ANA042	Ephemeral			7.08	0.02	0.01
Natrona	Salt, Wyoming	67.6	67.7	43.246078	-106.571487	S2ANA043	Ephemeral			18.25	0.05	0.02
Natrona	Salt, Wyoming	67.8	67.8	43.247480	-106.570638	S2ANA044	Ephemeral			7.42	0.02	0.01
Natrona	Salt, Wyoming	68.0	68.0	43.250704	-106.569263	S2ANA045	Ephemeral			4.37	0.01	0.00
Natrona	Salt, Wyoming	68.1	68.1	43.252144	-106.568708	S2ANA046	Ephemeral			17.80	0.03	0.01
Natrona	Salt, Wyoming	68.2	68.2	43.253262	-106.567880	S2ANA047	Ephemeral			6.74	0.02	0.01
Natrona	Salt, Wyoming	69.0	69.1	43.265285	-106.562462	S_UTM13_01438	Ephemeral			54.30	0.14	0.06
Natrona	Salt, Wyoming	69.7	69.7	43.273851	-106.558735	S1ANA024	Ephemeral			10.98	0.05	0.01
Natrona	Salt, Wyoming	70.1	70.1	43.279746	-106.556026	S1ANA023	Ephemeral			1.14	0.00	0.00
Natrona	Salt, Wyoming	70.2	70.2	43.281124	-106.555803	S1ANA022	Ephemeral			2.27	0.01	0.00
Natrona	Salt, Wyoming	70.6	70.6	43.286536	-106.553680	S_UTM13_01440	Ephemeral			47.09	0.20	0.05
Natrona	Salt, Wyoming	71.0	71.0	43.292194	-106.551517	S_UTM13_01442	Ephemeral			21.53	0.07	0.03
Natrona	South Fork Powder, Wyoming	72.4	72.4	43.310764	-106.540518	S1ANA026	Ephemeral			3.46	0.01	0.00
Natrona	South Fork Powder, Wyoming	72.8	72.8	43.315431	-106.537147	S1ANA027	Ephemeral			1.03	0.00	0.00
Natrona	South Fork Powder, Wyoming	73.7	73.7	43.327339	-106.528298	S1ANA028	Ephemeral			4.24	0.01	0.00
Natrona	South Fork Powder, Wyoming	74.1	74.1	43.332148	-106.524344	S1ANA029	Intermittent			16.39	0.05	0.02
Natrona	South Fork Powder, Wyoming	74.2	74.2	43.333236	-106.523931	S1ANA030	Ephemeral			2.77	0.01	0.00
Natrona	South Fork Powder, Wyoming	75.0	75.0	43.344447	-106.517485	S1ANA031	Ephemeral			58.72	0.05	0.01
Natrona	South Fork Powder, Wyoming	75.3	75.3	43.347827	-106.516571	S_UTM13_01444	Ephemeral			76.58	0.14	0.06
Natrona	South Fork Powder, Wyoming	76.5	76.5	43.365486	-106.514682	S1ANA025	Intermittent			20.89	0.07	0.04
Natrona	Salt, Wyoming	78.9	79.0	43.388222	-106.481972	S2ANA050	Intermittent			23.76	0.05	0.02
Natrona	Salt, Wyoming	79.2	79.4	43.392092	-106.477429	S2ANA049	Ephemeral	Government Creek	3B	58.25	0.59	0.13
Natrona	Salt, Wyoming	79.6	79.6	43.395937	-106.472803	S6ANA010	Intermittent	Government Creek	3B	23.08	0.06	0.03
Natrona	Salt, Wyoming	79.6	79.7	43.395769	-106.472852	W6ANA004	PEM		3B	237.28	0.47	0.27
Natrona	Salt, Wyoming	80.0	80.1	43.399962	-106.466180	S6ANA009	Intermittent			Adjacent	0.04	0.00
Natrona	Salt, Wyoming	80.1	80.1	43.399503	-106.467064	S6ANA008	Intermittent	Government Creek	3B	3.28	0.01	0.01
Natrona	Salt, Wyoming	80.1	80.1	43.400379	-106.466294	W6ANA003	PEM		3B	67.74	0.05	0.05
Natrona	Salt, Wyoming	80.7	80.8	43.408854	-106.462324	S2ANA048	Ephemeral	Government Creek	3B	2.31	0.01	0.00
Natrona	Salt, Wyoming	82.9	82.9	43.438143	-106.446546	S2ANA052	Intermittent	Lame Creek	(not listed)[2]	29.65	0.08	0.04
Natrona	Salt, Wyoming	83.2	83.2	43.441588	-106.445268	S2ANA053	Perennial	Scott Creek	(not listed)[2]	93.85	0.20	0.10
Natrona	Salt, Wyoming	83.5	83.5	43.445488	-106.442621	S2ANA054	Intermittent			3.05	0.02	0.00
Natrona	Salt, Wyoming	84.2	84.2	43.454505	-106.438014	S2ANA055	Intermittent			5.19	0.02	0.01
Natrona	Salt, Wyoming	84.3	84.3	43.456280	-106.436630	S2ANA056	Intermittent			4.87	0.01	0.01

Appendix D – Greencore Project Waterbody and Wetland Crossings

Location						Waterbody Identification				Disturbance		
County	HUC Subbasin	From (MP)	To (MP)	Latitude	Longitude	AECOM Feature ID	Type of Feature	Name[1]	Water Quality Classification[2]	Distance Directly Crossed by CL (feet)	Temporary ROW (acres)	Permanent ROW (acres)
Natrona	Salt, Wyoming	85.3	85.3	43.467950	-106.427532	S2ANA057	Intermittent			3.13	0.02	0.00
Natrona	Salt, Wyoming	85.4	85.4	43.468945	-106.425843	S2ANA051	Ephemeral			2.62	0.01	0.00
Natrona	Salt, Wyoming	87.0	87.0	43.485322	-106.405718	S1ANA021	Intermittent	Dug Out Creek	3B	14.95	0.05	0.02
Johnson	Salt, Wyoming	88.9	88.9	43.508633	-106.394730	S1AJO003	Ephemeral			5.37	0.01	0.01
Johnson	Salt, Wyoming	89.1	89.1	43.511639	-106.395767	S1AJO004	Ephemeral			14.17	0.03	0.01
Johnson	Salt, Wyoming	89.8	89.9	43.521294	-106.397140	S1AJO005	Ephemeral			6.40	0.02	0.01
Johnson	Salt, Wyoming	90.2	90.2	43.526602	-106.400218	S1AJO006	Intermittent			8.59	0.03	0.01
Johnson	Salt, Wyoming	93.7	93.8	43.565609	-106.374443	S1AJO008	Ephemeral			9.12	0.03	0.01
Johnson	Salt, Wyoming	93.9	93.9	43.567870	-106.373044	S1AJO009	Open Water			Adjacent	0.03	0.00
Johnson	Salt, Wyoming	95.3	95.4	43.579731	-106.352198	S_UTM13_01446	Ephemeral			43.40	0.11	0.04
Johnson	Salt, Wyoming	95.5	95.5	43.581166	-106.352254	S1AJO010	Perennial	Salt Creek	2C	45.39	0.14	0.05
Johnson	Salt, Wyoming	95.7	95.7	43.582812	-106.348250	S2AJO013	Ephemeral			10.96	0.03	0.01
Johnson	Salt, Wyoming	96.6	96.6	43.585844	-106.330778	S2AJO012	Perennial	Meadow Creek	2C	6.89	0.02	0.01
Johnson	Salt, Wyoming	96.7	97.5	43.586346	-106.323829	S2AJO006	Perennial	Meadow Creek	2C	10.53	0.05	0.01
Johnson	Salt, Wyoming	97.7	97.7	43.590174	-106.315170	S2AJO005	Ephemeral			2.92	0.01	0.00
Johnson	Salt, Wyoming	98.2	98.2	43.593372	-106.306379	S2AJO004	Ephemeral			Adjacent	0.00	0.00
Johnson	Salt, Wyoming	98.4	98.4	43.593740	-106.302669	S2AJO003	Ephemeral			3.96	0.00	0.00
Johnson	Salt, Wyoming	98.5	98.5	43.594077	-106.301309	S2AJO002	Ephemeral			4.15	0.01	0.00
Johnson	Salt, Wyoming	98.6	98.6	43.594656	-106.299003	S2AJO001	Ephemeral			10.40	0.03	0.01
Johnson	Salt, Wyoming	98.8	98.9	43.595047	-106.294819	S2AJO011	Ephemeral			4.04	0.01	0.00
Johnson	Salt, Wyoming	98.9	98.9	43.595244	-106.294431	S2AJO010	Ephemeral			1.08	0.00	0.00
Johnson	Salt, Wyoming	99.0	99.0	43.595526	-106.291481	S2AJO009	Ephemeral			4.02	0.01	0.00
Johnson	Salt, Wyoming	99.1	99.1	43.596487	-106.289719	S2AJO008	Ephemeral			4.19	0.01	0.00
Johnson	Salt, Wyoming	99.3	99.3	43.597786	-106.286136	W2AJO002	PEM			10.70	0.04	0.03
Johnson	Salt, Wyoming	99.4	99.4	43.597946	-106.285060	S2AJO007	Ephemeral			Adjacent	0.01	0.00
Johnson	Upper Powder, Wyoming	103.5	104.0	43.651764	-106.250321	S1AJO022	Perennial	Carpenter Draw	(not listed)[2]	Adjacent	0.08	0.00
Johnson	Upper Powder, Wyoming	104.1	104.1	43.655951	-106.246055	S1AJO021	Perennial	Carpenter Draw	(not listed)[2]	6.28	0.02	0.01
Johnson	Upper Powder, Wyoming	104.2	104.3	43.654001	-106.242700	S1AJO020	Intermittent			6.31	0.05	0.01
Johnson	Upper Powder, Wyoming	104.8	104.8	43.656558	-106.232364	S1AJO019	Intermittent			9.01	0.02	0.01
Johnson	Upper Powder, Wyoming	113.7	113.7	43.774468	-106.185126	S1AJO012	Perennial	Dry Fork Powder River	3B	17.38	0.05	0.02
Johnson	Upper Powder, Wyoming	117.2	117.2	43.823464	-106.167966	S2AJO022	Ephemeral	Fork Little Willow Creek		2.68	0.01	0.00
Johnson	Upper Powder, Wyoming	117.7	117.7	43.829697	-106.170117	S_UTM13_01447	Ephemeral			19.51	0.05	0.02
Johnson	Upper Powder, Wyoming	123.2	123.3	43.902402	-106.154722	S1AJO011	Intermittent	Willow Creek	(not listed)[2]	21.84	0.19	0.03
Johnson	Upper Powder, Wyoming	125.6	125.6	43.933534	-106.139922	S1AJO013	Ephemeral			4.21	0.01	0.00
Johnson	Upper Powder, Wyoming	132.3	132.3	44.019077	-106.130599	S2AJO024	Perennial	Pumpkin Creek	3B	20.52	0.05	0.02
Johnson	Upper Powder, Wyoming	132.9	133.0	44.026580	-106.125650	S2AJO025	Open Water			116.30	0.35	0.14
Johnson	Upper Powder, Wyoming	134.8	134.8	44.044604	-106.099037	S_UTM13_01449	Ephemeral			45.93	0.12	0.05
Johnson	Upper Powder, Wyoming	135.5	135.5	44.050843	-106.088274	S1AJO015	Ephemeral			3.01	0.01	0.00
Johnson	Upper Powder, Wyoming	136.0	136.0	44.054425	-106.081686	S_UTM13_01451	Ephemeral			33.89	0.07	0.04
Johnson	Upper Powder, Wyoming	138.8	138.8	44.082291	-106.040155	S_UTM13_01452	Ephemeral			20.41	0.06	0.02

Appendix D – Greencore Project Waterbody and Wetland Crossings

Location						Waterbody Identification				Disturbance		
County	HUC Subbasin	From (MP)	To (MP)	Latitude	Longitude	AECOM Feature ID	Type of Feature	Name[1]	Water Quality Classification[2]	Distance Directly Crossed by CL (feet)	Temporary ROW (acres)	Permanent ROW (acres)
Johnson	Upper Powder, Wyoming	139.1	139.1	44.083519	-106.035765	S1AJO016	Ephemeral			4.00	0.01	0.00
Johnson	Upper Powder, Wyoming	139.8	139.8	44.088999	-106.023929	S1AJO017	Ephemeral			7.30	0.01	0.01
Johnson	Upper Powder, Wyoming	139.8	139.8	44.088022	-106.023374	S8ACA005	Ephemeral			3.61	0.01	0.00
Johnson	Upper Powder, Wyoming	140.1	140.1	44.091936	-106.020299	S1AJO018	Perennial	Beaver Creek	3B	6.50	0.01	0.01
Campbell	Upper Powder, Wyoming	144.8	144.8	44.141660	-105.967299	S2ACA006	Intermittent			35.51	0.06	0.04
Campbell	Upper Powder, Wyoming	145.9	145.9	44.151155	-105.948075	S8ACA004	Ephemeral			3.29	0.01	0.00
Campbell	Upper Powder, Wyoming	147.0	147.1	44.160385	-105.932108	S2ACA007	Perennial	South Draw	(not listed)[2]	5.86	0.05	0.01
Campbell	Upper Powder, Wyoming	147.7	147.8	44.166231	-105.918783	S8ACA003	Intermittent	Deadhorse Creek	3B	19.18	0.05	0.02
Campbell	Upper Powder, Wyoming	148.5	148.6	44.175320	-105.910748	S8ACA001	Perennial	North Prong Deadhorse Creek	3B	17.45	0.04	0.02
Campbell	Upper Powder, Wyoming	149.1	149.1	44.181794	-105.907426	S3ACA004	Ephemeral			4.38	0.01	0.00
Campbell	Upper Powder, Wyoming	149.4	149.4	44.182952	-105.902425	S3ACA003	Ephemeral			3.97	0.01	0.00
Campbell	Upper Powder, Wyoming	150.0	150.0	44.188542	-105.894017	S_UTM13_00630	Ephemeral			67.68	0.16	0.08
Campbell	Upper Powder, Wyoming	150.4	150.4	44.193177	-105.889122	S_UTM13_00632	Ephemeral			32.88	0.06	0.04
Campbell	Upper Powder, Wyoming	151.0	151.1	44.200691	-105.881040	S_UTM13_00634	Ephemeral			37.39	0.10	0.04
Campbell	Upper Powder, Wyoming	151.3	151.4	44.202527	-105.877703	S3ACA002	Ephemeral			6.75	0.03	0.01
Campbell	Upper Powder, Wyoming	152.2	152.2	44.213723	-105.866408	S_UTM13_00638	Intermittent			230.23	0.54	0.26
Campbell	Upper Powder, Wyoming	160.0	160.0	44.290950	-105.781960	S6ACA009	Perennial	Kingsbury Creek	3B	21.70	0.07	0.03
Campbell	Upper Powder, Wyoming	161.4	161.4	44.299309	-105.759153	S6ACA007	Perennial	Wild Horse Creek	3B	25.11	0.06	0.03
Campbell	Upper Powder, Wyoming	162.1	162.1	44.304724	-105.750355	S6ACA006	Intermittent			6.57	0.02	0.01
Campbell	Upper Powder, Wyoming	162.6	162.7	44.308589	-105.742156	S_UTM13_00668	Ephemeral			68.62	0.34	0.10
Campbell	Upper Powder, Wyoming	163.8	163.8	44.318781	-105.724224	W4ACA001	PEM			38.63	0.04	0.04
Campbell	Upper Powder, Wyoming	165.7	165.8	44.345140	-105.714913	S8ACA006	Intermittent	Hay Creek	(not listed)[2]	18.12	0.11	0.02
Campbell	Little Powder, Montana, Wyoming	167.5	167.6	44.365267	-105.692487	S3ACA011	Intermittent			16.96	0.03	0.02
Campbell	Little Powder, Montana, Wyoming	168.5	168.5	44.374782	-105.681341	S_UTM13_01455	Ephemeral			20.17	0.06	0.02
Campbell	Little Powder, Montana, Wyoming	169.3	169.3	44.386674	-105.679728	W3ACA001	PEM			84.70	0.19	0.10
Campbell	Little Powder, Montana, Wyoming	169.4	169.4	44.387843	-105.678559	S_UTM13_00692	Ephemeral			10.30	0.04	0.01
Campbell	Little Powder, Montana, Wyoming	170.4	170.4	44.401447	-105.672952	S3ACA012	Intermittent	Road Prong	(not listed)[2]	8.94	0.03	0.01
Campbell	Little Powder, Montana, Wyoming	171.4	171.4	44.415643	-105.670159	S3ACA013	Ephemeral	9 T-Bar Creek	(not listed)[2]	3.49	0.01	0.00
Campbell	Little Powder, Montana, Wyoming	171.6	171.6	44.418544	-105.669693	S_UTM13_00704	Ephemeral			17.18	0.05	0.02
Campbell	Little Powder, Montana, Wyoming	171.9	171.9	44.422756	-105.668792	S_UTM13_00706	Ephemeral			23.38	0.07	0.02
Campbell	Little Powder, Montana, Wyoming	174.8	174.9	44.463528	-105.666077	S4ACA012	Ephemeral			5.41	0.05	0.01
Campbell	Little Powder, Montana, Wyoming	175.5	175.6	44.472992	-105.661613	S4ACA013	Ephemeral			19.21	0.02	0.01
Campbell	Little Powder, Montana, Wyoming	175.9	175.9	44.477677	-105.658098	S4ACA014	Perennial	Road Creek	(not listed)[2]	8.22	0.02	0.01
Campbell	Little Powder, Montana, Wyoming	176.6	176.6	44.485893	-105.651545	S_UTM13_01457	Ephemeral			97.39	0.22	0.11
Campbell	Little Powder, Montana, Wyoming	179.1	179.2	44.515615	-105.626641	S3Aca005	Intermittent			45.90	0.12	0.05
Campbell	Little Powder, Montana, Wyoming	181.3	181.3	44.537628	-105.599786	S4ACA003	Intermittent			92.52	0.24	0.10
Campbell	Little Powder, Montana, Wyoming	181.4	181.4	44.538501	-105.596860	S_UTM13_01049	Ephemeral			Adjacent	0.07	0.00
Campbell	Little Powder, Montana, Wyoming	183.3	183.3	44.547368	-105.563308	S4ACA011	Ephemeral	Calf Creek	(not listed)[2]	36.38	0.03	0.02
Campbell	Little Powder, Montana, Wyoming	184.2	184.2	44.545008	-105.544951	S3ACA006	Ephemeral			6.15	0.02	0.01
Campbell	Little Powder, Montana, Wyoming	186.6	186.6	44.559072	-105.506762	S3ACA010	Ephemeral	Boxelder Creek	(not listed)[2]	15.29	0.07	0.02

Appendix D – Greencore Project Waterbody and Wetland Crossings

Location						Waterbody Identification				Disturbance		
County	HUC Subbasin	From (MP)	To (MP)	Latitude	Longitude	AECOM Feature ID	Type of Feature	Name[1]	Water Quality Classification[2]	Distance Directly Crossed by CL (feet)	Temporary ROW (acres)	Permanent ROW (acres)
Campbell	Little Powder, Montana, Wyoming	186.7	186.7	44.560067	-105.506652	S3ACA009	Ephemeral			12.16	0.04	0.01
Campbell	Little Powder, Montana, Wyoming	186.9	186.9	44.563117	-105.505877	S3ACA008	Ephemeral			12.27	0.04	0.01
Campbell	Little Powder, Montana, Wyoming	187.0	187.0	44.564029	-105.505002	S3ACA007	Ephemeral			13.49	0.04	0.02
Campbell	Little Powder, Montana, Wyoming	187.3	187.4	44.569229	-105.502610	S_UTM13_01458	Ephemeral			35.20	0.11	0.03
Campbell	Little Powder, Montana, Wyoming	187.8	187.9	44.576108	-105.502008	S4ACA007	Ephemeral	Boxelder Creek	(not listed)[2]	52.21	0.06	0.02
Campbell	Little Powder, Montana, Wyoming	187.9	188.0	44.577583	-105.501788	S4ACA008	Ephemeral	Boxelder Creek	(not listed)[2]	32.70	0.05	0.02
Campbell	Little Powder, Montana, Wyoming	188.1	188.1	44.578999	-105.500688	S4ACA009	Ephemeral			Adjacent	0.06	0.00
Campbell	Little Powder, Montana, Wyoming	188.3	188.5	44.584520	-105.498734	S4ACA010	Ephemeral	Boxelder Creek	(not listed)[2]	43.57	0.09	0.02
Campbell	Little Powder, Montana, Wyoming	189.4	189.4	44.597538	-105.494820	S_UTM13_00759	Ephemeral			29.81	0.09	0.04
Campbell	Little Powder, Montana, Wyoming	189.9	189.9	44.604250	-105.491088	S5ACA001	Intermittent	Boxelder Creek	(not listed)[2]	37.61	0.04	0.03
Campbell	Little Powder, Montana, Wyoming	190.0	190.0	44.605633	-105.489226	S_UTM13_01459	Intermittent	Boxelder Creek	(not listed)[2]	31.62	0.10	0.04
Campbell	Little Powder, Montana, Wyoming	191.2	191.3	44.621801	-105.482091	W5ACA001	PEM			162.06	0.28	0.18
Campbell	Little Powder, Montana, Wyoming	191.9	191.9	44.630448	-105.477238	S5ACA002	Intermittent	Wildcat Creek	3B	25.28	0.05	0.03
Campbell	Little Powder, Montana, Wyoming	193.4	193.4	44.648427	-105.459779	S_UTM13_00771	Ephemeral			21.10	0.05	0.02
Campbell	Little Powder, Montana, Wyoming	194.7	194.7	44.663910	-105.444406	S5ACA003	Intermittent	Wildcat Creek	(not listed)[2]	15.95	0.03	0.02
Campbell	Little Powder, Montana, Wyoming	195.4	195.4	44.672542	-105.438610	S4ACA005	Intermittent	Trib Wildcat Creek	(not listed)[2]	11.33	0.10	0.01
Campbell	Little Powder, Montana, Wyoming	196.0	196.1	44.680653	-105.433175	S4ACA004	Ephemeral	Trib Wildcat Creek	(not listed)[2]	3.03	0.01	0.00
Campbell	Little Powder, Montana, Wyoming	196.8	196.8	44.690456	-105.425721	S_UTM13_00783	Ephemeral			26.95	0.08	0.03
Campbell	Little Powder, Montana, Wyoming	197.0	197.0	44.692845	-105.423975	S_UTM13_00785	Ephemeral			14.98	0.04	0.02
Campbell	Little Powder, Montana, Wyoming	199.3	199.4	44.721224	-105.399724	S2ACA004	Perennial	Horse Creek	3B	75.96	0.22	0.09
Campbell	Little Powder, Montana, Wyoming	200.1	200.1	44.731171	-105.393655	S2ACA003	Ephemeral			3.52	0.01	0.00
Campbell	Little Powder, Montana, Wyoming	203.1	203.1	44.762985	-105.358663	S6ACA005	Perennial	Little Powder River	2AB	25.36	0.05	0.03
Campbell	Little Powder, Montana, Wyoming	205.5	205.5	44.788527	-105.323650	S1ACA001	Intermittent			8.00	0.02	0.01
Campbell	Little Powder, Montana, Wyoming	208.4	208.4	44.822458	-105.296691	S1ACA003	Open Water			10.73	0.03	0.01
Campbell	Little Powder, Montana, Wyoming	212.0	212.1	44.868371	-105.268465	S_UTM13_00826	Ephemeral			29.24	0.08	0.03
Campbell	Little Powder, Montana, Wyoming	212.1	212.2	44.869632	-105.267617	S_UTM13_00828	Ephemeral			38.41	0.09	0.04
Campbell	Little Powder, Montana, Wyoming	212.6	212.6	44.876427	-105.263295	S_UTM13_00830	Ephemeral			Adjacent	0.00	0.00
Campbell	Little Powder, Montana, Wyoming	213.0	213.1	44.881377	-105.259152	S_UTM13_00832	Ephemeral			141.54	0.28	0.15
Campbell	Little Powder, Montana, Wyoming	214.2	214.2	44.896130	-105.248146	S8ACA008	Intermittent	Dry Creek	3B	14.66	0.05	0.02
Campbell	Little Powder, Montana, Wyoming	214.4	214.4	44.898762	-105.246654	S8ACA007	Intermittent			15.24	0.05	0.02
Campbell	Little Powder, Montana, Wyoming	215.2	215.2	44.908880	-105.242151	S_UTM13_01462	Ephemeral			32.02	0.08	0.04
Campbell	Little Powder, Montana, Wyoming	218.3	218.3	44.949394	-105.214597	S2ACA001	Perennial	Trail Creek	3B	113.97	0.29	0.13
Campbell	Little Powder, Montana, Wyoming	218.7	218.8	44.954286	-105.210872	W2ACA001	PEM			72.68	0.27	0.08
Campbell	Little Powder, Montana, Wyoming	218.9	219.0	44.955769	-105.206769	W6ACA002	PEM			325.27	1.05	0.36
Campbell	Little Powder, Montana, Wyoming	219.0	219.0	44.956872	-105.205235	W6ACA001	PEM			Adjacent	0.16	0.00
Campbell	Little Powder, Montana, Wyoming	219.5	219.5	44.962048	-105.198702	S_UTM13_01464	Ephemeral			20.19	0.08	0.03
Campbell	Little Powder, Montana, Wyoming	220.1	220.1	44.968718	-105.190208	S6ACA004	Ephemeral			3.36	0.01	0.00
Campbell	Little Powder, Montana, Wyoming	221.3	221.3	44.984207	-105.181932	S6ACA003	Intermittent			24.23	0.08	0.03
Campbell	Little Powder, Montana, Wyoming	221.5	221.5	44.987656	-105.182039	S6ACA002	Intermittent			6.56	0.02	0.01
Campbell	Little Powder, Montana, Wyoming	222.2	222.3	44.996615	-105.177698	S6ACA001	Intermittent			3.82	0.02	0.01

Appendix D – Greencore Project Waterbody and Wetland Crossings

Location						Waterbody Identification				Disturbance		
County	HUC Subbasin	From (MP)	To (MP)	Latitude	Longitude	AECOM Feature ID	Type of Feature	Name[1]	Water Quality Classification[2]	Distance Directly Crossed by CL (feet)	Temporary ROW (acres)	Permanent ROW (acres)
Montana												
Powder River	Little Powder, Montana, Wyoming	225.2	225.3	45.035299	-105.150311	S2APR001	Perennial	Ranch Creek	B-2	47.31	0.11	0.05
Powder River	Little Powder, Montana, Wyoming	231.5	231.5	45.111695	-105.088656	S1APR001	Perennial	Bell Creek	B-2	10.27	0.04	0.01

[1]Blank entries indicate waterbodies that are unnamed or whose names are unknown.

[2]The classification list does not contain an exhaustive listing of all the surface waters in the state. Those waters that are not specifically listed are classified as follows:

Those waters supported by an approved UAA containing defensible reasons for not protecting aquatic life uses shall be 4A, 4B or 4C;

The remaining waters shall be 3A, 3B or 3C.

Appendix E
Special Status Species Identified for the Greencore Project

Appendix E Special Status Species Identified for the Greencore Project

Common Name	Scientific Name	Status[1]	Habitat Association	Potential for Occurrence Within the Project Area	Eliminated From Detailed Analysis (Yes/No)	References
Mammals						
Black-footed ferret	*Mustela nigripes*	FE	This species inhabits prairie dog colonies within semi-arid grasslands and mountain basins. Primarily a nocturnal species that is solitary except during the breeding season. The only known populations are in captivity or have been reintroduced. Efforts are being made throughout the Great Plains, western U.S., and Mexico to reintroduce this species into suitable habitats.	None. The USFWS has block-cleared all black-tailed prairie dog colonies as well as white-tailed prairie dog colonies along the Project route in Wyoming. Black-tailed prairie dog colonies of suitable size do not occur along the Montana portion of the Project route. The nearest re-introduced population is approximately 75 miles southeast of the Project ROW in the Shirley Basin, Wyoming.	No. Due to the Project route occurring entirely within USFWS block-cleared areas in Wyoming, the lack of suitable habitat crossed in Montana, and the large geographic distance to the nearest reintroduced population. However, prairie dog colonies along the Project route may be used for potential future re-introduction sites.	BLM 2007a; Fitzgerald et al. 1994; HWA 2009; USFWS 2004.
White-tailed prairie dog	*Cynomys leucurus*	BLM	Colonies of this species occur primarily in mountain basins, semi-desert grasslands, and open shrublands. This species is typically distributed in relatively large, sparsely populated complexes and live in loosely knit clans.	High. This species occurs along the Project route in Wyoming. Surveys documented 6 active colonies crossed by the Project ROW.	No.	AECOM 2010c; BLM 2007a; Fitzgerald et al. 1994; HWA 2009; WGFD 2005.
Black-tailed prairie dog	*Cynomys ludovicianus*	BLM	This species inhabits short-grass and mixed-grass prairies throughout the Great Plains and west-central U.S. Areas with sparse vegetation and suitable soils for burrowing are most commonly used by this species.	High. This species occurs along the Project. Surveys documented 11 active and 1 inactive colonies crossed by the Project ROW.	No.	BLM 2007a; Fitzgerald et al. 1994; HWA 2009; WGFD 2005.
Preble's meadow jumping mouse	*Zapus hudsonius preblei*	BLM	This subspecies occurs in habitats consisting of well-developed plains riparian vegetation with dense herbaceous vegetation that include of a variety of grasses, forbs, and thick shrubs in close proximity to water. Suitable habitat can occur along stream channels, vegetated irrigation canals, ditches, and riparian and wetland areas (including native wet meadows).	None. This species is not known to occur in counties crossed by the Project route. The nearest habitat is located approximately 100 miles southeast of the Project route in Converse County.	Yes. Project is outside the known range and distribution of this species in Wyoming.	BLM 2007a; Fitzgerald et al. 1994.
Pygmy rabbit	*Brachylagus idahoensis*	BLM	This species requires dense sagebrush for cover as well as appropriate deep soils for burrowing (i.e., high clay content). Often found in drainages with taller sagebrush present.	None. This species is not known to occur along the Project route.	Yes. Project is outside the known range and distribution of this species in Wyoming.	BLM 2004; WGFD 2005.

Appendix E Special Status Species Identified for the Greencore Project

Common Name	Scientific Name	Status[1]	Habitat Association	Potential for Occurrence Within the Project Area	Eliminated From Detailed Analysis (Yes/No)	References
Swift fox	*Vulpes velox*	BLM	The swift fox inhabits short-grass and mid-grass prairie and may be associated with prairie dog colonies. Dens typically occur on small hills and ridges.	High. This species may occur in suitable habitats along the Project route.	No.	BLM 2007a; Fitzgerald et al. 1994; WGFD 2005.
Townsend's big-eared bat	*Corynorhinus townsendii*	BLM	This species occupies semi-desert shrublands, pinyon-juniper woodlands, and open montane forests. It is frequently associated with caves and abandoned mines but will also utilize abandoned buildings and rock crevices for refuge.	High. Suitable roosting and foraging habitat occurs along the Project route.	No.	BLM 2007a; Fitzgerald et al. 1994; WGFD 2005.
Spotted bat	*Euderma maculatum*	BLM	The spotted bat is known to occur in montane forests, pinyon-juniper woodlands, and open semi-desert shrublands. This species occupies ponderosa pine forests during the breeding season and lower elevations during other times of the year.	High. Suitable roosting and foraging habitat occurs along the Project route.	No.	Fitzgerald et al. 1994; WGFD 2005.
Long-eared myotis	*Myotis evotis*	BLM	This species occupies coniferous forest. It is most common in ponderosa pine woodlands but also occurs in pinyon-juniper woodlands and subalpine forests.	High. Suitable roosting and foraging habitat occurs along the Project route.	No.	BLM 2007a; Fitzgerald et al. 1994; WGFD 2005.
Fringed myotis	*Myotis thysanodes*	BLM	This species is known to occur in a wide range of habitats from low desert scrub to high elevation spruce-fir forests. The fringed myotis typically roosts in caves, mines, and buildings. Water courses and lowland riparian areas are very important to this species.	High. Suitable roosting and foraging habitat occurs along the Project route.	No.	BLM 2007a; Fitzgerald et al. 1994; WGFD 2005.
Birds						
Bald eagle	*Haliaeetus leucocephalus*	BLM	This species typically occurs near large perennial waterbodies that support suitable roosting and foraging habitat. Nests are commonly built in large cottonwoods or conifers along lakes or rivers. During the winter, this species tends to concentrate in areas with abundant food sources such as wounded waterfowl, carrion, and fish.	High. Three active nests have been identified within 1-mile of the Project ROW in Wyoming. No nests were documented within 1-mile of the Project ROW in Montana. One winter roost site was located in January 2010 along the Powder River.	No.	AECOM 2010a; BLM 2007a; Johnsgard 1990; WGFD 2005.

Appendix E Special Status Species Identified for the Greencore Project

Common Name	Scientific Name	Status[1]	Habitat Association	Potential for Occurrence Within the Project Area	Eliminated From Detailed Analysis (Yes/No)	References
Ferruginous hawk	*Buteo regalis*	BLM	This species occurs in open semi-arid habitats including basin-prairie shrubland, mountain-foothills, and badlands. Nest sites include short trees, ledges, and rock outcrops in sagebrush valleys and rolling grassland habitat.	High. No active nests have been identified within 1-mile of the Project ROW. Suitable nesting and foraging habitat occurs along the entire Project route.	No.	AECOM 2010b; BLM 2007a; Johnsgard 1990; WGFD 2005.
Northern goshawk	*Accipiter gentilis*	BLM	This species occupies mature, close-canopied coniferous and aspen forests. The northern goshawk typically selects open, older-aged class coniferous forests and aspen stands for nesting.	None. This species is not known to occur in central and eastern Wyoming or in southeast Montana. Habitats typically associated with this species do not occur along the Project route.	Yes. Occurrence would be limited to migrating or dispersing individuals.	BLM 2007a; Johnsgard 1990.
Burrowing owl	*Athene cunicularia hypugea*	BLM	This species is found in non-riparian habitats including abandoned burrows of prairie dogs, ground squirrels, foxes, and badgers in grassland and open shrubland communities.	High. This species is known to nest within suitable habitats along the Project route.	No.	AECOM 2010c; BLM 2007a; HWA 2010; Johnsgard 1988; WGFD 2005.
Peregrine falcon	*Falco peregrinus*	BLM	This species typically breeds in foothills and mountain areas. Nest sites are often located on ledges of high, steep-walled cliffs. Preferred foraging habitat includes marshes, lakes, rivers, and wet meadows.	None. Suitable nesting habitat does not occur along the Project route.	Yes. Occurrence would be limited to migrating or dispersing individuals.	BLM 2007a; Johnsgard 1990.
Greater sage-grouse	*Centrocercus urophasianus*	FC; BLM	This species inhabits sagebrush shrublands and grasslands. Breeding grounds (leks) are generally located in open areas such as broad ridges, grassy areas, and disturbed sites, adjacent to suitable nesting habitat. Most nesting occurs in sagebrush stands with adequate canopy cover and an understory of forbs and grasses. Winter habitat typically consists of south- and east-facing slopes with minimal snow cover.	High. This species is known to occur within suitable sagebrush habitat along the Project route. Sixty-nine leks (all occupied) are within 4 miles of the Project ROW. In addition, the Project ROW crosses 215 miles of suitable nesting habitat.	No.	AECOM 2010c; BLM 2007a; Connelly et al. 2004, 2000; WGFD 2009, 2005.
Brewer's sparrow	*Spizella breweri*	BLM	This species typically occurs in basin-prairie and mountain-foothills shrublands, especially sagebrush and woodland chaparral. Nests typically occur in shrubs.	High. This species is known to occupy suitable habitats along the Project route.	No.	BLM 2007a; WGFD 2005.

Appendix E Special Status Species Identified for the Greencore Project

Common Name	Scientific Name	Status[1]	Habitat Association	Potential for Occurrence Within the Project Area	Eliminated From Detailed Analysis (Yes/No)	References
Loggerhead shrike	*Lanius ludovicianus*	BLM	The loggerhead shrike typically inhabits open riparian areas, agricultural areas, grasslands, and shrublands (especially semi-desert shrublands). Nest sites usually occur in isolated trees or large shrubs.	High. This species is known to occupy suitable habitats along the Project route.	No.	BLM 2007a; WGFD 2005.
Sage sparrow	*Amphispiza belli*	BLM	This species inhabits basin-prairie and mountain-foothills shrublands. Nesting typically occurs in or beneath sagebrush.	High. This species is known to occupy suitable habitats along the Project route.	No.	BLM 2007a; WGFD 2005.
Sage thrasher	*Oreoscoptes montanus*	BLM	This species inhabits basin-prairie and mountain-foothills shrublands. Nesting typically occurs in or beneath sagebrush.	High. This species is known to occupy suitable habitats along the Project route.	No.	BLM 2007a; WGFD 2005.
Baird's sparrow	*Ammodramus bairdii*	BLM	This species inhabits grasslands, and fallow weedy fields.	Low. This species is uncommon during the summer months along the Project route. Very few breeding records exist in the vicinity of the Project route.	Yes. Occurrence would be limited to migrating individuals.	BLM 2007a.
Long-billed curlew	*Numenius americanus*	BLM	This species typically inhabits grasslands and wet meadows.	High. This species is known to occupy suitable habitats along the Project route.	No.	BLM 2007a; MFWP 2010h; WGFD 2005.
Mountain plover	*Charadrius montanus*	FP; BLM	This species inhabits flat, short-grass prairie in areas recently burned, overgrazed by livestock, or occupied by prairie dog colonies.	High. This species is a late spring/summer resident along the Project route. 2.9 miles of suitable nesting habitat occurs along portions of the Project route.	No.	BLM 2007a; HWA 2009, 2010.
White-faced ibis	*Plegadis chihi*	BLM	The white-faced ibis inhabits marshes, wetlands, wet meadows, and streams. Nesting habitat usually consists of dense vegetated islands surrounded by water >18" in depth.	None. This species is not known to nest along the Project route.	Yes. Occurrence would be limited to migrating or dispersing individuals.	BLM 2007a.
Yellow-billed cuckoo	*Coccyzus americanus*	BLM	This species inhabits lowland deciduous woodlands, willow, and alder thickets, mature cotton-wood-riparian woodlands, deserted farmlands, and orchards. Breeding typically occurs in dense, mature riparian woodlands.	Moderate. Suitable habitat is found along portions of the Project route, especially within perennial drainages (e.g., Powder River).	No.	BLM 2007a; Stokes and Stokes 1996; WGFD 2005.

Appendix E Special Status Species Identified for the Greencore Project

Common Name	Scientific Name	Status[1]	Habitat Association	Potential for Occurrence Within the Project Area	Eliminated From Detailed Analysis (Yes/No)	References
Trumpeter swan	*Cygnus buccinators*	BLM	This species inhabits lakes, ponds, marshes, and wetlands. Nests often occur on muskrat dens or small islands. Most of the North American population winters in Idaho.	None. This species is not known to nest along the Project route.	Yes. Occurrence would be limited to migrating or dispersing individuals.	BLM 2007a; WGFD 2004.
Amphibians						
Boreal Toad	*Bufo boreas boreas*	BLM	Inhabits wet areas in foothills, montane, and subalpine zones from 6,500 to 12,000 feet in elevation.	None. This species range in Wyoming and Montana is west of the Project route.	Yes. No records of occurrence exist for this species along the Project route.	Baxter and Stone 1980; WGFD 2005.
Northern leopard frog	*Rana pipiens*	BLM	Typical habitats include wet meadows and the banks and shallows of marshes, ponds, glacial kettle ponds, beaver ponds, lakes, reservoirs, streams, and irrigation ditches. Breeding season is generally May 1 - August 15.	High. This species is relatively common in suitable habitats along the Project route.	No.	Baxter and Stone 1980; BLM 2007a; WGFD 2005.
Columbia spotted frog	*Rana luteiventris*	BLM	Found in sub-alpine forests, grasslands, and sagebrush habitats at elevations from 1,700 feet to 6,400 feet.	None. This species range in Wyoming and Montana is west of the Project route.	Yes. No records of occurrence exist for this species along the Project route.	Baxter and Stone 1980; WGFD 2005.
Great Basin spadefoot	*Spea intermontana*	BLM	Prefer sagebrush communities below 6,000 feet in elevation, although they have been found at elevations of 9,200 feet. This species require loose soil to burrow.	Low. Suitable habitat occurs along the Project route; however, most records of this species in Wyoming are southwest of the Project.	No.	Baxter and Stone 1980; WGFD 2005.
Fish						
Yellowstone cutthroat trout	*Oncorhynchus clarkii bouvieri*	BLM	The Yellowstone cutthroat lives in lakes, large rivers, and small tributary streams. Native to the Yellowstone River drainage downstream to the Tongue River, including the Big Horn and Clarks Fork River drainages, this trout is also found in Pacific Creek and other Snake River tributaries.	None. This species range in Wyoming and Montana is west of the Project route.	Yes. No records of occurrence exist for this species along the Project route.	WGFD 2005.

Appendix E Special Status Species Identified for the Greencore Project

Common Name	Scientific Name	Status[1]	Habitat Association	Potential for Occurrence Within the Project Area	Eliminated From Detailed Analysis (Yes/No)	References
Plants						
Box pussytoes	*Antennaria arcuata*	BLM (Lander FO)	Box pussytoes is a white-wholly perennial herb found primarily in subirrigated meadows within broad stream channels dominated by *Deschampsia caespitosa, Juncus balticus, Poa pratensis, P. nevadensis, Koeleria macrantha,* and *Carex praegracilis between* 4,950-7,900 feet amsl. These communities are often found in a matrix of *Artemisia cana* and *Pentaphylloides floribunda*. Within these communities, the species may be found on hummocks, level ground, or shallow depressions on alkaline, clayey soils high in organic matter. This species is notably absent from riparian sites with tall, dense graminoid or shrub cover and where soils are saturated). Flowering period: July-September.	None. Regional endemic found in three disjunct areas in south-central Idaho, northeastern Idaho, and central Wyoming. In Wyoming, it is known only from the Sweetwater River Valley and the South Pass area of the southern Wind River Range in the vicinity of Atlantic City and Jeffrey City (Fremont County) and from the northern Green River Basin (Sublette County). Occurrences in Wyoming are known from 23 extant populations, 18 of which have been discovered or relocated since 1995.	Yes, due to limited geographic range and known species occurrence populations.	BLM 2010; USDA 2009; WYNDD 2009a, 2000a.
Laramie columbine	*Aquilegia laramiensis*	BLM (Casper FO)	Laramie columbine is a perennial, leafy, many-stemmed herb found primarily in shady, and usually level, microsites associated with granite outcrops, boulders, crevices, ledges, and cliff bases shaded by tree cover between 5,400-10,100 feet amsl. Flowering and fruiting period: June-August.	None. Regional endemic to the Laramie Range of southwest Wyoming (Albany and Converse counties). In Wyoming, it is known from 43 extant occurrences and two historical records.	Yes, due to limited geographic range and known species occurrence populations.	BLM 2010; USDA 2009; WYNDD 2009a,__.
Porter's sagebrush	*Artemisia porteri*	BLM (Buffalo, Casper, and Lander FO's)	Porter's wormwood is a mat-forming perennial subshrub occurring in sparsely vegetated badlands of ashy or tufaceous mudstones and clay slopes between 4,960-7,000 feet amsl. In the northern Wind River Basin, this species is found in semi-barren, low desert shrub communities dominated by *Artemisia pedatifida, A. porteri*, or *A. longifolia* on dry, whitish, ashyclay hills, gravelly-clay flats, and shaley erosional gullies of the Wind River, Wagon Bed, and Frontier formations. Flowering period: June-July, mature fruits into August.	Low. State endemic restricted to the Wind River Basin and Powder River Basin in Fremont, Johnson, and Natrona counties. Occurrences in Wyoming are known from eight occurrences, many of which consist of numerous subpopulations.	No. Suitable habitat determinations based on three queries: (1) elevations between 4,960-7,000 ft amsl based on NED data and (2) the Wind River, Wagon Bed, and Frontier formations based on the U.S. Geological Survey Integrated Geologic Map for Wyoming; or (1) listed above and (3) barren and badland vegetation cover types based on the Wyoming NW ReGAP data.	BLM 2010; USDA 2009; WYNDD 2009a, 2000b.

Appendix E Special Status Species Identified for the Greencore Project

Common Name	Scientific Name	Status[1]	Habitat Association	Potential for Occurrence Within the Project Area	Eliminated From Detailed Analysis (Yes/No)	References
Plains milkvetch	*Astragalus gilviflorus* var. *purpureus*	BLM (Lander FO)	Plains milkvetch is a loosely matted perennial herb occurring primarily in sparsely vegetated cushion plant/bunchgrass communities on sandy-clay soils with abundant surface gravel. These communities may lack a shrub component, or contain widely scattered individuals of Wyoming big sagebrush, mountain big sagebrush, or black sagebrush. This species may also be found on semi-disturbed roadbanks with short, sparse vegetation (total cover less than 40%). Populations are typically found on mid to upper slopes near the crest of badland ridges or low knolls between 6,400-8,800 feet amsl. Soils are mostly derived from the Tertiary Wind River or Indian Meadows formations, although some populations occur on deposits of the Cretaceous Cody Shale, Triassic Chugwater and Dinwoody formations, Paleozoic limestones, or gravelly moraines. Flowering period: late May to early July, while fruits are produced from mid June to July.	None. Local endemic of the Dubois Badlands in the northwestern Wind River Basin and adjacent foothills of the northeastern Wind River and southern Absaroka ranges in Fremont County, Wyoming. Occurrences in Wyoming are known from 11 extant populations, six of which have been discovered or relocated since 1990.	Yes, due to limited geographic range, elevational range, and known species occurrence populations.	BLM 2010; USDA 2009; WYNDD 2009a, 2000c.
Desert thistle	*Cirsium aridum*	BLM (Lander FO)	Desert thistle is a perennial taprooted herb with loosely to densely woolly-hairy stems occurring on barren slopes, fans, and draws on whitish-gray sandstone, chalk, turfaceous colluviums, or clay substrates derived from the Split Rock, White River, Wagon Bed, Wind River, Green River, and Wasatch formations. Populations are found mostly in sparsely vegetated openings within Wyoming big sagebrush grasslands between 5,800 to 7,500 feet amsl. Flowering period: June-July.	None. State endemic, restricted to the Green River Basin in Sublette County, Beaver Rim area of Fremont County, Sweetwater River Valley in Carbon County, and highlands on the east side of Flaming Gorge in Sweetwater County. Occurrences in Wyoming are known from 12 extant populations.	Yes, due to limited geographic range, elevational range, and known species occurrence populations.	BLM 2010; USDA 2009; WYNDD 2009a, 2000d.

Appendix E Special Status Species Identified for the Greencore Project

Common Name	Scientific Name	Status[1]	Habitat Association	Potential for Occurrence Within the Project Area	Eliminated From Detailed Analysis (Yes/No)	References
Many-stemmed spider flower	*Cleome multicaulis*	BLM (Casper FO)	Many-stemmed spider flower is an annual forb found primarily on whitish, alkali-rich, strongly hydrogen-sulfide scented soils bordering shallow, spring-fed playa lakes or dried lakebeds. Populations are most abundant on damp (but not flooded) flats with approximately 90 percent cover of *Spartina gracilis*, *Distichlis stricta*, *Juncus balticus*, *Puccinellia nuttalliana*, *Scirpus nevadensis*, and *Triglochin maritimum* bordering playa lakes. Small patches may also occur within clayey dunes surrounding alkaline lakes, on low hummocks, or within dry alkaline depressions. All Wyoming populations occur at approximately 5,860 feet amsl. Flowering period: June-August.	None. In Wyoming, populations are restricted to the Sweetwater River Valley in southern Natrona County. Two records are known within Wyoming; one is extent, the second has not been relocated during follow-up surveys.	Yes, due to limited geographic range, elevational range, and known species occurrence populations.	BLM 2010; USDA 2009; WYNDD 2009a.
Wallowa cryptantha	*Cryptantha subcapitata*	BLM (Lander FO)	Wallowa cryptantha is a mat-forming perennial herb occurring on sandy-gravelly slopes and desert ridges in sparsely vegetated cushion plant communities, often dominated by *Sphaeromeria capitata* or *Artemisia nova*. This species appears to be restricted to sandstones and conglomerates derived from the Eocene Wind River Formation. Flowering period: late May-June, mature fruits present from mid June-mid July; reproduces by seed; plants form large mats by vegetative means.	None. Narrow endemic of the Owl Creek and Bridger Mountains in the vicinity of Boysen Reservoir and the northern Wind River Basin in Fremont County, Wyoming. Occurrences in Wyoming are known from three extant populations.	Yes, due to limited geographic range and known species occurrence populations.	BLM 2010; USDA 2009; WYNDD 2009a, 2000e.
Williams' springparsley	*Cymopterus williamsii*	BLM (Buffalo and Casper FO's)	Williams' springparsley is a tufted, perennial herb occurring primarily on open, south or east-facing ridgetops and upper slopes with exposed limestone outcrops or talus between 6,000-8,300 feet amsl. Soils tend to be thin, sandy, and often restricted to small cracks or pockets in limestone bedrock, Barren rock can provide up to 50% of total cover. Common associates include *Cercocarpus ledifolius* and *Pinus ponderosa*. Flowering period: May thru mid-June; fruiting from June to July.	None. State endemic restricted to the Bighorn Mountains of north-central Wyoming in Bighorn, Johnson, Natrona, and Washakie counties. Occurrences in Wyoming are known from 23 extant populations and one historical record.	Yes, due to limited geographic range, elevational range, and known species occurrence populations.	BLM 2010; USDA 2009; WYNDD 2009a, 2000f.

Appendix E Special Status Species Identified for the Greencore Project

Common Name	Scientific Name	Status[1]	Habitat Association	Potential for Occurrence Within the Project Area	Eliminated From Detailed Analysis (Yes/No)	References
Fremont's bladderpod	*Lesquerella fremontii*	BLM (Lander FO)	Fremont's bladderpod is a pubescent, perennial, tap-rooted herb occupying meadows, slopes, ridges, and benches in cushion plant communities on rocky, mesic, limestone derived soils. The species occurs primarily in arid foothills and desert ridges, but may also occasionally occur in cushion plant communities near timberline between 6,800-11,100 feet amsl. Flowering and fruiting period: May-July.	None. Local endemic of the east slope of the Wind River Range and Sweetwater Plateau in Fremont County. Occurrences in Wyoming are known from nine extant populations, six of which have been discovered or relocated since 1993.	Yes, due to limited geographic range, elevational range, and known species occurrence populations.	BLM 2010; USDA 2009; WYNDD 2009a; 2000g.
Blowout penstemon	*Penstemon haydenii*	FE	Blowout beardtongue is a perennial herb restricted to sparsely vegetated, early-successional, shifting sand with crater-like blowout depressions created by wind erosion. In Wyoming, the species is found primarily on the rim and lee sloped of blowouts, and associated steep slopes deposited at the base of foothills between 5,840-7,440 feet amsl. Flowering/fruiting period: Mid-June thru early-July and sets fruits in July thru August.	Low. Regional endemic of the Nebraska sandhills and the northeastern end of the Great Divide basin in Carbon County, Wyoming. Occurrences in Wyoming are known from three populations including multiple dune and dune complexes. Based on pre-construction surveys for the co-located PetroSource CO_2 Pipeline Project, no populations were identified. Additional suitable habitat was identified based on desktop analysis.	No. Suitable habitat determinations based on one query: "wind blown (eolian) deposits of sand, silt, and clay" based on the Wyoming State Geological Survey and the Western Water Resources Center surficial geology datasets.	USDA 2009; USFWS 2009; WYNDD 2008.
Prickly phlox	*Phlox pungens*	BLM (Lander FO)	Prickly phlox is a leafy perennial forb occurring in sparsely vegetated cushion plant communities on slopes of limestone, volcanic-rich sandstone, siltstone, or red-bed clays between 6,000-7,400 feet amsl. Populations of the "Ross Butte" form in the Green River Basin occurring in concave washes along summit rims, midslopes, and ridgetops of gray to reddish-brown clay-shale soils with a surface layer of white limey-sandstone in cushion plant/bunchgrass vegetation or openings in sagebrush/grasslands. Flowering period: May-June.	None. Endemic to the Wind River and Green River basins and southeastern foothills of the Wind River Range in Fremont, Lincoln, and Sublette counties, Wyoming. Occurrences in Wyoming are known from at least 16 occurrences, all of which have been discovered or relocated since 1990.	Yes, due to limited geographic range, elevational range, and known species occurrence populations.	BLM 2010; USDA 2009; WYNDD 2009a, 2000h.

Appendix E Special Status Species Identified for the Greencore Project

Common Name	Scientific Name	Status[1]	Habitat Association	Potential for Occurrence Within the Project Area	Eliminated From Detailed Analysis (Yes/No)	References
Fremont County twinpod	*Physaria saximontana* var. *saximontana*	BLM (Lander FO)	Fremont County twinpod is a perennial herb occurring on sparsely vegetated slopes on sandy, gravelly soils, or talus of limestone, red sandstone, or clay between 5,200-8,300 feet. Flowering period: May thru late-June; mature fruits present late-June thru August.	None. Endemic to Wyoming's southern Bighorn and Wind River Basins and foothills of the Wind River and Absaroka Ranges in Fremont, Hot Springs, and Park counties. Occurrences in Wyoming are known from 18 occurrences, 9 of which have been discovered or relocated since 1990.	Yes, due to limited geographic range and known species occurrence populations.	BLM 2010; USDA 2009; WYNDD 2009a, 2000i.
Limber pine	*Pinus flexilis*	BLM (Lander, Casper, and Buffalo FO's)	Limber pine is a cold and drought tolerant, shade intolerant, slow-growing, long-lived (up to 2,000 years) native tree of western North America. This species dominates dry, rocky sites at many elevations (4,900-11,800 feet amsl) within its range. Limber pine can occur scattered throughout forested regions on more mesic sites, especially in low density, open areas. At higher elevations, *Pinus flexilis* can define the boundary of the treeline. Timberline and at lower elevation with sagebrush. Associated species include *Pinus contorta*, *Picea engelmannii*, *Pinus albicaulis*, *Psuedotsuga menziesii*, *Abies lasiocarpa*, *Juniperus scopulorum*, *Cercocarpus* spp., and *Juniperus* spp.	Low. Known to occur east of the Continental Divide within suitable habitat.	No. Suitable habitat determinations based on the following two queries: 1) elevations between 4,900 and 11,800 feet amsl; and 2) woodland vegetation cover types based on Wyoming NW REGAP data.	BLM 2010; USDA 2009; WYNDD 2009a.

Appendix E Special Status Species Identified for the Greencore Project

Common Name	Scientific Name	Status[1]	Habitat Association	Potential for Occurrence Within the Project Area	Eliminated From Detailed Analysis (Yes/No)	References
Persistent sepal yellowcress	*Rorippa calycina*	BLM (Lander FO)	Persistent sepal yellowcress is a rhizominous perennial occurring in sparsely vegetated, moist sandy to muddy banks of streams, stock ponds, and man-made reservoirs near the high water line. Its habitat is usually sparsely vegetated with bunchgrasses, early successional or weedy forbs, and scattered shrubs. In Wyoming, it occurs mostly on semi-disturbed or recently flooded openings in small inlets or bays with scattered clumps of *Hordeum jubatum*, *Poa secunda*, *Elymus smithii* and a variety of native and exotic early successional forbs. Occasional populations can also be found in openings in grassy streambanks, in barren patches among thickets of *Salix exigua* or *Tamarix chinensis* (salt cedar), and on the banks of small playa lakes. Flowering/fruiting period: May thru July.	Low. Regional endemic of south-central Montana, western North Dakota, and central Wyoming. Suitable habitat was identified based on desktop analysis.	No. Suitable habitat determinations based on one query: intermittent and perennial waterbodies and all wetlands identified based on desktop LULC analysis and 2009 biological field surveys.	BLM 2010; USDA 2009; WYNDD 2009a, Montana Field Guide no date.
Laramie chickensage	*Sphaeromeria simplex*	BLM (Casper FO)	Laramie chickensage is a mat-forming, perennial herb occurring on gentle slopes or rims of dry, rocky limestone-sandstone “pebble plains” in wind-scoured openings dominated by cushion plant communities within more densely vegetated juniper, limber pine, big sagebrush, or mountain mahogany stands between 7,200-8,760 feet amsl. Flowering/fruiting period: May thru August.	None. Endemic to southeast Wyoming in the western foothills of the Laramie Range, Shirley Basin, and Shirley Mountains (Albany, Carbon, Converse, and Natrona counties). Occurrences in Wyoming are known from 11 occurrences, all of which have been discovered or observed since 1996.	Yes, due to limited geographic range, elevational range, and known species occurrence populations.	BLM 2010; USDA 2009; WYNDD 2009a, 2000j.

Appendix E Special Status Species Identified for the Greencore Project

Common Name	Scientific Name	Status[1]	Habitat Association	Potential for Occurrence Within the Project Area	Eliminated From Detailed Analysis (Yes/No)	References
Ute's ladies'-tresses orchid	*Spiranthes diluvialis*	FT	Ute ladies' tresses is a perennial herb occupying primarily moist, subirrrigated or seasonally flooded soils in valley bottoms, gravel bars, old oxbows, or floodplains bordering springs, lakes, rivers, or perennial streams at elevations between 1,800-6,800 feet amsl. Soils vary from sandy or coarse cobbley alluvium to calcareous, histic, or fine-textured clays and loams. Populations have been documented within alkaline sedge meadows within riverine floodplains, flooded alkaline meadows adjacent to woodlands and sagebrush steppe, and streamside floodplains and meadows on alluvium. Some occurrences are also found on agricultural lands managed for winter or early season grazing or hay production. Known sites often have low vegetative cover and may be subjected to periodic disturbances (flooding, or grazing). Flowering period: mid-July thru late-August. Fruiting period: late-August.	Low. Known from western Nebraska, southeastern Wyoming, north-central Colorado, northeastern and southern Utah, east-central Idaho, southwestern Montana, and north-central Washington. An historical population is also known from south-central Nevada. In Wyoming, the species occurs at four locations on the Western Great Plains in Converse, Goshen, Laramie, and Niobrara counties. These populations are found in the Horse and Bear Creek drainages (tributaries of the North Platte River), Antelope Creek drainage (a tributary of the Cheyenne River), and along the Niobrara River. Based on pre-construction surveys for the co-located PetroSource CO_2 Pipeline Project, no populations were identified. Additional suitable habitat was identified based on desktop analysis.	No. Suitable habitat determinations based on the intersection of the following three queries: (1) perennial waterbodies and all wetlands identified based on desktop LULC analysis and 2009 biological field surveys; (2) elevations between 1,800-6,800 ft amsl based on NED data; and (3) Quaternary Alluvium (Qa) and the Wasatch Formation based on the U.S. Geological Survey Integrated Geologic Map for Wyoming.	USDA 2009; USFWS 2009; WYNDD 2009a, 2000k.
Barneby's clover	*Trifolium barnebyi*	BLM (Lander FO)	Barneby's clover is a mat-forming, perennial herb occurring in ledges, crevices, and seams, mainly on reddish-cream Nugget Sandstone, secondarily on Frontier Sandstone, between 5,500-6,780 feet amsl. Flowering /fruiting period: May thru July.	None. Local endemic restricted to the southeastern foothills of the Wind River and southern Beaver Rim area in Fremont County, Wyoming. Occurrences in Wyoming are known from five extant populations.	Yes, due to limited geographic range, elevational range, and known species occurrence populations.	BLM 2010; USDA 2009; WYNDD 2009a,b.

[1] FE = Federally listed as endangered.
FT = Federally listed as threatened.
FC = Federal candidate.
FP = Federally proposed.
BLM = BLM Sensitive Species.

Appendix F
Visual Contrast Rating Forms

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date: 10/06/2010
District:
Resource Area:
Activity (program):

SECTION A. PROJECT INFORMATION

1. Project Name: Greencare Cell
2. Key Observation Point: 1 - South Bighorn Backcountry Byway
3. VRM Class: IV
4. Location: Township ____ Range ____ Section ____
5. Location Sketch: See Chapter 2.

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	Concave plane, Planar	Irregular	Fence posts and T-line structures narrow
LINE	Undulating	Horizontal and vertical edges	Vertical elements Horizontal road edge
COLOR	Tans, light browns	Tans, beiges, greens	Umber, browns gray, highway
TEXTURE	NA	Fine to medium	Fine

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	NA	Planar row	NA
LINE	NA	Horizontal edges	NA
COLOR	NA	Tans, beiges	NA
TEXTURE	NA	Fine to medium	NA

SECTION D. CONTRAST RATING ☐ SHORT TERM ☐ LONG TERM

1. DEGREE OF CONSTRAST

ELEMENTS	FEATURES: LANDWATER BODY (1) Strong	Moderate	Weak	None	VEGETATION (2) Strong	Moderate	Weak	None	STRUCTURES (3) Strong	Moderate	Weak	None
Form				X			X					X
Line				X		X						X
Color				X			X					X
Texture				X			X					X

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended? ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names: M Paulson
Date: 10/06/10

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date: 10/06/2010
District:
Resource Area:
Activity (program):

SECTION A. PROJECT INFORMATION

1. Project Name: Greencore CO2
2. Key Observation Point: 2 - U.S. 20
3. VRM Class: III
4. Location: Township ____ Range ____ Section ____
5. Location Sketch: See Chapter 2

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Concave plane, Convex foreground	Irregular planes	Planar highway
LINE	Undulating Concave and convex	Irregular	Horizontal inclined
COLOR	Tans, browns	Tans, beiges, olive greens	Greys, browns
TEXTURE	NA	Fine to coarse	Fine

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	NA	Planar row	NA
LINE	NA	Horizontal edges	NA
COLOR	NA	Tans, beiges	NA
TEXTURE	NA	Fine	NA

SECTION D. CONTRAST RATING ☐ SHORT TERM ☐ LONG TERM

1. DEGREE OF CONSTRAST

ELEMENTS	FEATURES: LANDWATER BODY (1) Strong	Moderate	Weak	None	VEGETATION (2) Strong	Moderate	Weak	None	STRUCTURES (3) Strong	Moderate	Weak	None
Form				X			X					X
Line				X			X					X
Color				X		X						X
Texture				X			X					X

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended? ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names: M Paulson
Date: 10/06/10

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date: 10/06/2010
District:
Resource Area:
Activity (program):

SECTION A. PROJECT INFORMATION

1. Project Name: Greencare Coz
2. Key Observation Point: 3 - I25
3. VRM Class: IV
4. Location: Township ____ Range ____ Section ____
5. Location Sketch: See Chapter 2.

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	Irregular shapes Planar, concave, convex	Irregular patches	Planar highway & access road
LINE	Undulating horizontal, convex, concave	Irregular	Horizontal, curvilinear
COLOR	Tans, browns	Olive greens, Tans, beiges	Grays, light to medium Tans
TEXTURE	Medium	Medium to coarse	Fine

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	NA	Planar row.	
LINE	NA	Horizontal edges	
COLOR	NA	Tans, light browns	
TEXTURE	NA	Fine	

SECTION D. CONTRAST RATING ☐ SHORT TERM ☐ LONG TERM

1. DEGREE OF CONSTRAST

ELEMENTS	FEATURES: LANDWATER BODY (1) Strong	Moderate	Weak	None	VEGETATION (2) Strong	Moderate	Weak	None	STRUCTURES (3) Strong	Moderate	Weak	None
Form				X			X					X
Line				X		X						X
Color				X		X						X
Texture				X		X						X

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended? ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names: M PAULSON
Date: 10/06/10

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date: 10/06/2010
District:
Resource Area:
Activity (program):

SECTION A. PROJECT INFORMATION

1. Project Name: Greencore Coz
2. Key Observation Point: 4 - SH 192
3. VRM Class: IV
4. Location
   Township: _____
   Range: _____
   Section: _____
5. Location Sketch

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	Planar, horizontal and inclined.	Indistinct	Highway is planar horizontal
LINE	Horizontal	Horizontal, vertical, inclined	Horizontal straight
COLOR	Tans, light browns	Tans, Olive greens	Grays, yellow stripe is dominate
TEXTURE	Fine	Fine	Fine

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	NA	Planar row.	NA
LINE	NA	Horizontal or horizon and vertical	NA
COLOR	NA	Tans, light beiges	NA
TEXTURE	NA	Fine	NA

SECTION D. CONTRAST RATING ☐ SHORT TERM ☐ LONG TERM

1. DEGREE OF CONSTRAST

ELEMENTS	FEATURES: LANDWATER BODY (1) Strong	Moderate	Weak	None	VEGETATION (2) Strong	Moderate	Weak	None	STRUCTURES (3) Strong	Moderate	Weak	None
Form				X			X					X
Line				X			X					X
Color				X			X					X
Texture				X			X					X

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended? ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names: M PAULSON
Date: 10/06/10

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date: 10/06/2010
District:
Resource Area:
Activity (program):

SECTION A. PROJECT INFORMATION

1. Project Name: Greencove CO2
2. Key Observation Point: 5 - Bozeman Trail
3. VRM Class: IV
4. Location: Township ____ Range ____ Section ____
5. Location Sketch:

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	Horizontal planar Concave background	Strong irregular trees, planar row edges	NA
LINE	Horizontal and undulating	Olive green trees Tan grasses ↑	NA
COLOR	Tans light browns	↳ Irregular lines	NA
TEXTURE	Fine	Fine to medium	NA

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	NA	Planar row. Trapezoidal	NA
LINE	NA	Horizontal, inclined left & rt.	NA
COLOR	NA	Tans, light beiges	NA
TEXTURE	NA	Fine	NA

SECTION D. CONTRAST RATING ☐ SHORT TERM ☐ LONG TERM

1. DEGREE OF CONSTRAST

ELEMENTS	FEATURES: LANDWATER BODY (1) Strong	Moderate	Weak	None	VEGETATION (2) Strong	Moderate	Weak	None	STRUCTURES (3) Strong	Moderate	Weak	None
Form				X			X					X
Line				X			X					X
Color				X			X					X
Texture				X			X					X

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended? ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names: M PAULSON
Date: 10/06/10

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date: 10/06/2010
District:
Resource Area:
Activity (program):

SECTION A. PROJECT INFORMATION

1. Project Name: Greencore Coz
2. Key Observation Point: 6 - 1-90
3. VRM Class: III
4. Location: Township ____ Range ____ Section ____
5. Location Sketch: See Chapter 2

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	Horizontal planar FG & concave FG	Scattered amorphous	NA
LINE	Undulating & horizontal	Irregular	NA
COLOR	Tans, browns	Dark olives and light tans, ochres	NA
TEXTURE	Fine	Medium to coarse	NA

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	NA	Planar and trapezoidal row	NA
LINE	NA	Horizontal & inclined edges	NA
COLOR	NA	Tans and ochres	NA
TEXTURE	NA	Fine	NA

SECTION D. CONTRAST RATING ☐ SHORT TERM ☐ LONG TERM

1. DEGREE OF CONSTRAST

ELEMENTS	FEATURES: LANDWATER BODY (1) Strong	Moderate	Weak	None	VEGETATION (2) Strong	Moderate	Weak	None	STRUCTURES (3) Strong	Moderate	Weak	None
Form				X			X					X
Line				X		X						X
Color				X		X						X
Texture				X		X						X

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended? ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names: M. PAULSON
Date: 10/06/10

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date: 10/06/10
District:
Resource Area:
Activity (program):

SECTION A. PROJECT INFORMATION

1. Project Name: Greencare Co2
2. Key Observation Point: 7- U.S. 14/16
3. VRM Class: IV
4. Location: Township ____ Range ____ Section ____
5. Location Sketch: See Chapter 2

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	Planar FG Concave FG	Indistinct grasses	Rectangular Bldg & fence posts
LINE	Horizontal FG Undulating BG	Horizontal & undulating	Horizontal & vertical edges
COLOR	Tans, browns	Golds, ochres, Lt. Browns	White, Lt Tans
TEXTURE	Fine	Fine	Fine

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	NA	Planar & trapezoidal R.O.W.	NA
LINE	NA	Horizontal & inclined edges	NA
COLOR	NA	Ochres, golds, tans	NA
TEXTURE	NA	Fine	NA

SECTION D. CONTRAST RATING ☐ SHORT TERM ☐ LONG TERM

1. DEGREE OF CONSTRAST

ELEMENTS	FEATURES: LANDWATER BODY (1) Strong	Moderate	Weak	None	VEGETATION (2) Strong	Moderate	Weak	None	STRUCTURES (3) Strong	Moderate	Weak	None
Form				X			X					X
Line				X			X					X
Color				X		X						X
Texture				X			X					X

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended? ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names: M Paulson
Date: 10/06/10

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date: 10/06/10
District:
Resource Area:
Activity (program):

SECTION A. PROJECT INFORMATION

1. Project Name: Greencore Co2
2. Key Observation Point: 8 - SH59
3. VRM Class: ~~II~~ III & IV
4. Location: Township ____ Range ____ Section ____
5. Location Sketch: See Chapter 2.

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	Planar & FG Concave MG-FG	Irregular groups & shrubs	Cylindrical tank & rectangular fencepost
LINE	Horizontal FG Undulating FG	Olive greens, beiges, browns, tans	Lt. Tan & gray & to dark greys in shade
COLOR	Tans, browns	Irregular & indistinct	Horizontal base, vertical sides, concave top
TEXTURE	Fine	Fine to medium	Fine

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	NA	Planar & trapezoidal R.O.W.	NA
LINE	NA	Horizontal & indistinct edges	NA
COLOR	NA	Browns, dark ochres	NA
TEXTURE	NA	Fine	NA

SECTION D. CONTRAST RATING ☐ SHORT TERM ☐ LONG TERM

1. DEGREE OF CONSTRAST

ELEMENTS	FEATURES: LANDWATER BODY (1) Strong	Moderate	Weak	None	VEGETATION (2) Strong	Moderate	Weak	None	STRUCTURES (3) Strong	Moderate	Weak	None
Form				X		X						X
Line				X		X						X
Color				X			X					X
Texture				X			X					X

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended? ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names: M Paulson
Date: 10/06/10