Ruby Pipeline LLC Voluntary Conservation Plan for Migratory Birds Support Document

Prepared for

Ruby Pipeline LLC

Prepared by

SWCA Environmental Consultants

June 15, 2010

Ruby Pipeline LLC Voluntary Conservation Plan for Migratory Birds Support Document

Submitted to

U.S. Fish and Wildlife Service

Prepared by

SWCA Environmental Consultants
295 Interlocken Boulevard, Suite 300
Broomfield, Colorado 80021
303-487-1183

June 15, 2010

TABLE OF CONTENTS

Page

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Purpose and Need of Conservation Plan 5
1.2.1 History of Conservation Plan Development 5
2.0 MIGRATORY BIRDS 6
2.1 Avian Population Status 19
2.1.1 Range-wide 19
2.1.2 State-specific 19
2.2 THREATS 20
2.2.1 Project-specific 20
2.2.2 Climate Change 21
3.0 MIGRATORY BIRD CONSERVATION MEASURES 21
4.0 PROJECT AREA HABITATS 24
5.0 MIGRATORY BIRD HABITAT EQUIVALENCY ANALYSIS METHODS 30
5.1 Habitat Service Level Metric 30
5.1.1 Vegetation Type 30
5.1.2 Patch Size 31
5.1.3 Fire Regime Condition Class 32
5.2 Extent of Injury Analysis 36
5.3 Habitat Available by Service Level and Project Condition 37
5.4 GIS Calculation of Habitat Available by Service Level and Project Condition 38
5.4.1 Vegetation Data 38
5.4.2 Other Data Inputs 39
5.4.3 Disturbance Areas 40
5.4.4 Baseline 40
5.4.5 Construction 42
5.4.6 Restoration 43
5.4.7 Recovery 44
5.4.8 Data Limitations 44
5.5 Calculation of Habitat Services Provided by Project Condition 45
5.6 Calculation of Habitat Services Lost Over the 40-year Analysis Period 45
5.7 Calculation of Scaled Habitat Compensation 48
6.0 MIGRATORY BIRD HABITAT EQUIVALENCY ANALYSIS RESULTS 48
6.1 Project Area Habitats 48
6.1.1 Current Conditions by Habitat Quality Score 48
6.1.2 Construction Disturbance and Restoration 58
6.1.3 Habitat Injury and Compensation 63
7.0 HEA RESULTS AND CONCLUSION 68
8.0 REFERENCES 70

LIST OF MAPS

Map **Page**
1. Proposed Action Route for the Ruby Pipeline Project from Opal, Wyoming, to Malin, Oregon. 2

LIST OF FIGURES

Figure **Page**
1. Multiple levels of vegetation measurements throughout the Project Area corridor. 36
2. Development of the Baseline patches layer. 42
3. Example model of interim and permanent injury to habitat services over 40 years with four project conditions: A) Baseline, B) Construction, C) Restoration, and D) Recovery. 47
4. Percentage of aggregate vegetation type by habitat quality score for Wyoming, as measured by the acres of vegetation within the Pipeline Intersect at Baseline condition. 55
5. Percentage of aggregate vegetation type by habitat quality score for Utah, as measured by the acres of vegetation within the Pipeline Intersect at Baseline condition. 56
6. Percentage of aggregate vegetation type by habitat quality score for Nevada, as measured by the acres of vegetation within the Pipeline Intersect at Baseline condition. 57
7. Percentage of aggregate vegetation type by habitat quality score for Oregon, as measured by the acres of vegetation within the Pipeline Intersect at Baseline condition. 58

LIST OF TABLES

Table **Page**
1. MBTA-Protected Species Observed During 2008-09 Surveys Across the Project 6
2 Numbers of MBTA-Protected Breeding Bird Nests and Fledglings Observed Along the Ruby Pipeline Route Based on 2008-09 Surveys 12
3. Birds of Conservation Concern That Are Protected Under the MBTA in Wyoming, Utah, Nevada, and Oregon that Are Documented, Likely to Occur, or Have the Potential to Occur Within the Project ROW. 15
4. Aggregation of LANDFIRE Vegetation Types. 24
5. Area and Relative Abundance of Each Aggregate Vegetation Type within a 10-mile Buffer Centered on the Pipeline for Each State. 29
6. Importance Score Ascribed to Aggregate Vegetation Types. 31
7. Acreages Used to Determine Habitat Quality Value for Contiguous Patches within each Aggregate Vegetation Type. 32
8. Use of Indicator Species to Evaluate Vegetation Patch Size, Including Assigned Value of Vegetation Importance to Migratory Birds (1 Low to 3 High). 33
9. Right-of-Way Widths Used to Calculate Vegetation Disturbance at the Pipeline for Construction, Restoration, and Recovery. 38
10. Aggregate Vegetation Identification Value. 39
11. Recovery Times Used in the HEA Models for Aggregate Vegetation Types. 47
12. Acres of Migratory Bird Habitat within the Pipeline Intersect by Habitat Quality Score (1 Low to 27 High) at Baseline condition for Nevada, Oregon, Utah, and Wyoming. 50

13. Acres of Migratory Bird Habitat in Wyoming within the Pipeline Intersect by Habitat Quality Score (1 Low to 27 High) at Baseline condition by Aggregate Vegetation. 51
14. Acres of Migratory Bird Habitat in Utah within the Pipeline Intersect by Habitat Quality Score (1 Low to 27 High) at Baseline condition by Aggregate Vegetation Type. 52
15. Acres of Migratory Bird Habitat in Nevada within the Pipeline Intersect by Habitat Quality Score (1 Low to 27 High) at Baseline condition by Aggregate Vegetation Type. 53
16. Acres of Migratory Bird Habitat in Oregon within the Pipeline Intersect by Habitat Quality Score (1 Low to 27 High) at Baseline condition by Aggregate Vegetation..... 54
17. Acres of Migratory Bird Habitat in Wyoming within the Restoration Right-of-Way Assigned to Each of the Habitat Quality Scores (1 Low to 27 High) at Baseline 59
18. Acres of Migratory Bird Habitat in Utah within the Restoration Right-of-Way Assigned to Each of the Habitat Quality Scores (1 Low to 27 High) at Baseline Condition. 60
19. Acres of Migratory Bird Habitat in Nevada within the Restoration Right-of-Way Assigned to Each of the Habitat Quality Scores (1 Low to 27 High) at Baseline Condition. 61
20. Acres of Migratory Bird Habitat in Oregon within the Restoration Right-of-Way Assigned to Each of the Habitat Quality Scores (1 Low to 27 High) at Baseline Condition. 62
21. Estimation of Migratory Bird Habitat Services and Habitat Injury in the Ruby Pipeline Corridor through Wyoming and Scaled Habitat Compensation to Offset Injury from HEA Model. 64
22. Estimation of Migratory Bird Habitat Services and Habitat Injury in the Ruby Pipeline Corridor through Utah and Scaled Habitat Compensation to Offset Injury from HEA Model. 65
23. Estimation of Migratory Bird Habitat Services and Habitat Injury in the Ruby Pipeline Corridor through Nevada and Scaled Habitat Compensation to Offset Injury from HEA Model. 66
24. Estimation of Migratory Bird Habitat Services and Habitat Injury in the Ruby Pipeline Corridor through Oregon and Scaled Habitat Compensation to Offset Injury from HEA Model. 67

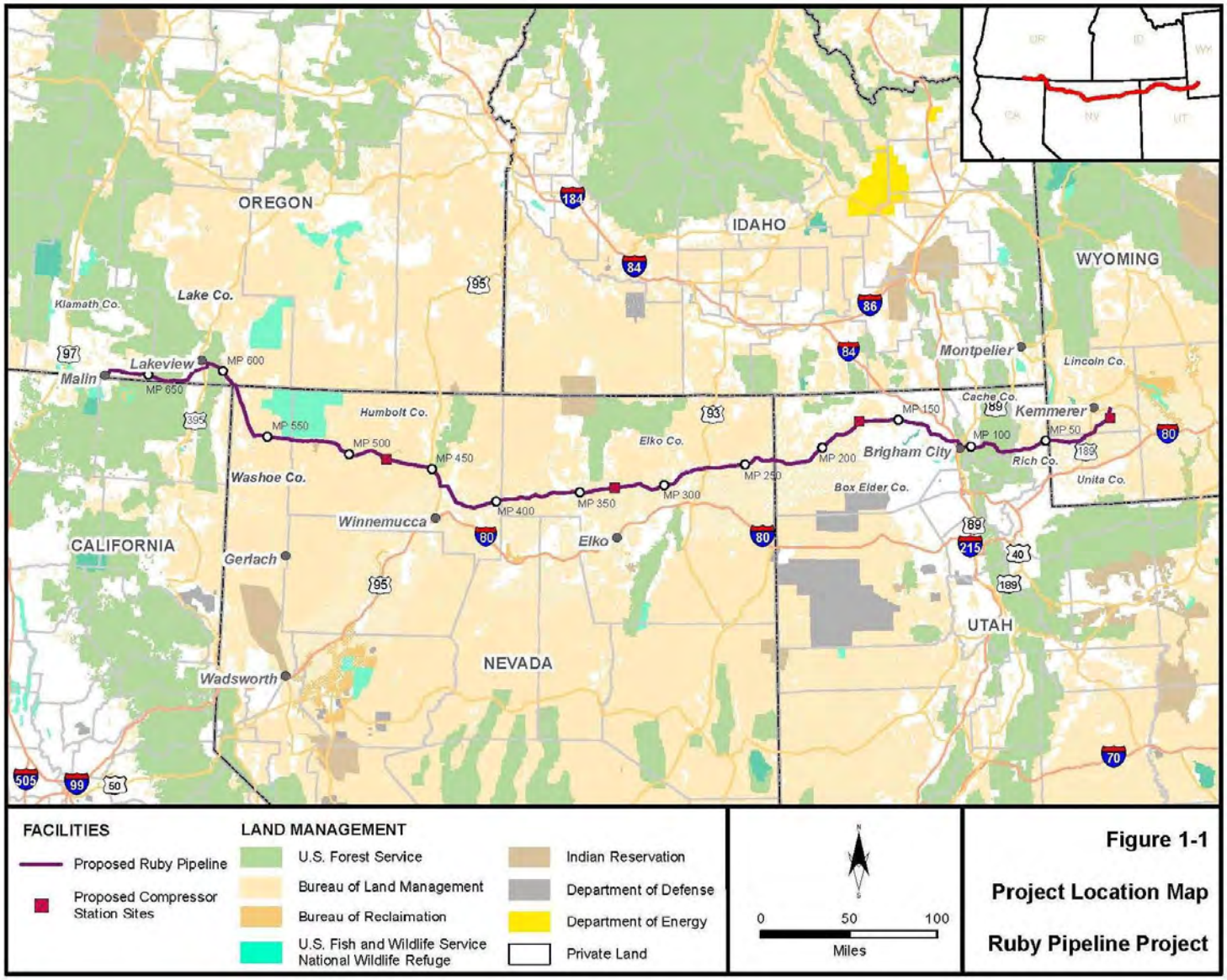
1.0 INTRODUCTION

The Ruby Pipeline Project (Project) is located within occupied and suitable habitat for avian species protected under the Migratory Bird Treaty Act of 1918 (16 United States Code [U.S.C.] § 703-712) (MBTA) and birds are found year-round in all of the habitats contained within the boundaries of the Project and surrounding areas. Migratory birds are federally protected under the MBTA as described in Ruby Pipeline LLC's Voluntary Conservation Plan for Migratory Birds (Plan), of which this Ruby Pipeline LLC's Voluntary Conservation Plan for Migratory Birds Support Document is an attachment. In addition, to the protections under MBTA, bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) also receive protection through the Bald and Golden Eagle Protection Act of 1962 (16 U.S.C. 668-668d) (BGEPA). Executive Order (EO) No. 13186, ordered in 2001, also protects migratory birds and habitats by requiring federal agencies to support the conservation intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions; and restore and enhance the habitat of migratory birds, as practicable.

1.1 PROJECT DESCRIPTION

The FERC has prepared a final environmental impact statement (FEIS) to assess the environmental impacts associated with the construction and operation of the Project in accordance with the requirements of the National Environmental Policy Act (NEPA) (FERC 2009a). USFWS is participating as a cooperating agency because of its special expertise regarding fish, wildlife, and wetland and waterbody ecology, and because Ruby would use access roads on National Wildlife Refuge (NWR) system land in Nevada. The Project is within the following USFWS regions: Region 6 (Wyoming and Utah), Region 8 (Nevada), and Region 1 (Oregon and the Sheldon-Hart NWR).

The Project would involve the construction and operation of a buried natural gas pipeline and related aboveground facilities, including temporary extra workspaces, staging areas, water appropriation sites, contractor yards, pipe yards, construction camps, temporary housing facilities, and new and to-be-improved access roads. The Project construction route is shown in Map 1. The construction right-of-way (ROW) would be 115 feet wide for a majority of the pipeline route; Ruby would use a narrower ROW in some areas to minimize impacts on sensitive environmental resources such as wetlands, and would use a wider ROW in areas of uneven terrain and other construction constraints. Approximately 19,724 acres of land would be impacted during construction of the pipeline. This total acre figure is for the area of direct habitat impacts and does not account for other disturbance impacts that may occur outside of these acres in the adjacent habitat. Major components of the Project would include construction of: the pipeline itself, temporary workspaces, storage yards, contractor yards, access roads, compressor stations, meter stations, communication towers, and aboveground facilities.



Map 1. Proposed Action Route for the Ruby Pipeline Project from Opal, Wyoming, to Malin, Oregon.

Following construction, Ruby would retain a 50-foot-wide permanent ROW to operate the pipeline and aboveground facility sites. Ruby estimates that this permanent ROW required for operation of the Project would comprise a post-construction footprint of approximately 4,250 acres. Future impacts to migratory bird habitat after construction would be limited to these acres and the areas immediately adjacent to them.

Ruby proposes to construct and operate four compressor stations as part of the Ruby Pipeline Project. The Roberson Creek Compressor Station would be located at Mile Post (MP) 5.7, near the beginning of the pipeline in Lincoln County, Wyoming. The Wildcat Hills Compressor Station would be located at MP 172.5, in Box Elder County, Utah. The Weiland Flat Compressor Station would be located at MP 330.1, in Elko County, Nevada. The Desert Valley Compressor Station would be located at MP 476.3, in Humboldt County, Nevada. In addition to compressor stations, Ruby would construct and operate meter stations, mainline valves, pig launchers and receivers, and four communication towers less than 50 feet tall with no guy wires (one at each of the four compressor station sites).

Ruby would use a number of temporary extra workspaces, staging areas, and water appropriation sites during construction. Extra workspace typically would be located along the construction ROW on both sides of wetland, waterbody, road, and utility crossings, and in areas of rugged terrain. Most extra workspaces would add 80 feet to the 115-foot-wide construction ROW, effectively creating a 195-foot-wide work area in specific locations. Staging areas would be similar to extra workspaces but may be located on or off the construction ROW and would vary in size and, in many instances, would widen the construction ROW beyond temporary extra workspaces for short distances. Water appropriation sites, like staging areas, would be located on and off the construction ROW to facilitate well drilling and water appropriation for hydrostatic testing, dust abatement, and equipment cleaning.

Ruby would use 8 contractor construction yards and 17 pipe storage/staging/stringing yards to support pipeline construction. Contractor and pipe yards typically would be located away from the construction ROW and would be used for stockpiling pipe, storing materials, staging work, fabricating accessories, repairing equipment, housing mobile offices, and parking vehicles. A construction camp would be used to provide temporary housing and food service for non-local workers in northwestern Nevada where adequate facilities are not readily available. Camp components would include up to 425 temporary modular-type housing units, up to 200 camper and recreation vehicle parking pads, as well as access to support facilities such as potable water, a food service hall, waste treatment, fuel storage, and electrical power. A temporary housing facility would be similar to the construction camp except that it would not include a food service hall or fuel storage. The temporary housing facility would be located in the town of Lakeview, Oregon and would be comprised of seven temporary dormitory buildings capable of accommodating up to 350 workers. The buildings would include provisions for laundry, showers, and toilets and would be served by municipal sewer, water, and power.

Ruby would primarily use existing public and private roads and would construct a limited number of new roads to gain access to the Project area. Many of the existing access roads are presently in a condition that could accommodate construction traffic without significant

modification or improvement. Some roads consist of small two-track roads that are not suitable for construction traffic. Ruby would improve unsuitable access roads through grading, filling, and/or widening up to a total road width of 30 feet. A total of 4 new dirt and gravel roads would be constructed up to 15 feet wide to accommodate timber clearing at various locations, at a landowner's request, or access to an aboveground facility. Following construction, Ruby would restore access roads to their preconstruction condition, to the extent practicable, unless otherwise requested by a landowner or land management agency.

Ruby anticipates beginning construction of the Project in 2010 and completing construction in 2011. Construction will occur throughout the year and will overlap the primary migratory bird nesting season (early April through mid-July) for migratory birds, such as songbirds, in the four-state area of the proposed Project. In terms of Project-related disturbances and habitat losses to migratory birds, this primary nesting season is the most important time period to avoid.

The primary construction impacts will be the cutting, clearing, and/or removal of existing vegetation, which provides migratory bird habitat, within the construction work area. These actions will remove nesting habitat and could impact migratory birds through the loss of nests (including those with eggs and/or young), possible loss of migratory birds themselves, reduction in migratory bird productivity, displacement, loss of second nesting opportunities, etc. Most of this impact will occur within the immediate area of Project construction. However, there will likely be additional disturbance or fragmentation effects to migratory birds outside the immediate Project construction area. Also, since migratory birds occur within the Project area year round it should be noted that although the primary concern with the Project is for impacts to nesting migratory birds, that there could also be impacts to migration and wintering habitat for these species as well. Ruby will, to the best extent possible, remove vegetation prior to the nesting season so as to discourage birds from establishing nests in those areas. Some of the vegetation communities that Ruby will restore or allow to revegetate will achieve pre-Project conditions within three to five years after construction. Construction impacts in forested and some sagebrush steppe areas are considered to be long-term because of the time required for trees and sagebrush species (up to 120 years) to reach the same pre-construction condition within the Project route.

Ruby has developed restoration plans specific to each state traversed by the Project. Reclamation of the ROW would be considered successful if upon visual survey and documentation with digital photos (both pre-Project and post-reclamation) the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands. There is also the expected impact of habitat fragmentation, which will be greater than the actual acreage cleared. Many species of migratory birds, and often those of greatest conservation concern, require large blocks of contiguous habitat to successfully reproduce and survive. Construction and maintenance of utility ROWs, and associated new or widened access roads, fragment habitat, with the resulting fragments sometimes losing or having reduced capacity to successfully sustain associated bird species. Much of the Project is located in previously disturbed areas fragmented by ROWs or other development and, as such, fragmentation of areas of contiguous habitat has been limited to the extent possible.

Operational activities on the pipeline after construction would be limited to maintenance of the ROW and inspection, repair, and cleaning of the pipeline. Vegetation on the 50-foot-wide permanent ROW would be maintained by mowing, cutting, and trimming as described in Ruby's Plan, Procedures[1], and other documents (FERC 2010) to maintain accessibility of the ROW and to accommodate pipeline integrity surveys. Typically this would be done using field crews with hand-held power tools or brushhog or similar machinery. Vegetation maintenance generally would be limited to removal of large brush and trees within 25 feet of either side of the pipeline (or 15 feet on either side of the pipeline in wetlands or within 25 feet of waterbodies). Vegetation in certain land use types may not need to be regularly maintained within the 50-foot-wide permanent ROW, including open land, agricultural land, developed land, and open water, which account for approximately 93 percent of the Project area. Ruby has agreed to not conduct any vegetation maintenance activities in sagebrush steppe vegetation during operation of the pipeline.

Monthly aerial (fixed-wing aircraft following Federal Aviation Administration requirements) and annual ground inspections (using ATVs or pickup trucks) by pipeline personnel would assist in identification of soil erosion that may expose the pipe, surface visual clues that may indicate a leak in the line, conditions of the vegetation cover and erosion control measures, unauthorized encroachment on the ROW, excavation activities in the vicinity of the ROW, and other conditions that could present a safety hazard or require preventative maintenance or repairs. The pipeline cathodic protection system also would be monitored and inspected by pipeline personnel periodically to ensure proper and adequate corrosion protection.

1.2 PURPOSE AND NEED OF CONSERVATION PLAN

This plan provides a detailed description of the Project, the history of the conservation plan process, identifies migratory birds detected along the Project route, describes threats to those species, and identifies appropriate offset ratios and habitat conservation funds to replace the loss of habitat services that would occur as a result of pipeline construction.

1.2.1 History of Conservation Plan Development

To comply with the MBTA, BGEPA, and EO 13186, Ruby began discussions with the USFWS to determine the appropriate avian conservation measures for the Project. On 20–21 May 2009, a meeting of biologists from various state and federal natural resource management and wildlife management agencies was convened in Reno, Nevada. The purpose of the meeting was to identify a strategy for the development of conservation plans for species impacted by the Ruby Pipeline Project, including a specific conservation plan for migratory birds.

[1] Appendix F of the Federal Energy Regulatory Commissions' Final Environmental Impact Statement (2010).

2.0 MIGRATORY BIRDS

Migratory birds are found in every ecosystem around the world including all terrestrial habitats. They include a wide variety of bird species such as: songbirds, shorebirds, water birds, woodpeckers, waterfowl, and raptors. Birds are of ecological and economic value to this country and to other countries. They contribute to biological diversity and bring tremendous enjoyment to millions of Americans who study, watch, feed, or hunt these birds throughout the United States and other countries. The United States has recognized the critical importance of this shared resource by ratifying international, bilateral conventions for the conservation of migratory birds.

Ruby conducted raptor surveys in 2008 within 0.5 mile of the outside edge of the proposed construction ROW along the entire pipeline route. Ruby also conducted additional raptor surveys between April 15 and June 15, 2009, within 1 mile of all Project areas. Ruby's contractors conducted nest surveys for migratory birds in 2008-09 within a 300-foot-wide study corridor (Ruby Pipeline corridor) centered on the pipeline route to determine what species are present and to locate nests. Preliminary results of those surveys indicated that 143 species of birds occurred along the Project ROW during those years (Table 1). Of these species, 135 are migratory birds covered under the MBTA with the remaining species being upland game birds or exotic species. Migratory birds documented along the Project route involve a variety of waterfowl, shorebird, waterbird, raptor, songbird, and woodpecker species (Table 1). Species documented as nesting within the Project ROW were primarily songbirds (Table 2).

The 1988 amendment to the Fish and Wildlife Conservation Act mandated USFWS to ~~"i~~identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973." In 2008, USFWS published the most recent list of Birds of Conservation Concern as per the requirements of that mandate (USFWS 2008). The overall goal of this list is to accurately identify the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent the highest conservation priorities. Table 3 displays the status of the Birds of Conservation Concern protected under the MBTA that are documented, likely to occur, or have the potential to occur within the Project ROW. Confirmed presence for some species is based on FERC (2009b). The status within the Project area is defined as the potential for a given species to be present during the nesting season. As these birds are capable of long-distance migrations, it cannot be discounted that some of the species listed below also travel through the Project area during non-nesting season.

Table 1. MBTA-Protected Species Observed During 2008-09 Surveys across the Project [a]

Common Name	Scientific Name	County and State
Canada Goose	*Branta canadensis*	Box Elder, UT; Elko, NV; Klamath, Lake, OR
Gadwall	*Anas strepera*	Lake, OR

Common Name	Scientific Name	County and State
Mallard	*Anas platyrhynchos*	Lincoln, WY; Box Elder, UT; Elko, NV; Lake, OR
Cinnamon Teal	*Anas cyanoptera*	Box Elder, UT; Elko, NV
Northern Shoveler	*Anas clypeata*	Elko, NV; Lake, OR
Green-winged Teal	*Anas crecca*	Box Elder, UT
Common Merganser	*Mergus merganser*	Elko, NV; Lake, OR
Western Grebe	*Aechmophorus occidentalis*	Box Elder, UT
American White Pelican	*Pelecanus erythrorhynchos*	Lincoln, WY; Cache, Box Elder, UT; Lake, OR
Great Blue Heron	*Ardea herodias*	Lincoln, WY; Rich, Box Elder, UT; Elko, NV; Lake, OR
Great Egret	*Ardea alba*	Box Elder, UT; Elko, NV; Lake, OR
Black-crowned Night Heron	*Nycticorax nycticorax*	Rich, Box Elder, UT
White-faced Ibis	*Plegadis chihi*	Box Elder, UT; Lake, Klamath, OR
Turkey Vulture	*Cathartes aura*	Rich, Cache, Box Elder, UT; Elko, Humboldt, Washoe, NV; Lake, Klamath, OR
Osprey	*Pandion haliaetus*	Lincoln, WY
Bald Eagle	*Haliaeetus leucocephalus*	Lake, Klamath, OR
Northern Harrier	*Circus cyaneus*	Lincoln, Uinta, WY; Rich, Cache, Box Elder, UT; Elko, Humboldt, NV; Lake, Klamath, OR
Sharp-shinned Hawk	*Accipiter striatus*	Cache, Box Elder, UT; Lake, OR
Cooper's Hawk	*Accipiter cooperii*	Cache, Box Elder, UT; Elko, NV; Klamath, Lake, OR
Swainson's Hawk	*Buteo swainsoni*	Box Elder, UT; Elko, Humboldt, NV; Lake, Klamath, OR
Red-tailed Hawk	*Buteo jamaicensis*	Uinta, WY; Rich, Cache, Box Elder, UT; Elko, Humboldt, Washoe, NV; Lake, Klamath, OR
Ferruginous Hawk	*Buteo regalis*	Box Elder, UT; Washoe, NV
Golden Eagle	*Aquila chrysaetos*	Lincoln, Uinta, WY; Rich, Cache, Box Elder, UT; Elko, Washoe, NV; Lake, Klamath, OR
American Kestrel	*Falco sparverius*	Uinta, Lincoln, WY; Rich, Cache Box Elder, UT; Elko, Humboldt, Washoe, NV; Lake, Klamath, OR
Peregrine Falcon	*Falco peregrinus*	Uinta, WY; Lake, OR

Common Name	Scientific Name	County and State
Prairie Falcon	*Falco mexicanus*	Rich, UT; Elko, Humboldt, Washoe, NV; Lake, Klamath, OR
Sandhill Crane	*Grus canadensis*	Lincoln, WY; Box Elder, UT; Elko, NV; Lake, Klamath, OR
Killdeer	*Charadrius vociferus*	Lincoln, WY; Box Elder, UT, Elko, Humboldt, Washoe, NV; Lincoln, WY; Lake, Klamath, OR
American Avocet	*Recurvirostra americana*	Box Elder, UT; Lake, OR
Spotted Sandpiper	*Actitis macularius*	Elko, NV; Lake, OR
Willet	*Catoptrophorus semipalmatus*	Elko, NV; Lake, OR
Long-billed Curlew	*Numenius americanus*	Lincoln, WY; Box Elder, UT; Elko, Humboldt, NV; Lake, OR
Wilson's Snipe	*Gallinago delicata*	Box Elder, UT; Elko, NV; Klamath, Lake, OR
Wilson's Phalarope	*Phalaropus tricolor*	Lake, OR
Franklin's Gull	*Leucophaeus pipixcan*	Box Elder, UT; Lake, OR
Ring-billed Gull	*Larus delawarensis*	Lake, OR
California Gull	*Larus californicus*	Box Elder, UT; Lake, OR
Black Tern	*Chlidonias niger*	Lake, OR
Forster's Tern	*Sterna forsteri*	Lake, OR
Mourning Dove	*Zenaida macroura*	Lincoln, Uinta, WY; Rich, Cache, Box Elder, UT; Humboldt, Elko, Washoe, NV; Klamath, Lake, OR
Long-eared Owl	*Asio otus*	Elko, NV; Lake, OR
Burrowing Owl	*Athene cunicularia*	Lincoln, WY; Box Elder, UT; Elko, Humboldt, Washoe, NV
Common Nighthawk	*Chordeiles minor*	Uinta, WY; Box Elder, UT; Elko, Humboldt, Washoe, NV; Klamath, Lake, OR
Common Poorwill	*Phalaenoptilus nuttalli*	Elko, NV
White-throated Swift	*Aeronautes saxatalis*	Washoe, NV
Calliope Hummingbird	*Stellula calliope*	Lake, OR
Broad-tailed Hummingbird	*Selasphorus platycercus*	Rich; Cache, UT
Rufous Hummingbird	*Selasphorus rufus*	Cache, UT; Elko, NV
Belted Kingfisher	*Megaceryle alcyon*	Elko, NV; Lake, OR
Lewis' Woodpecker	*Melanerpes lewis*	Elko, NV
White-headed Woodpecker	*Picoides albolarvatus*	Lake, OR
Williamson's Sapsucker	*Sphyrapicus thyroideus*	Cache, UT
Red-naped Sapsucker	*Sphyrapicus nuchalis*	Cache, UT; Elko, NV; Lake, OR
Hairy Woodpecker	*Picoides villosus*	Cache, UT; Lake, OR
Northern Flicker	*Colaptes auratus*	Uinta, WY; Rich, Cache, UT; Elko, Washoe, NV Lake, Klamath, OR
Olive-sided Flycatcher	*Contopus cooperi*	Cache, UT; Elko, NV

Common Name	Scientific Name	County and State
Western Wood-pewee	*Contopus sordidulus*	Cache, UT; Lake, Klamath, OR
Hammond's Flycatcher	*Empidonax hammondii*	Cache, UT; Humboldt, NV
Gray Flycatcher	*Empidonax wrightii*	Box Elder, UT; Elko, Humboldt, Washoe, NV
Dusky Flycatcher	*Empidonax oberholseri*	Cache, UT; Elko, Humboldt, Washoe, NV; Lake, OR
Say's Phoebe	*Sayornis saya*	Uinta, WY; Box Elder, UT; Elko, Washoe, NV
Western Kingbird	*Tyrannus verticalis*	Rich, Cache, Box Elder, UT; Elko, Humboldt, Washoe, NV; Lake, Klamath, OR
Eastern Kingbird	*Tyrannus tyrannus*	Cache, Box Elder, UT
Loggerhead Shrike	*Lanius ludovicianus*	Box Elder, UT; Elko, Humboldt, Washoe, NV
Northern Shrike	*Lanius excubitor*	Lincoln, WY
Warbling Vireo	*Vireo gilvus*	Cache, Box Elder, UT; Elko, NV
Steller's Jay	*Cyanocitta stelleri*	Box Elder, UT; Washoe, NV; Lake, Klamath, OR
Western Scrub-Jay	*Aphelocoma californica*	Elko, Humboldt, Washoe, NV; Lake, OR
Pinyon Jay	*Gymnorhinus cyanocephalus*	Box Elder, UT; Elko, NV
Clark's Nutcracker	*Nucifraga columbiana*	Elko, Washoe, NV ; Lake, Klamath, OR
Black-billed Magpie	*Pica hudsonia*	Lincoln, Uinta, WY; Rich, Cache, Box Elder, UT; Elko, NV; Lake, Klamath, OR
American Crow	*Corvus brachyrhynchos*	Cache, Box Elder, UT; Lake, OR
Common Raven	*Corvus corax*	Lincoln, Uinta, WY; Cache, Box Elder, UT; Elko, Humboldt, Washoe, NV; Lake, Klamath, OR
Horned Lark	*Eremophila alpestris*	Lincoln, Uinta, WY; Rich, Box Elder, UT; Elko, Humboldt, Washoe, NV; Lake, OR
Tree Swallow	*Tachycineta bicolor*	Uinta, WY; Rich, Cache, Box Elder, UT
Violet-green Swallow	*Tachycineta thalassina*	Uinta, Lincoln, WY; Rich, Box Elder, UT Elko, Washoe, NV; Lake, OR
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Rich, Cache, UT
Bank Swallow	*Riparia riparia*	Box Elder, UT; Elko, NV; Klamath, OR
Cliff swallow	*Petrochelidon pyrrhonota*	Lincoln, WY; Cache, Box Elder, UT; Elko, Humboldt, Washoe, NV ; Lake, OR

Common Name	Scientific Name	County and State
Barn Swallow	*Hirundo rustica*	Uinta, WY; Box Elder, UT; Elko, Humboldt, Washoe, NV; Lake, Klamath, OR
Black-capped Chickadee	*Poecile atricapilla*	Cache, Box Elder, UT; Lake, Klamath, OR
Mountain Chickadee	*Poecile gambeli*	Cache, UT; Washoe, NV; Lake, OR
Juniper Titmouse	*Baeolophus ridgwayi*	Box Elder, UT; Humboldt, Washoe, NV
Bushtit	*Psaltriparus minimus*	Box Elder, UT; Elko, NV; Lake, OR
Red-breasted Nuthatch	*Sitta canadensis*	Cache, UT; Lake, OR
White-breasted Nuthatch	*Sitta carolinensis*	Lake, Klamath, OR
Pygmy Nuthatch	*Sitta pygmaea*	Lake, OR
Brown Creeper	*Certhia americana*	Cache, UT; Klamath, OR
Rock Wren	*Salpinctes obsoletus*	Uinta, WY; Rich, Box Elder, UT; Humboldt, Elko, Washoe, NV; Lake, OR
Canyon Wren	*Catherpes mexicanus*	Washoe, NV
House Wren	*Troglodytes aedon*	Uinta, WY; Cache, Rich, Box Elder, UT; Elko, Humboldt, Washoe, NV
Blue-gray Gnatcatcher	*Polioptila caerulea*	Box Elder, UT; Elko, NV
Western Bluebird	*Sialia mexicana*	Cache, UT; Lake, Klamath, OR
Mountain Bluebird	*Sialia currucoides*	Lincoln, Uinta, WY; Rich, Cache, Box Elder, UT; Elko, Washoe, NV; Lake, Klamath, OR
Hermit Thrush	*Catharus guttatus*	Cache, UT
American Robin	*Turdus migratorius*	Cache, Box Elder, UT; Elko, Humboldt, Washoe, NV; Lake, Klamath, OR
Northern Mockingbird	*Mimus polyglottos*	Humboldt, NV
Sage Thrasher	*Oreoscoptes montanus*	Lincoln, Uinta, WY; Rich, Cache, Box Elder, UT; Elko, Humboldt, Washoe, NV; Lake, OR
Orange-crowned Warbler	*Vermivora celata*	Cache, UT; Elko, NV
Yellow Warbler	*Dendroica petechia*	Rich, Cache, Box Elder, UT; Elko, NV
Yellow-rumped Warbler	*Dendroica coronata*	Cache, UT; Elko, NV; Lake, OR
Black-throated Gray Warbler	*Dendroica nigrescens*	Box Elder, UT
MacGillivray's Warbler	*Oporornis tolmei*	Cache, UT
Common Yellowthroat	*Geothlypis trichas*	Elko, NV
Yellow-breasted Chat	*Icteria virens*	Rich, Cache, UT
Green-tailed Towhee	*Pipilo chlorus*	Cache, Box Elder, UT; Humboldt, Elko, NV; Lake, OR

Common Name	Scientific Name	County and State
Spotted Towhee	*Pipilo maculatus*	Cache, Box Elder, UT; Humboldt, Elko, Washoe, NV
Chipping Sparrow	*Spizella passerina*	Rich; Cache, Box Elder, UT; Elko, Humboldt, Washoe, NV
Brewer's Sparrow	*Spizella breweri*	Lincoln, Uinta, WY; Rich, Box Elder, UT; Elko, Humboldt, Washoe, NV; Lake, OR
Vesper Sparrow	*Pooecetes gramineus*	Lincoln, Uinta, WY; Rich, Cache, Box Elder, UT; Elko, Humboldt, Washoe, NV; Lake, Klamath, OR
Lark Sparrow	*Chondestes grammacus*	Cache, Box Elder, UT; Elko, Humboldt, Washoe, NV; Klamath, OR
Black-throated Sparrow	*Amphispiza bilineata*	Box Elder, UT; Elko, Humboldt, Washoe, NV
Sage Sparrow	*Amphispiza belli*	Uinta, WY; Rich, Box Elder, UT; Elko, Humboldt, Washoe, NV
Savannah sparrow	*Passerculus sandwichensis*	Elko, Humboldt, Washoe, NV; Klamath, OR
Grasshopper Sparrow	*Ammodramus savannarum*	Box Elder, UT
Fox Sparrow	*Passerella iliaca*	Cache, UT
Song Sparrow	*Melospiza melodia*	Rich, UT; Elko, NV
White-crowned Sparrow	*Zonotrichia leucophrys*	Uinta, WY; Cache, Box Elder, UT; Washoe, Elko, NV; Lake, Klamath, OR
Dark-eyed Junco	*Junco hyemalis*	Cache, Box Elder, UT; Washoe, NV; Klamath, Lake, OR
Western Tanager	*Piranga ludoviciana*	Cache, Box Elder, UT; Elko, NV; Lake, OR
Black-headed Grosbeak	*Pheucticus melanocephalus*	Cache, Box Elder, UT; Elko, Washoe, NV
Lazuli Bunting	*Passerina amoena*	Rich, Cache, Box Elder, UT; Washoe, NV; Lake, OR
Indigo Bunting	*Passerina cyanea*	Box Elder, UT
Red-winged Blackbird	*Agelaius phoeniceus*	Lincoln, WY; Box Elder, UT; Elko, Humboldt, Washoe, NV; Lake, Klamath, OR
Western Meadowlark	*Sturnella neglecta*	Cache, Box Elder UT; Elko, Humboldt, Washoe, NV; Lake, Klamath, OR
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	Rich, Cache, Box Elder, UT; Elko, NV; Lake, Klamath OR
Brewer's Blackbird	*Euphagus cyanocephalus*	Lincoln, Uinta, WY; Box Elder, Cache, UT; Humboldt, Elko, Washoe, NV ; Lake, Klamath, OR

Common Name	Scientific Name	County and State
Brown-headed Cowbird	*Molothrus ater*	Cache, Box Elder, UT; Elko, Humboldt, Washoe, NV; Lake, OR
Bullock's Oriole	*Icterus bullockii*	Cache, UT; Elko, NV
Cassin's Finch	*Carpodacus cassinii*	Cache, Box Elder, UT; Humboldt, Washoe, NV
House Finch	*Carpodacus mexicanus*	Washoe, NV
Pine Siskin	*Spinus pinus*	Cache, UT; Washoe, NV
Lesser Goldfinch	*Spinus psaltris*	Klamath, OR
American Goldfinch	*Spinus tristis*	Cache, Box Elder, UT

[a] Bird species arranged taxonomically following the American Ornithologists' Union (AOU) Checklist of North American Birds (AOU 1998) through the 50th Supplement (Chesser et al. 2009).

Table 2 Numbers of MBTA-Protected Breeding Bird Nests and Fledglings Observed Along the Ruby Pipeline Route Based on 2008-09 Surveys

State	County	Common Name	Nests/Fledglings Observed
Wyoming	Lincoln	Killdeer	2 nests
		Mallard	1 nest
		Sage Thrasher	1 fledgling
		Unknown bird	1 nest
	Uinta	Brewer's Sparrow	4 fledglings
		Vesper Sparrow	1 fledgling
		Violet-green Swallow	1 nest
		Unknown Bird	1 nest
Utah	Box Elder	Bullock's Oriole	1 nest
		Cinnamon Teal	1 nest
		Common Raven	2 nests
		Horned Lark	2 nests, 13 fledglings
		Lark Sparrow	8 fledglings
		Lazuli Bunting	1 adult carrying food
		Loggerhead Shrike	1 nest, 1 fledgling
		Red-winged Blackbird	1 nest
		Sage Sparrow	2 nests, 1 fledgling
		Sage Thrasher	1 nest, 1 fledgling
		Spotted Towhee	1 fledgling
		Vesper Sparrow	3 fledglings
		Western Kingbird	1 fledgling
		Western Meadowlark	10 fledglings
		Unknown bird	2 nests
	Cache	American Robin	1 fledgling
		Hammond's Flycatcher	2 fledglings
		House Wren	3 fledglings
		Red-naped Sapsucker	1 nest

State	County	Common Name	Nests/Fledglings Observed
	Rich	Mountain Bluebird	3 fledglings
		Unknown bird	1 nest
Nevada	Elko	American Robin	1 nest
		Black-throated Sparrow	1 nest
		Brewer's Sparrow	2 nests, 7 fledglings
		Common Poorwill	1 nest
		Common Raven	5 nests
		Dusky Flycatcher	1 fledgling
		Sage Sparrow	1 nest
		Sage Thrasher	1 nest, 6 fledglings
		Sparrow species	3 nests
		Spotted Sandpiper	1 fledgling
		Spotted Towhee	1 fledgling
		Western Meadowlark	3 fledglings
		Western Tanager	1 fledgling
		Yellow Warbler	2 fledglings
		Unknown bird	7 nests
	Humboldt	Brewer's Sparrow	7 nests
		Common Nighthawk	2 nests
		House Wren	1 nest
		Sage Sparrow	1 nest
		Western Kingbird	1 nest
		Western Meadowlark	1 nest
		Unknown bird	1 nest
	Washoe	American Robin	2 fledglings
		Black-headed Grosbeak	1 fledgling
		Brewer's Sparrow	13 nests, 1 fledgling
		Chipping Sparrow	1 fledgling
		Dark-eyed Junco	2 fledglings
		Gray Flycatcher	4 nests, 1 fledgling
		Horned Lark	1 nest, 2 fledglings
		Juniper Titmouse	4 fledglings
		Mountain Bluebird	4 fledglings
		Rock Wren	8 fledglings

State	County	Common Name	Nests/Fledglings Observed
		Sage Thrasher	3 nests, 3 fledglings
		Spotted Towhee	1 fledgling
		Vesper Sparrow	7 fledglings
		Western Meadowlark	3 fledglings
		Western Scrub-Jay	5 fledglings
		Unknown bird	2 nests
Oregon	Lake	Brewer's Sparrow	2 nests
		Wilson's Snipe	2 nests
		Killdeer	2 fledglings
		Unknown bird	2 nests
		Mallard	10 fledglings
		Mourning Dove	1 nest

While migratory birds can be found year-round in all North American habitat types, in the interior western United States, species richness and abundance are highest during the migratory and breeding seasons. A total of 135 migratory bird species have been detected in the Project area to date (Table 1). These bird species, and other migratory bird species not identified in that table, may be impacted by construction, operation, and maintenance activities associated with the pipeline. Some representative bird species found in a few of the dominant habitats along the pipeline ROW include sage thrasher (*Oreoscoptes montanus*), Brewer's sparrow (*Spizella breweri*), and sage sparrow (*Amphispiza belli*) in sagebrush steppe; gray flycatcher (*Empidonax wrightii*) and black-throated gray warbler (*Dendroica nigrescens*) in pinyon-juniper woodland; lazuli bunting (*Passerina amoena*) and spotted towhee (*Pipilo maculatus*) in montane shrubland; common yellowthroat (*Geothlypis trichas*) and song sparrow (*Melospiza melodia*) in low-elevation riparian; warbling vireo (*Vireo gilvus*) and red-naped sapsucker (*Sphyrapicus nuchalis*) in montane deciduous forest; and dark-eyed junco (*Junco hyemalis*) and Steller's jay (*Cyanocitta stelleri*) in montane coniferous forest. The conservation measures presented in the Plan are intended to avoid, minimize, and provide habitat conservation for all species protected under the MBTA and BGEPA that may occur within the Project's boundaries.

Table 3. Birds of Conservation Concern That Are Protected Under the MBTA in Wyoming, Utah, Nevada, and Oregon that Are Documented, Likely to Occur, or Have the Potential to Occur Within the Project ROW.

Common Name	Scientific Name	Status in Project Area
Eared Grebe	*Podiceps nigricollis*	Unlikely to occur. Nests on lakes.
American Bittern	*Botaurus lentiginosus*	Potential to occur. Nests in marshes. Possibly present in cattail (*Typha* spp.) marshes, if present, within the Project area.
Golden Eagle	*Aquila chrysaetos*	Confirmed presence in Project area in Lincoln and Uinta counties, WY; Rich, Cache, and Box Elder counties, UT; Elko and Washoe counties, NV; and Lake and Klamath counties, OR. Suitable habitat exists across most of the remainder of the Project area.
Bald Eagle	*Haliaeetus leucocephalus*	Confirmed presence east of Lakeview, Oregon (E&E 2009). Species may occasionally forage or migrate through remainder of Project area.
Swainson's Hawk	*Buteo swainsoni*	Confirmed presence in Box Elder County, UT; Elko and Humboldt counties, NV; and Lake and Klamath counties, OR. Potentially suitable nesting habitat (grasslands) may be present elsewhere within the Project area.
Ferruginous Hawk	*Buteo regalis*	Confirmed presence in Box Elder County, UT and Washoe County, NV. May be present across other open areas across the Project area.
Peregrine Falcon	*Falco rusticolus*	Confirmed presence in Uinta County, WY and Lake County, OR. Potentially suitable nesting habitat (cliffs) may be present along certain portions elsewhere within the Project area.
Prairie Falcon	*Falco mexicanus*	Confirmed presence in Rich County, UT; Elko, Humboldt, and Washoe counties, NV; and Lake and Klamath counties, OR. Potentially suitable nesting habitat (cliffs) may be present along certain portions elsewhere within the Project area.
Yellow Rail	*Coturnicops noveboracensis*	Potential to occur. Nests in marshes in Oregon. Potentially suitable habitat may exist along localized portions of the Project area.
Snowy Plover	*Charadrius alexandrinus*	Unlikely to occur. Nests on sandy beaches along lakeshores.
Mountain Plover	*Charadrius montanus*	Potential to occur. Nests in short grasslands. May be present in localized areas of the Project area.

Common Name	Scientific Name	Status in Project Area
Long-billed Curlew	*Numenius americanus*	Confirmed presence in Lincoln County, WY; Box Elder County, UT, Elko and Humboldt Counties, NV; and Lake County, OR. Potential suitable habitat (grasslands and wetlands) exist across other portions of the Project area.
Marbled Godwit	*Limosa fedoa*	Unlikely to occur. The Project area lies well south of the known nesting range of the species.
Yellow-billed Cuckoo (Western Distinct Population Segment)	*Coccyzus americanus*	Potential to occur. Suitable habitat consists of dense riparian woodlands and shrublands. The species may occasionally be found within that habitat type in the Project area.
Flammulated Owl	*Otus flammeolus*	Potential to occur. Suitable habitat consists of ponderosa pine and quaking aspen forests. The species may be present locally in those habitat types within the Project area.
Burrowing Owl	*Athene cunicularia*	Confirmed presence in Lincoln County, WY, Box Elder County, UT; Elko and Washoe counties, NV; and Lake and Klamath counties, OR. Species may be present elsewhere in project area.
Black Swift	*Cypseloides niger*	Unlikely to occur. The species nests behind montane waterfalls.
Calliope Hummingbird	*Stellula calliope*	Confirmed presence in Lake County, OR. May nest in other montane areas in UT and NV.
White-headed Woodpecker	*Picoides alboarvatus*	Potential to occur. Nests in montane pine woodlands.
Lewis's Woodpecker	*Melanerpes lewis*	Confirmed presence in Elko County, NV. May be present in other suitable habitat areas (cottonwoods and ponderosa pine woodlands) of the Project area.
Williamson's Sapsucker	*Sphyrapicus thyroids*	Confirmed presence in Cache County, UT. May be present in other suitable habitat areas (ponderosa pine woodlands) across other portions of the Project area.
Olive-sided Flycatcher	*Contopus cooperi*	Confirmed presence in Cache County, UT and Elko County, NV. Potentially suitable habitat (montane coniferous forests) exists across other localized areas within the Project area.
Willow Flycatcher	*Empidonax traillii*	Potential to occur. Species nests in shrubby riparian areas.
Loggerhead Shrike	*Lanius ludovicianus*	Confirmed presence in Box Elder County, UT and Elk, Humboldt, and Washoe counties, NV. Likely present in other suitable habitat areas (sagebrush steppe, grasslands) of the Project area.
Gray Vireo	*Vireo vicinior*	Potential to occur in pinyon-juniper/shrublands within Project areas.

Common Name	Scientific Name	Status in Project Area
Pinyon Jay	*Gymnorhinus cyanocephalus*	Confirmed presence in Box Elder County, UT and Elko County, NV. May exist in other suitable habitat areas (pinyon-juniper woodlands) across the Project area.
Juniper Titmouse	*Baeolophus ridgwayi*	Confirmed presence in Box Elder County, UT and Humboldt and Washoe counties, NV. May exist in other suitable habitat areas (pinyon-juniper woodlands) across the Project area.
Veery	*Catharus fuscescens*	Potential to occur in riparian areas dominated by willow (*Salix* spp.) within montane portions of the Project area.
Sage Thrasher	*Oreoscoptes montanus*	Confirmed presence in Lincoln County, WY; Rich, Cache, and Box Elder counties, UT; Elko, Humboldt, and Washoe counties, NV; and Lake County, OR. Suitable habitat (sagebrush steppe) exists across many other portions of the Project area.
Virginia's Warbler	*Vermivora virginiae*	Likely to occur within shrubby areas of the Project area in Utah and Nevada.
Green-tailed Towhee	*Pipilo chlorurus*	Confirmed presence in Cache and Box Elder counties, UT; Humboldt and Elko counties, NV; and Lake County, OR. Suitable habitat (sagebrush steppe) exists across many other portions of the Project area.
Brewer's Sparrow	*Spizella breweri*	Confirmed presence in Lincoln County, WY; Rich and Box Elder counties, UT; Humboldt County, NV; and Lake County, OR. Potentially suitable habitat (sagebrush steppe) is present across many other portions of the Project area and the species most likely inhabits many areas within the Project area away from those areas listed above.
Sage Sparrow	*Amphispiza belli*	Confirmed presence in Uinta County, WY; Rich and Box Elder counties, UT; and Elko, Humboldt, and Washoe counties, NV. Potentially suitable habitat (sagebrush steppe) is present across many other portions of the Project area and the species most likely inhabits many areas within the Project area away from those areas listed above.
Grasshopper Sparrow	*Ammodramus savannarum*	Confirmed presence in Box Elder County, UT. May be present in across other suitable habitats (grasslands) within remainder of the Project area.
Tricolored Blackbird	*Agelaius tricolor*	Potential to occur in cattail marshes within the central Oregon portion of the Project area.

Common Name	Scientific Name	Status in Project Area
Black Rosy-Finch	*Leucosticte atrata*	Unlikely to occur. The species nests in alpine areas, of which the Project area does not extend through.
Cassin's Finch	*Carpodacus cassinii*	Confirmed presence in Cache and Box Elder counties, UT and Humboldt and Washoe counties, NV. May be present across other montane conifer areas within the Project area.

2.1 AVIAN POPULATION STATUS

Several large-scale national efforts to monitor breeding and wintering bird populations have been established in the United States (Butcher et al. 1993). The largest and longest-running of these programs are the U.S. Geological Survey's *Breeding Bird Survey* initiated in 1966 (Sauer et al. 1997), the Institute for Bird Populations *Monitoring Avian Productivity and Survivorship* which began in 1989 (Saracco and Desante 2008), and National Audubon Society's *Christmas Bird Count* that has been conducted since 1900 (National Audubon Society 2009). Migration studies have been conducted on small, localized scales, and for specific species or groups of species (e.g., hawkwatch sites), for similar lengths of time; however, a coordinated and comprehensive monitoring program to study bird populations during migration across the continent is lacking. While national programs are robust at measuring long-term population trends on a continental basis, state-specific analysis using national program data often lacks rigor. State-specific monitoring programs are still evolving.

2.1.1 Range-wide

Trend data from national efforts to monitor breeding bird populations across the continent indicate that many migratory bird populations are in decline (Saracco et al. 2008; Sauer et al. 2008). Declines of North American bird populations, both migratory and non-migratory, and their casual factors have been widely studied and publicized (Carson 1962; Robinson et al. 1995; Saracco and Desante 2008; North American Bird Conservancy Initiative 2009).

2.1.2 State-specific

The U.S. Geological Society (USGS) coordinates and manages the Breeding Bird Survey (BBS). The BBS was established in 1966 and is an avian monitoring program initiated to track the status and trends of North American bird populations. Following a rigorous protocol, BBS data are collected by volunteer participants along thousands of randomly distributed roadside routes across the continent, including Wyoming, Utah, Nevada, and Oregon and data from the BBS can be analyzed at the state level. These state-based analyses, however, are not robust for most species as sample sizes may be affected by habitat specificity, road bias, low population densities, etc., resulting in few individuals being detected. Besides BBS monitoring for the four states crossed by the Ruby Pipeline, each state has implemented more refined programs for monitoring population trends for a specific suite of birds (e.g., riparian obligates) or specific species, and in some cases all bird species, within their political borders. Additional monitoring programs initiated for each of the four states is presented below.

2.1.2.1 Wyoming

Bird populations are currently being monitored by the Rocky Mountain Bird Observatory through a program, *Monitoring Wyoming's Birds* (Leukering et al. 2001; White and Sparks 2008), implemented in 2002 by the Wyoming Partners In Flight group as part of its *Wyoming Bird Conservation Plan* (Nicholoff 2003).

2.1.2.2 Utah

Currently, there is no comprehensive statewide bird monitoring program for Utah. However, the Utah Partners In Flight established a long-term study in 1992 to monitor bird population trends in riparian areas (Parrish et al. 2007).

2.1.2.3 Nevada

Nevada Partners In Flight initiated a statewide bird monitoring program in 2002, called *Nevada Bird Count*, designed and implemented by the Great Basin Bird Observatory (Arsenault 2002; Ammon 2004). In addition, Nevada completed a Breeding Bird Atlas (Floyd et al. 2007) in 2000 that was initiated in 1997. A Breeding Bird Atlas is a survey designed to document the status and distribution of all breeding species of birds that occur within a given area. Most breeding bird atlases are statewide and the basic survey unit is based on USGS 7.5- minute topographic maps. Typically each topographic map is divided into 6 equally sized blocks roughly 10 square miles each and one of these blocks is designated as the priority survey block. Generally BBAs are conducted by volunteer surveyors who document the breeding status of all species encountered. Surveyors register for atlas blocks and agree to provide adequate survey coverage either in the form of hours spent atlasing or number of species encountered – or both. Surveying a block involves documenting all bird species encountered. Their breeding status is recorded based on a series of codes which categorizes them as possible, probable or confirmed.

2.1.2.4 Oregon

Oregon completed a Breeding Bird Atlas in 2001 (Adamus et al. 2001). There is no current comprehensive statewide bird monitoring program for Oregon; however, the Klamath Bird Observatory and USFS Redwood Sciences Laboratory cooperatively operate the *Klamath Bird Monitoring Network*, a collective effort from multiple partners to monitor bird populations in southern Oregon and northern California (USFS 2009).

2.2 THREATS

2.2.1 Project-specific

Threats to migratory birds are multifaceted. The very nature of migration itself is a substantial hurdle, especially for long-distance species and those that must cross inhospitable habitats (e.g., Gulf of Mexico), that most species endure twice a year. And, while birds have adapted and evolved with natural predators, competition for food resources, and changing environmental conditions on a geologic timescale, more recent human-influenced threats add significant additional challenges to their annual survivorship.

Anthropogenic threats to migratory birds can be generally classified as those that alter the natural environment to the detriment of nesting, foraging, or cover services, or directly result in mortality or predispose birds to mortality factors. Habitat fragmentation is another concern that results from direct removal or alteration of intact native bird habitats. Indirect threats to migratory birds include land-use conversions like urbanization, energy development, and agricultural practices that directly remove habitat and render the landscape less attractive to birds for nesting or remove important foraging opportunities. Less-obvious alterations like importation of non-native predators (e.g., outdoor domestic cats are estimated to kill hundreds of millions of birds per year in the United States; American Bird Conservancy 2007) and

increased noise and air pollution pose threats that may result in the reduction of bird populations and reduced functionality of otherwise intact native habitat surrounding a project area.

2.2.1.1 Project-Specific Direct Effects

Direct effects to migratory birds from the Ruby Pipeline Project could include destruction of nests, eggs, and young of birds, and will include the loss of requisite nesting, foraging, roosting, migration, or wintering habitats for bird species. These effects contribute to reduced survivorship and productivity of migratory birds.

2.2.1.2 Project-Specific Indirect Effects

Indirect impacts from the Ruby Pipeline Project could be associated with increased human presence and noise from construction activity that is close enough to disturb actively nesting birds. Construction activity near active nests during incubation or brood rearing could result in nest abandonment; overheating, chilling, or desiccation of unattended eggs or young causing nestling mortality; premature fledging; and ejection of eggs or young from the nest. Ultimately, indirect effects also can lead to reduced fecundity and vigor for populations.

2.2.2 Climate Change

The body of evidence for climate change, whether natural or human-influenced, and confidence in predictive models of climate change continue to advance (Intergovernmental Panel on Climate Change 2007). Changes in regional precipitation patterns and long-term average temperature may affect recovery times for ―injured" habitats. As such, the role climate change may play in shaping the environmental landscape over the next several decades is an issue that cannot be effectively analyzed, as the rate of temperature increase and its effects on habitats are not known constants that can be applied to the ―recovery time" of a given habitat. Of note, the construction and operation of the Ruby Pipeline has been designed to be carbon-neutral (FERC 2009).

3.0 MIGRATORY BIRD CONSERVATION MEASURES

Conservation measures were developed by Ruby for the Ruby Pipeline Project in coordination with USFWS. Detailed descriptions of the Project-specific conservation measures are contained in the Plan. The starting point for these conservation measures was the USFWS policy statement for pipeline projects for conservation of migratory birds. This policy statement is as follows:

1. Avoid any take of migratory birds and/or minimize the loss, destruction, or degradation of migratory bird habitat while completing the proposed project or action.

2. Determine if the proposed project or action will involve below- and/or above-ground construction activities since recommended practices and timing of surveys and clearances could differ accordingly.

3. If the proposed project or action includes a reasonable likelihood that take of migratory birds will occur, then complete actions that could take migratory birds outside of their nesting season. This includes clearing or cutting of vegetation,

grubbing, etc. The primary nesting season for migratory birds varies greatly between species and geographic location, but generally extends from early April to mid-July. However, the maximum time period for the migratory bird nesting season can extend from early February through late August. Also, eagles may initiate nesting as early as late December or January depending on the geographic area. Due to this variability, project proponents should consult with the appropriate Regional Migratory Bird Program (USFWS) for specific nesting seasons. Strive to complete all disruptive activities outside the peak of migratory bird nesting season to the greatest extent possible. Always avoid any habitat alteration, removal, or destruction during the primary nesting season for migratory birds. Additionally, clearing of vegetation in the year prior to construction (but not within the nesting season) may discourage birds from attempting to nest in the proposed construction area, thereby decreasing chance of take during construction activities.

4. If a proposed project or action includes the potential for take of migratory birds and/or the loss or degradation of migratory bird habitat and work cannot occur outside the migratory bird nesting season (either the primary or maximum nesting season), project proponents will need to provide the USFWS with an explanation for why work has to occur during the migratory bird nesting season. Further, in these cases, project proponents also need to demonstrate that all efforts to complete work outside the migratory bird nesting season were attempted, and that the reasons work needs to be completed during the nesting season were beyond the proponent's control.

   Also, where project work cannot occur outside the migratory bird nesting season, project proponents should survey those portions of the project area during the nesting season prior to construction occurring to determine if migratory birds are present and nesting in those areas. In addition to conducting surveys during the nesting season/construction phase, companies may also benefit from conducting surveys during the prior nesting season Such surveys will assist the company in any decisions about the likely presence of nesting migratory birds or sensitive species in the proposed project or work area. While individual migratory birds will not necessarily return to nest at the exact site as in previous years, a survey in the nesting season in the year before construction allows the company to become familiar with species and numbers present in the project area well before the nesting season in the year of construction. Bird surveys should be completed during the nesting season in the best biological timeframe for detecting the presence of nesting migratory birds, using accepted bird survey protocols. USFWS Offices can be contacted for recommendations on appropriate survey guidance. Project proponents should also be aware that results of migratory bird surveys are subject to spatial and temporal variability. Finally, project proponents will need to conduct migratory bird surveys during the actual year of construction, if they cannot avoid work during the primary nesting season (see above) and if construction will impact habitats suitable for supporting nesting birds.

5. If no migratory birds are found nesting in proposed project or action areas immediately prior to the time when construction and associated activities are to occur, then the project activity may proceed as planned.

6. If migratory birds are present and nesting in the proposed project or action area, contact your nearest USFWS Ecological Services Field Office and USFWS Region Migratory Birds Program for guidance as to appropriate next steps to take to minimize impacts to migratory birds associated with the proposed project or action

These priorities assume there are no federally listed endangered or threatened migratory birds species present in the project area, or any other federally listed animal or plant species present in the area, or any designated critical habitat for any listed species. If federally listed species and/or designated critical habitat are present, or they could potentially be present and the project may affect these species, these are subject to outcomes from informal or formal section 7 consultation, under the Endangered Species Act.

** The Migratory Bird Treaty Act prohibits the taking, killing, possession, and transportation, (among other actions) of migratory birds, their eggs, parts, and nests, except when specifically permitted by regulations. While the Act has no provision for allowing unauthorized take, the USFWS realizes that some birds may be killed during construction and operation of energy infrastructure, even if all known reasonable and effective measures to protect birds are used. The USFWS Office of Law Enforcement carries out its mission to protect migratory birds through investigations and enforcement, as well as by fostering relationships with individuals, companies, and industries that have taken effective steps to avoid take of migratory birds, and by encouraging others to implement measures to avoid take of migratory birds. It is not possible to absolve individuals, companies, or agencies from liability even if they implement bird mortality avoidance or other similar protective measures. However, the Office of Law Enforcement focuses its resources on investigating and prosecuting individuals and companies that take migratory birds without identifying and implementing all reasonable, prudent and effective measures to avoid that take. Companies are encouraged to work closely with Service biologists to identify available protective measures when developing project plans and/or avian protection plans, and to implement those measures prior to/during construction or similar activities.

*** Also note that Bald and Golden Eagles receive additional protection under the Bald and Golden Eagle Protection Act (BGEPA). BGEPA prohibits the take, possession, sale, purchase, barter, offer to sell, purchase, or barter, transport, export or import, of any Bald or Golden Eagle, alive or dead, including any part, nest, or egg, unless allowed by permit. Further, activities that would disturb Bald or Golden Eagles are prohibited under BGEPA. ―Disturb" means to agitate or bother a Bald or Golden Eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an Eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. If a proposed project or action would occur in areas where nesting, feeding, or roosting eagles occur, then project proponents may need to take additional conservation measures to achieve compliance with BGEPA. New regulations (50 CFR § 22.26 and § 22.27) allow the take of bald and golden eagles and their nests,

respectively, to protect interests in a particular locality. However, consultation with the Migratory Bird, Ecological Services, and Law Enforcement programs of the Service will be required before a permit may be issued.

4.0 PROJECT AREA HABITATS

Using existing LANDFIRE vegetation mapping (Department of the Interior 2006), Walsh Environmental obtained and redefined the LANDFIRE vegetation data for 14 aggregate vegetation types grouped by dominant land cover and functional vegetation types (Table 4) (Jerry Barker, Walsh Environmental, personal communication with Darcee Killpack, SWCA Environmental Consultants [SWCA], September 2, 2009). To maintain as much consistency as possible with the efforts put forth for the Ruby Pipeline draft environmental impact statement (DEIS), SWCA adopted these 14 aggregate habitat types for their analyses.

Table 4. Aggregation of LANDFIRE Vegetation Types.

Aggregate Vegetation Type	LANDFIRE Vegetation Type
Agriculture/Developed	Agriculture – Cultivated Crops and Irrigated Agriculture
	Agriculture – General
	Agriculture – Pasture/Hay
	Developed – High Intensity
	Developed – Low Intensity
	Developed – Open Space
	Developed – Medium Intensity
	Open Water
Conifer Forest	Abies Concolor Forest Alliance
	California Montane Jeffrey Pine(-Ponderosa Pine) Woodland
	Central and Southern California Mixed Evergreen Woodland
	East Cascades Mesic Montane Mixed-Conifer Forest and Woodland
	Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland
	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland
	Mediterranean California Mesic Mixed Conifer Forest and Woodland
	Mediterranean California Mixed Evergreen Forest
	Mediterranean California Red Fir Forest
	Mediterranean California Subalpine Woodland
	Middle Rocky Mountain Montane Douglas-fir Forest and Woodland

Aggregate Vegetation Type	LANDFIRE Vegetation Type
	North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest
	North Pacific Mesic Western Hemlock-Silver Fir Forest
	North Pacific Mountain Hemlock Forest
	Northern California Mesic Subalpine Woodland
	Northern Rocky Mountain Conifer Swamp
	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest
	Northern Rocky Mountain Foothill Conifer Wooded Steppe
	Northern Rocky Mountain Mesic Montane Mixed Conifer Forest
	Northern Rocky Mountain Ponderosa Pine Woodland and Savanna
	Northern Rocky Mountain Subalpine Woodland and Parkland
	Pseudotsuga menziesii Forest Alliance
	Pseudotsuga menziesii Giant Forest Alliance
	Rocky Mountain Alpine Dwarf-Shrubland
	Rocky Mountain Foothill Limber Pine-Juniper Woodland
	Rocky Mountain Lodgepole Pine Forest
	Rocky Mountain Poor-Site Lodgepole Pine Forest
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
	Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland
	Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland
	Sierra Nevada Subalpine Lodgepole Pine Forest and Woodland
	Sierran-Intermontane Desert Western White Pine-White Fir Woodland
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland
	Southern Rocky Mountain Ponderosa Pine Savanna
	Southern Rocky Mountain Ponderosa Pine Woodland
Deciduous Forest	Quercus garryana Woodland Alliance
	Rocky Mountain Aspen Forest and Woodland
	Rocky Mountain Bigtooth Maple Ravine Woodland
Grassland/Herbaceous	Apacherian-Chihuahuan Semi-Desert Grassland and Steppe

Aggregate Vegetation Type	LANDFIRE Vegetation Type
	Columbia Basin Palouse Prairie
	Inter-Mountain Basins Semi-Desert Grassland
	North Pacific Alpine and Subalpine Dry Grassland
	North Pacific Dry and Mesic Alpine Dwarf-Shrubland or Fell-field or Meadow
	North Pacific Montane Grassland
	Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland
	Northern Rocky Mountain Subalpine-Upper Montane Grassland
	Northwestern Great Plains Mixed-grass Prairie
	Rocky Mountain Alpine Turf
	Rocky Mountain Subalpine-Montane Mesic Meadow
	Southern Rocky Mountain Montane-Subalpine Grassland
Introduced Annual Grass and Forb	Introduced Upland Vegetation-Annual and Biennial Forbland
	Introduced Upland Vegetation-Annual Grassland
Introduced Perennial Grass and Forb	Introduced Upland Vegetation-Perennial Grassland and Forbland
Mixed Deciduous Conifer Forest	East Cascades Oak-Ponderosa Pine Forest and Woodland
	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland
	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland
	Pseudotsuga menziesii-Quercus garryana Woodland Alliance
Pinyon-Juniper Woodlands	Colorado Plateau Pinyon-Juniper Woodlands
	Columbia Plateau Western Juniper Woodland and Savanna
	Great Basin Pinyon-Juniper Woodland
	Inter-Mountain Basins Juniper Savanna
	Juniperus occidentalis Wooded Herbaceous Alliance
	Juniperus occidentalis Woodland Alliance
Riparian	California Montane Riparian Systems
	Inter-Mountain Basins Montane Riparian Systems
	Introduced Riparian Vegetation
	North Pacific Montane Riparian Woodland and Shrubland
	Rocky Mountain Montane Riparian Systems
	Rocky Mountain Subalpine/Upper Montane Riparian Systems
	Western Great Plains Floodplain Systems
Sagebrush Steppe	Artemisia tridentata ssp. vaseyana Shrubland Alliance
	Colorado Plateau Mixed Low Sagebrush Shrubland

Aggregate Vegetation Type	LANDFIRE Vegetation Type
	Columbia Plateau Low Sagebrush Steppe
	Columbia Plateau Steppe and Grassland
	Great Basin Xeric Mixed Sagebrush Shrubland
	Inter-Mountain Basins Big Sagebrush Shrubland
	Inter-Mountain Basins Big Sagebrush Steppe
	Inter-Mountain Basins Montane Sagebrush Steppe
	Wyoming Basins Dwarf Sagebrush Shrubland and Steppe
Salt Desert Shrub	Grayia spinosa Shrubland Alliance
	Inter-Mountain Basins Greasewood Flat
	Inter-Mountain Basins Mat Saltbush Shrubland
	Inter-Mountain Basins Mixed Salt Desert Scrub
	Inter-Mountain Basins Semi-Desert Shrub-Steppe
	Mojave Mid-Elevation Mixed Desert Scrub
Shrubland	Arctostaphylos patula Shrubland Alliance
	California Mesic Chaparral
	California Montane Woodland and Chaparral
	Coleogyne ramosissima Shrubland Alliance
	Columbia Plateau Scabland Shrubland
	Great Basin Semi-Desert Chaparral
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland
	Mediterranean California Alpine Dry Tundra
	Mogollon Chaparal
	North Pacific Avalanche Chute Shrubland
	North Pacific Montane Shrubland
	Northern and Central California Dry-Mesic Chaparral
	Northern Rocky Mountain Montane-Foothill Deciduous Shrubland
	Northern Rocky Mountain Subalpine Deciduous Shrubland
	Quercus gambelii Shrubland Alliance
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland
	Rocky Mountain Lower Montane-Foothill Shrubland
	Sonora-Mojave Semi-Desert Chaparral
	Southern Colorado Plateau Sand Shrubland
Sparsely Vegetated	Barren
	Inter-Mountain Basins Sparsely Vegetated Systems
	North Pacific Sparsely Vegetated Systems
	North Pacific Wooded Volcanic Flowage

Aggregate Vegetation Type	LANDFIRE Vegetation Type
	Rocky Mountain Alpine/Montane Sparsely Vegetated Systems
Wetlands	Western Great Plains Depressional Wetland Systems

Due to the strong emphasis on geographic information system (GIS)-based analysis of construction, restoration, and recovery levels of habitat impacts for the Habitat Equivalency Analysis (HEA) presented below, SWCA could not simply pull categorical habitat and impact analyses numbers from the DEIS to conduct the HEA. Therefore, SWCA re-calculated current habitat conditions (Table 5), as well as impact analyses for the Ruby Pipeline Project HEA. HEA models were only run for the proposed action.

Table 5 summarizes the relative abundance of each aggregate vegetation type surrounding and overlain by the Project for each state. Area for each aggregate vegetation type is rounded and does not depict specific values; thus total acres may not equal the sum of aggregate vegetation types. The aggregate vegetation type summary includes all vegetation types within a 10-mile buffer centered on the pipeline (4,263,922 acres of total area), which was the extent of the vegetation data provided by Walsh Environmental. Sagebrush (*Artemisia* spp.) steppe comprises an overwhelming 2,301,538 acres (54.0%) of the 10-mile buffer centered on the pipeline. Other dominant land cover surrounding and overlain by the Project includes salt desert shrub (14.2%), agriculture and developed areas (7.9%), introduced annual grasses and forbs (4.6%), and conifer forest (4.3%). Sagebrush steppe accounts for approximately 72.7% (233,427 acres) of the Wyoming portion of the 10-mile buffered pipeline area, 35.8% (407,600 acres) of the Utah portion, 65.5% (1,465,853 acres) of the Nevada portion, and 34.3% (194,658 acres) of the Oregon portion. Aggregate vegetation types in Wyoming of significant cover also include salt desert shrub (11.8%) and riparian areas (5.5%). Salt desert shrub (21.7%), agriculture and developed areas (14.7%), deciduous forest (7.0%), and sparsely vegetated areas (6.8%) also occur at higher levels in the Utah portion. In addition to sagebrush steppe, salt desert shrub (13.8%) and introduced annual grasses and forbs (7.3%) account for a large portion of land cover in the Nevada segment. Lower percentages of sagebrush steppe are found in the Oregon portion, which has increased occurrences of conifer forest (27.5%), agriculture and developed areas (18.8%), and pinyon (*Pinus edulis*)-juniper (*Juniperus* sp.) woodlands (5.9%).

The impact the Project will have on migratory bird habitat is dependent on the abundance of the different vegetation types in the proposed pipeline route, vegetation-specific disturbance areas for construction and maintenance, and the time required for each of those vegetation types to recover. These impacts, or habitat injuries, were quantified using HEA.

Table 5. Area and Relative Abundance of Each Aggregate Vegetation Type within a 10-mile Buffer Centered on the Ruby Pipeline Corridor for Each State.

Vegetation Type	Area (acres)								Total Acres[a]	
	Wyoming		Utah		Nevada		Oregon			
Agriculture/ Developed	6,005	1.90%	167,478	14.70%	56,898	2.50%	106,629	18.80%	**337,010**	**7.90%**
Conifer Forest	2,340	0.70%	24,745	2.20%	1,517	0.10%	156,171	27.50%	**184,773**	**4.30%**
Deciduous Forest	4,940	1.50%	79,980	7.00%	38,101	1.70%	9,346	1.60%	**132,367**	**3.10%**
Grassland/ Herbaceous	3,867	1.20%	17,157	1.50%	45,184	2.00%	2,626	0.50%	**68,834**	**1.60%**
Introduced Annual Grass and Forb	5,614	1.70%	25,441	2.20%	162,860	7.30%	2,218	0.40%	**196,133**	**4.60%**
Introduced Perennial Grass and Forb	444	0.10%	5,106	0.40%	2,210	0.10%	107	0.00%	**7,867**	**0.20%**
Mixed Deciduous Conifer Forest	0	0.00%	19,935	1.80%	352	0.00%	170	0.00%	**20,457**	**0.50%**
Pinyon-Juniper Woodland	518	0.20%	24,187	2.10%	73,349	3.30%	33,676	5.90%	**131,730**	**3.10%**
Riparian	17,503	5.50%	12,025	1.10%	17,099	0.80%	21,184	3.70%	**67,811**	**1.60%**
Sagebrush Steppe	233,427	72.70%	407,600	35.80%	1,465,853	65.50%	194,658	34.30%	**2,301,538**	**54.00%**
Salt Desert Shrub	37,885	11.80%	247,421	21.70%	308,011	13.80%	13,066	2.30%	**606,383**	**14.20%**
Shrubland	310	0.10%	29,746	2.60%	7,668	0.30%	19,829	3.50%	**57,553**	**1.30%**
Sparsely Vegetated	8,003	2.50%	77,155	6.80%	58,280	2.60%	7,987	1.40%	**151,425**	**3.60%**
Wetlands	12	0.00%	29	0.00%	0	0.00%	0	0.00%	**41**	**0.00%**
Total Acres*	**320,868**	**100%**	**1,138,005**	**100%**	**2,237,382**	**100%**	**567,667**	**100%**	**4,263,922**	**100%**

[a] Area for each aggregate vegetation type is rounded and does not depict specific values; thus total acres may not equal the sum of aggregate vegetation types.

5.0 MIGRATORY BIRD HABITAT EQUIVALENCY ANALYSIS METHODS

A Habitat Equivalency Analysis (HEA) approach was used to determine habitat compensation ratios for the Project. The HEA incorporated all surface disturbing components of the Project, including construction and operation of the buried natural gas pipeline ROW, temporary extra workspaces, staging areas, water appropriation sites, contractor yards, pipe yards, construction camps, temporary housing facilities, and new and to-be-improved access roads. HEA is a method of quantifying interim and permanent habitat injuries, measured as a loss of habitat services from pre-disturbance conditions, and scaling compensatory habitat requirements to those injuries (King 1997; Dunford et al. 2004; Allen et al. 2005; Kohler and Dodge 2006; National Oceanic and Atmospheric Administration 2006, 2009). Habitat services are generally defined by a metric (e.g., species density, wetland oxygen level) that represents the functionality of that habitat (i.e., the ability of that habitat to provide ―services" such as nest sites, prey populations, cover from predators). Interim habitat injuries are those habitat services that are absent during disturbance and during vegetation restoration that would have been available if that disturbance had not occurred. Permanent habitat injuries are those habitat injuries remaining after vegetation recovery is complete (e.g., permanent roads). The objective of an HEA is to replace lost services with like services, providing a 1:1 replacement ratio for interim and permanent injury.

5.1 HABITAT SERVICE LEVEL METRIC

For the purposes of this HEA, habitat for migratory birds is the service of interest. The most direct method to quantify the quality of migratory bird habitat would be to define and compare the number of migratory birds. However, the survey effort necessary to provide this metric for the entire length of the pipeline and the 10-mile buffer is not logistically feasible. Therefore, SWCA developed a methodology for determining indicators of habitat quality used as surrogate measures of the habitat services provided. The metric representing the habitat services provided to migratory birds contains the product of three equally-weighted scores: 1) importance of vegetation type to migratory birds, 2) size of the vegetation patch relative to home range sizes of indicator bird species for that vegetation type, and 3) LANDFIRE Fire Regime Condition Class. The product of these scores is the habitat quality score.

5.1.1 Vegetation Type

Using existing LANDFIRE vegetation mapping (Department of the Interior 2006), Walsh Environmental obtained and redefined the LANDFIRE vegetation data for 14 aggregate vegetation types grouped by dominant land cover and functional vegetation types (Table 6) (Jerry Barker, Walsh Environmental, personal communication with Darcee Killpack, SWCA, September 2, 2009). These 14 aggregate vegetation types were given a score (1 to 3; low to high value) based on their importance to migratory birds (Table 6). This is a qualitative score based on sound ecological principle. In general, native vegetation types (e.g., salt desert shrub, pinyon-juniper woodlands) were ascribed a high score (i.e., 3), whereas non-native vegetation types (e.g., introduced annual grass and forb) were scored as low quality habitat (i.e., 1). The only vegetation type to receive a score of 2 was agriculture/developed. Although the development components of that aggregate vegetation type are of little overall

value to migratory bird species, SWCA considered the value of agricultural fields, specifically hay fields, to some grassland bird species of conservation interest, like bobolink (*Dolichonyx oryzivorus*) and grasshopper sparrow (*Ammodramus savannarum*), to be significant enough to warrant the moderate importance score.

Table 6. Importance Score Ascribed to Aggregate Vegetation Types.

Aggregate Vegetation Type	Importance Score (low 1 to high 3)
Agriculture/Developed	2
Conifer Forest	3
Deciduous Forest	3
Grassland/Herbaceous	3
Introduced Annual Grass and Forb	1
Introduced Perennial Grass and Forb	1
Mixed Deciduous Conifer Forest	3
Pinyon-Juniper Woodland	3
Riparian	3
Sagebrush Steppe	3
Salt Desert Shrub	3
Shrubland	3
Sparsely Vegetated	1
Wetlands	3

5.1.2 Patch Size

Existing patches of habitat were prioritized by determining the area (acreage) necessary to support either an ~~"u~~mbrella" bird species or 10 pairs of an avian species dependent on, or characteristic of, that habitat type (Table 7). Migratory bird species used for this prioritization were taken from the U.S. Fish and Wildlife Service (FWS) Birds of Conservation Concern list for Bird Conservation Regions 9, 10, and 16 (FWS 2008), conservation strategies for Wyoming and Nevada (Wyoming Game and Fish Department [WGFD] 2005; Great Basin Bird Observatory 2005), or were considered by SWCA ornithologists to be representative of that habitat type when a species of conservation interest could not be determined (Table 8).

The value of patch size within each aggregate vegetation type was scored (1 to 3; low to high) based on the acreage available to support indicator species (Tables 7 and 8). Table 8 provides the rationale and resources used to determine the species and acreages used in the prioritization process. Patches were defined as continuous vegetation of the same type. Natural habitat discontinuities due to habitat ecotones created by perennial rivers and human-caused habitat fragmentation from paved roads or construction disturbance defined the boundaries between patches of the same vegetation type.

Table 7. Acreages Used to Determine Habitat Quality Value for Contiguous Patches within each Aggregate Vegetation Type.

Aggregate Vegetation Type	Patch Habitat Quality Value (low 1 to high 3)		
	1	2	3
Agriculture/Developed	<75 acres	>75 acres	n/a
Conifer Forest	<100 acres	100-257 acres	>257 acres
Deciduous Forest	<30 acres	30-99 acres	>99 acres
Grassland/Herbaceous	<75acres	75-168 acres	>168 acres
Introduced Annual Grass and Forb	All patches	n/a	n/a
Introduced Perennial Grass and Forb	All patches	n/a	n/a
Mixed Deciduous Conifer Forest	<30 acres	30-393 acres	>393 acres
Pinyon-Juniper Woodland	<32 acres	32-247 acres	>247 acres
Riparian	n/a	n/a	All patches
Sagebrush Steppe	<50 acres	50-126 acres	>126 acres
Salt Desert Shrub	<116 acres	116-387 acres	>387 acres
Shrubland	<22 acres	22-40 acres	>40 acres
Sparsely Vegetated	All patches	n/a	n/a
Wetlands	n/a	n/a	All patches

5.1.3 Fire Regime Condition Class

The LANDFIRE Fire Regime Condition Class represents the magnitude of vegetation community alteration between historical to current conditions. The Fire Regime Condition Class was used as a surrogate for habitat integrity. The fire classes were: 1 = low vegetation departure from historical conditions; 2 = moderate vegetation departure; and 3 = high vegetation departure. SWCA assumed that low vegetation departure was an indication of relatively high habitat integrity and that habitat injuries would result in a change in fire class (i.e., a higher vegetation departure). To be consistent with the other metrics of habitat quality used for migratory birds, the rankings were inversed: Regime Condition Class 1 was assigned a rank 3, and Regime Condition Class 3 was assigned a rank 1 for the HEA.

The three scores were multiplied to produce the metric of habitat quality (service level). Thus, the lowest quality habitat would score a 1 (= 1 × 1 × 1) and the highest quality habitat would score 27 (= 3 × 3 × 3) using this metric. These values are not continuous due to the multiplicative nature of the formula. Values possible are 1, 2, 3, 4, 6, 8, 9, 12, 18, and 27. As such, the multiplicative scale allows for definitive quantification of high-quality habitats from those that are of lower quality. High-quality habitat patches are expected to be rare in the environment, given the level of existing disturbance in and around the proposed Project area, and would merit a higher avian habitat compensation ratio for incurred injury.

Table 8. Use of Indicator Species to Evaluate Vegetation Patch Size, Including Assigned Value of Vegetation Importance to Migratory Birds (1 Low to 3 High).

Aggregate Vegetation Type	Indicator Species	Minimum Patch/Territory Size (acres)	Rationale	Citation
Agriculture / Developed (2)	Bobolink	75.0	The *Comprehensive Wildlife Conservation Strategy for Wyoming* calls for managing areas >75 acres in size for sites where this species nests. Analysis considered Agriculture/Developed lands below 75 acres as less desirable habitat for migratory birds and only used bobolink to identify the high-quality category. All other Agriculture/Developed sites are categorized as a 1 (low quality).	Wyoming Game and Fish Department (WGFD) (2005)
Conifer Forest (3)	White-headed woodpecker	257.0	Breeding territories in Oregon ranged from 104 hectares (ha) in continuous forest to 321 ha in fragmented forest. Analysis used the 104 ha as the minimum requirement for patch size.	Dixon (1995)
	Williamson's sapsucker	10.0	The *Wyoming Bird Conservation Plan* lists territory size as 1 pair per 10 acres (extrapolated to 10 pairs and 100 acres).	Nicholoff (2003)
Deciduous Forest (3)	Red-naped sapsucker	9.9	Territory size in Blue Mountains of Oregon and Washington estimated at 4 ha (extrapolated to 10 pairs and 99 acres).	Thomas et al. (1979) *in* Walters et al. (2002)
	Warbling vireo	3.0	Territory sizes across their range are consistently around 1.2 ha (extrapolated to 10 pairs and 30 acres).	Gardali and Ballard (2000)
Grassland / Herbaceous (3)	Long-billed curlew	168.0	Nest density in Utah ranged from 0.64–2.36 males/square kilometer (km). Analysis used the mean 1.5 pair/square km and extrapolated to 1 pair/168 acres.	Paton and Dalton (1994) *in* Fellows and Jones (2009)
	Grasshopper sparrow	75.0	The *Comprehensive Wildlife Conservation Strategy for Wyoming* calls for managing areas >75 acres in size for sites where this species nests.	WGFD (2005)
Introduced Annual Grass and Forb (1)	None		No species are provided for this cover type due to its perceived low value to migratory bird species as breeding habitat within the Ruby Pipeline corridor, regardless of patch size.	

Aggregate Vegetation Type	Indicator Species	Minimum Patch/Territory Size (acres)	Rationale	Citation
Introduced Perennial Grass and Forb (1)	None		No species are provided for this cover type due to its perceived low value to migratory bird species as breeding habitat within the Ruby Pipeline corridor, regardless of patch size.	
Mixed Deciduous Conifer Forest (3)	Flammulated owl	39.3	In Oregon, the home range mean size during incubation was 15.9 ha (extrapolated to 10 pairs and 393 acres).	Montana Natural Heritage Program (no date)
	Warbling vireo	3.0	Territory sizes across their range are consistently around 1.2 ha (extrapolated to 10 pairs and 30 acres).	Gardali and Ballard (2000)
Pinyon-Juniper Woodlands (3)	Pinyon jay	247.0	The species breeds colonially in areas approximately 100 ha in size.	Balda and Bateman (1972) *in* Balda (2002)
	Juniper titmouse	3.2	Territory size in western Nevada estimated at 1.3 ha (extrapolated to 10 pairs and 32 acres).	Panik (1976) *in* Cicero (2000)
Riparian (3)	None		The importance of riparian habitats to multiple species of breeding birds in the western United States is well-established. The analysis considered all riparian to have a value of 3, regardless of patch size.	
Sagebrush Steppe (3)[a]	Sage sparrow	12.6	For conservation priority species, an average count per 40 ha by primary habitat type within two major physiogeographic regions, Great Basin and Mohave, was used. The average count for sage sparrow (15.7 individuals/40 ha) for the habitat type Sagebrush within the Great Basin region was extrapolated to 10 pairs/126 acres.	Great Basin Bird Observatory (GBBO) (2005)
	Sage thrasher	50.0	The *Comprehensive Wildlife Conservation Strategy for Wyoming* calls for maintaining 50-acre stands of unfragmented sagebrush habitat.	WGFD (2005)

Aggregate Vegetation Type	Indicator Species	Minimum Patch/Territory Size (acres)	Rationale	Citation
Salt Desert Shrub (3)	Loggerhead shrike	38.7	For each conservation priority species, an average count per 40 ha by primary habitat type within two major physiogeographic regions, Great Basin and Mohave was used. The average count for loggerhead shrike (5.1 birds/40 ha) for the habitat Salt Desert Scrub within the Great Basin region was extrapolated to 10 pairs/387 acres.	GBBO (2005)
	Black-throated sparrow	11.6	For each conservation priority species, an average count per 40 ha by primary habitat type within two major physiogeographic regions, Great Basin and Mohave, was used. The average count for black-throated sparrow (17 birds/40 ha) for the habitat Salt Desert Scrub within the Great Basin region was extrapolated to 10 pairs/116 acres.	GBBO (2005)
Shrubland (3)	Virginia's warbler	4.0	Mean territory size near Flagstaff, Arizona, was 1.64 ha (extrapolated to 10 pairs and 40 acres).	Fischer (1978) *in* Olson and Martin (1999)
	Green-tailed towhee	2.2	Mean territory size in Utah shrub-steppe habitat was estimated at 0.9 ha (extrapolated to 10 pairs and 22 acres).	Dotson (1971) *in* Dobbs et al. (1998)
Sparsely Vegetated (1)	None		No species are provided for this cover type due to its perceived low value to migratory bird species as breeding habitat within the Ruby Pipeline corridor, regardless of patch size.	
Wetlands (3)	None		The importance of riparian habitats to multiple species of breeding birds in the western United States is well-established. The analysis considered all riparian to have a value of 3, regardless of patch size.	

[a] SWCA did not consider greater sage-grouse a suitable umbrella species for migratory birds in sagebrush steppe, especially sagebrush obligates that are of conservation interest, as Crawford et al. (2004) states: ―Sage-grouse is not a species that can thrive only where large homogeneous stands of any single plant species occupy the bulk of the landscape. While recommendations exist for the kinds of habitats that are preferred at different times in the life cycle of the bird (Connelly et al. 2000), the proportions of habitats that are optimum or even tolerable remains unknown. It is likely that sage-grouse are responding to habitat attributes at multiple scales while other sagebrush obligates may be responding at different scales."

5.2 EXTENT OF INJURY ANALYSIS

Separate HEA models were created for each of the 14 aggregate vegetation types and state (Wyoming, Utah, Nevada, and Oregon) for migratory birds. The area used in the HEA injury analysis was the Pipeline Intersect, not all acres in the 10-mile buffer around the pipeline. This means that the HEA calculations are based on only about 38% of the 4,263,922 total habitat acres that occur in the 10-mile buffer (Table 5). The Pipeline Intersect was defined as the area of the vegetation patches that came in contact with an area disturbed by construction (Pipeline Intersect in Figure 1), including the pipeline right-of-way (ROW), access roads, compressor stations, and storage yards for equipment and materials within a 10-mile buffer centered on the pipeline (i.e., 5 miles on either side of the pipeline). The Pipeline Intersect was limited to the 10-mile buffer because that was the extent of the data provided by Walsh Environmental (Jerry Barker, Walsh Environmental, personal communication with Darcee Killpack, SWCA Environmental Consultants [SWCA], September 2, 2009; See Section 4.0), and few contiguous vegetation patches extended outside this buffer. The Construction ROW includes the acreage of direct and indirect disturbance during pipeline construction. Recovery ROW includes the acreage of disturbance after construction and reseeding is complete, but vegetation is not yet established. In this example, polygons 1, 2, and 5 are intersecting the pipeline while polygons 3, 4, and 6 are not. The Construction ROW and Restoration ROW are contained within the Pipeline Intersect. By using the Pipeline Intersect as the area of analysis for the HEA models, changes in habitat functionality due to patch fragmentation are quantified in addition to those impacts occurring in the pipeline ROW.

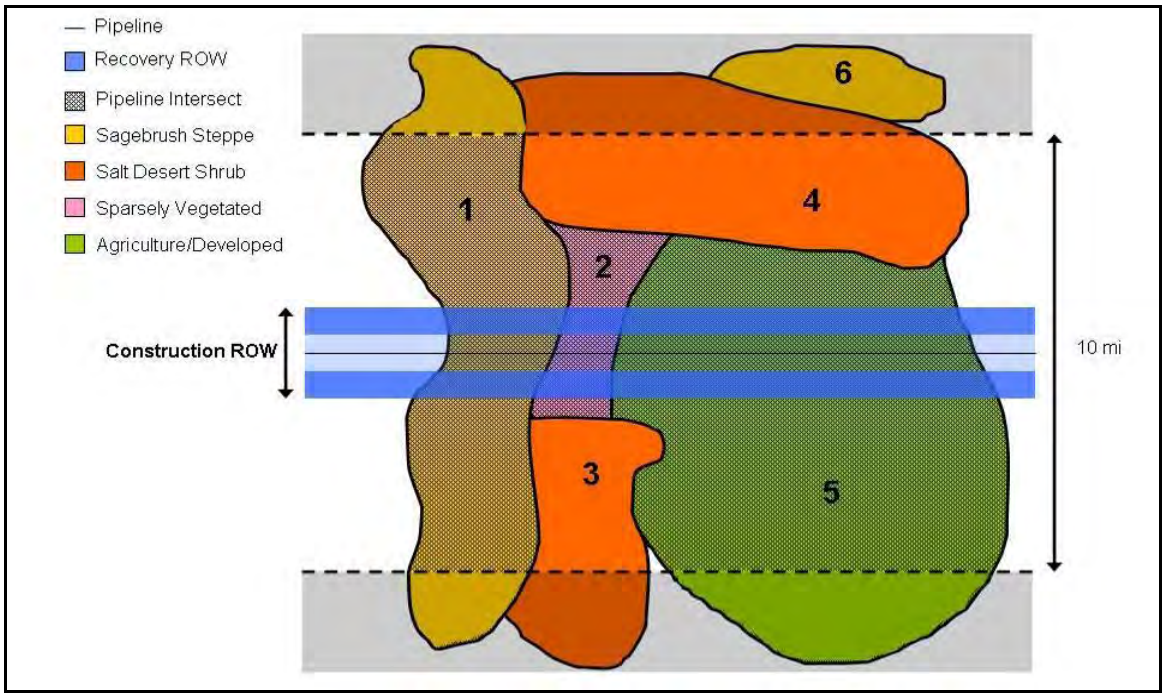


Figure 1. Multiple levels of vegetation measurements throughout the Ruby Pipeline corridor. Note: Distances in diagram are not to scale.

5.3 HABITAT AVAILABLE BY SERVICE LEVEL AND PROJECT CONDITION

All three scores (vegetation type, patch size, and fire condition class) were applied using ESRI ArcGIS 9.3 GIS software (see detailed description in next section) to quantify the number of acres within each of the habitat quality score categories (1, 2, 3, 4, 6, 8, 9, 12, 18, and 27) at four disturbance-level condition types over the life of the Project (Baseline, Construction, Restoration, and Recovery) for each state and aggregate vegetation type.

A) **Baseline**—The baseline condition quantifies habitat available to birds in the Pipeline Intersect before disturbance (pre-construction).

B) **Construction**—The construction condition quantifies habitat available to birds in the Pipeline Intersect during construction. This calculation assumes 100% loss of habitat functionality for migratory birds within the construction ROWs (Table 9) and other disturbed sites. At Construction, vegetation patches identified at Baseline would be fragmented by the ROW, temporary access roads, and other pipeline-associated infrastructure.

C) **Restoration**—The restoration condition quantifies habitat available to birds in the Pipeline Intersect after construction is complete and some habitat services are restored to the disturbed sites, generally as a result of initial Ruby reclamation efforts that would reduce ROW disturbance (Table 9). At Restoration, pipeline construction and re-seeding are assumed to be complete, but baseline vegetation conditions would not yet have recovered; thus vegetation patches identified at Baseline would still be fragmented by the ROW, temporary access roads, and other pipeline-associated infrastructure.

D) **Recovery**—The recovery condition quantifies habitat available to birds in the Pipeline Intersect after the vegetation has recovered. This calculation assumes no loss of habitat functionality for birds except in areas of permanent disturbance (e.g., compressor stations). At Recovery for vegetation types without trees, the vegetation patches would no longer be fragmented by the pipeline or temporary access roads. However, because a Recovery ROW (Table 9) would be maintained free of trees, vegetation types with trees would sustain permanent injury and patch fragmentation.

The ROW widths provided by Ruby were 195 feet for forested areas, 75 feet for wetlands, and 115 feet for the majority of the pipeline. These ROW widths were designated as the restoration ROW (Table 9). Many species of migratory birds are sensitive to noise, dust, and human presence. For this reason, it was assumed that the impact during construction would exceed restoration ROW widths. The construction ROW, defined as the area affected by dust settlement and heavy vehicle traffic, was calculated by adding 35 feet in width to the ROW. For four locations classified as ―long wetlands" along the pipeline route (areas north of Brigham City, Utah; the Bear and Little rivers, Utah; Goose Lake, Oregon; and the Hams Fork in Wyoming) the width of the restoration ROW through these wetlands changed from the 75 feet to 195 feet (Nicole Pedigo, Ruby Pipeline, personal communication with Larry Semo, SWCA, August 26, 2009). The construction ROW for these four wetlands was assumed to be 230 feet.

Table 9. Right-of-Way Widths Used to Calculate Vegetation Disturbance at the Pipeline for Construction, Restoration, and Recovery.

Aggregate Vegetation Types	Construction ROW Width (feet)	Restoration ROW Width (feet)	Recovery ROW Width (feet)[a]
Agriculture/Developed	150	115	0
Conifer Forest	230	195	60
Deciduous Forest	230	195	60
Grassland/Herbaceous	150	115	0
Introduced Annual Grass and Forb	150	115	0
Introduced Perennial Grass and Forb	150	115	0
Mixed Conifer Deciduous Forest	230	195	60
Pinyon-Juniper Woodlands	230	195	60
Riparian[b]	110	75	0
Sagebrush Steppe	150	115	0
Salt Desert Shrub	150	115	0
Shrubland	150	115	0
Sparsely Vegetated	150	115	0
Wetlands	110	75	0

[a] Only in forested vegetation classes. The Recovery ROW will be maintained without trees.

[b] In four locations along the pipeline, the ROW changes to 230 feet for Construction and 195 feet for Restoration.

5.4 GIS CALCULATION OF HABITAT AVAILABLE BY SERVICE LEVEL AND PROJECT CONDITION

GIS was used to provide area calculations for the HEA for migratory birds. Details on the GIS methods, data inputs, and resulting products are described below.

5.4.1 Vegetation Data

The analysis was based on LANDFIRE vegetation type and Fire Regime Condition Class data (Department of the Interior 2006). SWCA used a modified vegetation classification supplied by Walsh Environmental which simplified the original 119 vegetation classifications by combining related vegetation cover types into 14 new aggregate vegetation categories (Jerry Barker, Walsh Environmental, personal communication with Darcee Killpack, SWCA, September 2, 2009). These aggregate vegetation types are summarized in Table 4. Each aggregate vegetation type was then attributed with a vegetation identification value (Table 10).

Table 10. Aggregate Vegetation Identification Value.

Aggregate Vegetation Types	Vegetation Identification Values
Agriculture/Developed	0
Sagebrush Steppe	1
Salt Desert Shrub	2
Grassland/Herbaceous	3
Introduced Annual Grass and Forb	4
Introduced Perennial Grass and Forb	5
Pinyon-Juniper Woodland	6
Mixed Conifer Deciduous Forest	7
Deciduous Forest	8
Conifer Forest	9
Shrubland	10
Riparian	11
Wetlands	12
Sparsely Vegetated	13

The individual polygons of the LANDFIRE data classes were dissolved based on the aggregate vegetation identification value (hereafter referred to as the Vegetation Layer) to allow a single polygon in the dataset to reflect a single patch of a vegetation type. It was important that the data stay as single-part polygons, versus multi-part, to ensure that each record in the data layer's attribute table reflected an individual vegetation patch.

A Vegetation Qualitative Score was added to the Vegetation Layer attribute table. The ranking (1 to 3; low to high value) was based on their importance to migratory birds (Table 6).

The LANDFIRE Fire Regime Condition Class data, also used in the analysis (hereafter referred to as the Fire Layer), had to be reclassified to be consistent with the other metrics of habitat quality used for migratory birds. The rankings were inversed so Fire Condition Class 1 was assigned a rank of 3 and Fire Condition Class 3 was assigned a rank of 1.

5.4.2 Other Data Inputs

Habitat patches were defined as continuous vegetation of the same types. Natural habitat discontinuities due to habitat ecotones created by perennial rivers and human-caused habitat fragmentation from paved roads or construction disturbance defined the boundaries between patches of the same vegetation type. As such, to ensure that existing roads and perennial streams were correctly reflected in the LANDFIRE vegetation data and the vegetation patches were being segmented by these features, road and perennial stream data were incorporated into the Vegetation Layer. The roads and stream data were obtained from ESRI's Data and Maps DVDs (ESRI 2008). The roads data included major highways, highways, major roads, local roads, minor road or vehicular trail, special road features (roundabouts, service drives), ramps, ferries, and private roads. The stream data were selected to include only perennial

streams. The FCODE_DESC field was queried based on "Stream/River: Hydrographic Category = Perennial." The roads and perennial streams were then overlaid with the Vegetation Layer resulting in some segmenting of the vegetation polygons by these road and water features.

5.4.3 Disturbance Areas

Ecology and Environment, Inc. (E&E) supplied GIS data layers for known disturbance areas (Luis Murillo, E&E, personal communication with Darcee Killpack, SWCA, August 25, 2009). These areas are comprised of known compressor stations, staging areas, storage yards, and extra workspace areas. E&E also provided construction access roads as part of the disturbance datasets. These access roads were compared to the original LANDFIRE data and the roads not already included in the dataset were selected out. These new roads were then buffered to a total width of 35 feet to account for the disturbance of a general two-lane road. A total disturbance area layer was then created that joined all the individual features.

Because each vegetation type required different ROW widths, the total disturbance area layer was joined to each ROW layer to create six disturbance layers based on each ROW configuration (see Table 9). These layers were Construction Forested, Construction Non Forested, Construction Wetland/Riparian, Restoration Forested, Restoration Non Forested, and Restoration Wetland/Riparian.

The Wetland/Riparian disturbance warranted a unique disturbance layer. In four locations labeled long wetlands along the pipeline route (areas north of Brigham City, Utah; the Bear and Little rivers, Utah; Goose Lake, Oregon; and the Hams Fork in Wyoming) the width of the ROW through these wetlands changed from the 75 feet to 195 feet (Nicole Pedigo, Ruby Pipeline, personal communication with Larry Semo, SWCA, August 26, 2009). Therefore, for the Wetlands/Riparian disturbance layer, the ROW width grew for Construction and Restoration in these four areas only to 230 feet and 195 feet, respectively.

Disturbance for Recovery was calculated as permanent disturbance, as it is only comprised of the compressor station areas and the forested vegetation types. All forested vegetation types would not be allowed to return to the pre-existing state as a 60-foot-wide corridor centered on the pipeline would be maintained and cleared of all trees All other vegetation types were assumed to return to their pre-existing state upon recovery, expect those under the compressor station footprints.

The 10-mile-wide corridor centered on the pipeline was joined to each of the disturbance layers to ensure all polygons were maintained later in the analysis when the intersections were preformed.

5.4.4 Baseline

The Vegetation Layer was queried and patches that were in contact with any of the disturbance areas were selected. Because the geographic extent of the disturbance was different for forested and non-forested vegetation types, two baseline layers were created using the Construction Forested and Construction Non Forested Disturbance layers. The

resulting baseline data are hereafter called Forested Baseline Patches and Non Forested Baseline Patches.

A Patch Size Value was added to the Forested Baseline Patches and Non Forested Baseline Patches attribute tables. The Forested Baseline Patches and Non Forested Baseline Patches were then queried based on the size (number of acres) of each patch for each vegetation type. The selection was then attributed with a Patch Size value based on the acreage available to support indicator species. These values can be seen in Table 7.

The Baseline Patches (both Forested and Non Forested) layers were then intersected with the Fire Layer to incorporate the Fire Regime Class values into the analysis. The acre attribute of each new polygon, created from the intersection, was updated to reflect the new size of the polygon. Figure 2 demonstrates how the original patches are intersected by the Fire Regime Class (the hatched areas with values of 3, 2, and 1). The new areas or polygons resulting from the intersection are then calculated for the acreage and used in the subsequent steps in the analysis.

To determine an overall ranking of habitat quality, the three ranking values (Vegetation Qualitative Ranking, Patch Size Value, and Fire Regime Class) were multiplied together. The result was a Baseline Habitat score for each polygon in the Forested and Non Forested Baseline Patches layers.

The final product of the analysis was a table of baseline acreage of each Baseline Habitat score by vegetation type to be used in the HEA. To produce the acreage values, the attribute table was selected for vegetation type and the acres were summed by habitat score. The individual vegetation type tables were combined into a summary table that showed the baseline acres of each habitat quality score for each of the 14 vegetation types.

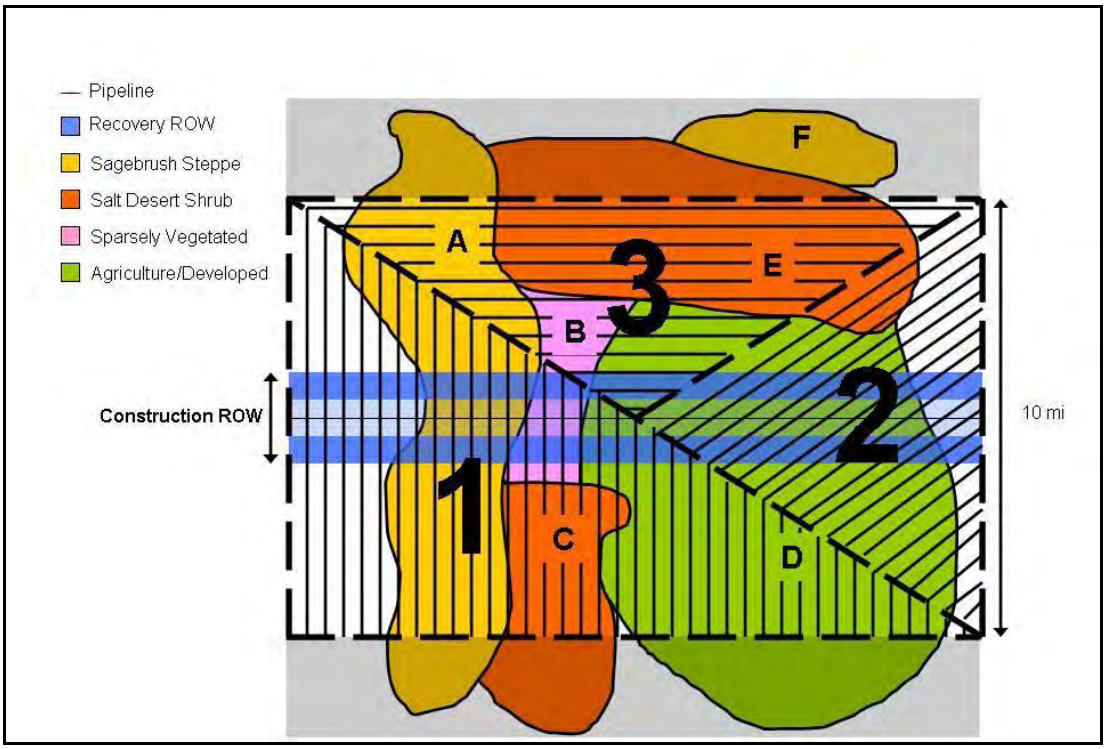


Figure 2. Development of the Baseline patches layer.

5.4.5 Construction

To determine the impacts of construction, the originally selected patches from the Forested Baseline Patches were intersected with the Construction Forested disturbance layer (hereafter referred to as Construction Forest Patches). The originally selected patches from the Non Forested Baseline Patches were intersected with the Construction Non Forested disturbance layer (hereafter referred to as Construction Non Forest Patches) and the Construction Wetland/Riparian disturbance layer (hereafter referred to as Construction Wetland Patches). The acre attribute of each new polygon for each layer, created from the intersections, was updated to reflect the new size of the polygon or patch. The polygons that were classified as disturbance were selected and the vegetation type identification value was reclassified to sparsely vegetated or 13, which includes barren land.

A Patch Size Value was added to the Construction Forest Patches, Construction Non Forest Patches, and Construction Wetland Patches attribute tables. Each layer was then queried based on the size (number of acres) of each patch for each vegetation type. The selection was then attributed with a Patch Size value based on the acreage available to support indicator species. These values can be seen in Table 7.

The Construction Patches (Forested, Non Forested, and Wetland) layers were then intersected with the Fire Layer to incorporate the Fire Regime Class values into the analysis. The acre attribute of each new polygon, created from the intersection, was updated to reflect the new size of the polygon.

To determine an overall ranking of habitat quality, the three ranking values (Vegetation Qualitative Ranking, Patch Size Value, and Fire Regime Class) were multiplied together. The result was a Construction Habitat score for each polygon in the Construction Forested, Non Forested, and Wetland Patches layers.

The final product of the analysis was a table of construction acreage of each Construction Habitat score by vegetation type to be used in the HEA. To produce the acreage values, the attribute table was selected for vegetation type and the acres were summed by habitat score. The individual vegetation type tables were combined into a summary table that showed the construction acres of each habitat quality score for each of the 14 vegetation types.

5.4.6 Restoration

To determine the impacts of restoration, the originally selected patches from the Forested Baseline Patches were intersected with the Restoration Forested disturbance layer (hereafter referred to as Restoration Forest Patches). The originally selected patches from the Non Forested Baseline Patches were intersected with the Restoration Non Forested disturbance layer (hereafter referred to as Restoration Non Forest Patches) and the Restoration Wetland/Riparian disturbance layer (hereafter referred to as Restoration Wetland Patches). The acre attribute of each new polygon for each layer, created from the intersections, was updated to reflect the new size of the polygon or patch. The polygons that were classified as disturbance were selected and the vegetation type identification value was reclassified to sparsely vegetated or 13, which includes barren land.

A Patch Size Value was added to the Restoration Forest Patches, Restoration Non Forest Patches, and Restoration Wetland Patches attribute tables. Each layer was then queried based on the size (number of acres) of each patch for each vegetation type. The selection was then attributed with a Patch Size value based on the acreage available to support indicator species. These values can be seen in Table 7.

The Restoration Patches (Forested, Non Forested, and Wetland) layers were then intersected with the Fire Layer to incorporate the Fire Regime Class values into the analysis. The acre attribute of each new polygon, created from the intersection, was updated to reflect the new size of the polygon.

To determine an overall ranking of habitat quality, the three ranking values (Vegetation Qualitative Ranking, Patch Size Value, and Fire Regime Class) were multiplied together. The result was a Restoration Habitat score for each polygon in the Restoration Forested, Non Forested, and Wetland Patches layers.

The final product of the analysis was a table of restoration acreage of each Restoration Habitat score by vegetation type to be used in the HEA. To produce the acreage values, the attribute table was selected for vegetation type and the acres were summed by habitat score. The individual vegetation type tables were combined into a summary table that showed the restoration acres of each habitat quality score for each of the 14 vegetation types.

5.4.7 Recovery

To determine the impacts of recovery, the originally selected patches from the Forested Baseline Patches were intersected with the Permanent disturbance layer (hereafter referred to as Recovery Patches). The originally selected patches from the Non Forested Baseline Patches were intersected with the Permanent disturbance layer (hereafter referred to as Recovery Non Forest Patches). The acre attribute of each new polygon for each layer, created from the intersections, was updated to reflect the new size of the polygon or patch. The polygons that were classified as permanent disturbance were selected and the vegetation type identification value was reclassified to sparsely vegetated or 13, which includes barren land.

A Patch Size Value was added to the Recovery Forest Patches and the Recovery Non Forest Patches attribute tables. Each layer was then queried based on the size (number of acres) of each patch for each vegetation type. The selection was then attributed with a Patch Size value based on the acreage available to support indicator species. These values can be seen in Table 7.

The Recovery Patches (Forested and Non Forested) layers were then intersected with the Fire Layer to incorporate the Fire Regime Class values into the analysis. The acre attribute of each new polygon, created from the intersection, was updated to reflect the new size of the polygon.

To determine an overall ranking of habitat quality, the three ranking values (Vegetation Qualitative Ranking, Patch Size Value, and Fire Regime Class) were multiplied together. The result was a Recovery Habitat score for each polygon in the Recovery Forested and Non Forested layers.

The final product of the analysis was a table of recovery acreage of each Recovery Habitat score by vegetation type to be used in the HEA. To produce the acreage values, the attribute table was selected for vegetation type and the acres were summed by habitat score. The individual vegetation type tables were combined into a summary table that showed the recovery acres of each habitat quality score for each of the 14 vegetation types.

5.4.8 Data Limitations

For future analyses, re-aggregating the vegetation classes may provide more beneficial breakdown of vegetation types and how they relate to migratory birds. Open water should become its own aggregate class. Agriculture should be removed from developed, and barren lands may need to be considered a different aggregate class or removed from sparely vegetated class. New aggregate classifications may provide more distinction of the vegetation types and provide more flexibility in the model to rank the vegetation types and determine their importance to migratory birds.

LANDFIRE was used for this analysis because it provided national-level, landscape-scale vegetation classification data set for the entire Project study area and was used in the DEIS. The most current data available for the entire Project area has a publication date of 2006. Although LANDFIRE represented the most comprehensive and consistent land cover classification data sets for the study area, it has known limitations. LANDFIRE is based on

30-meter grid resolution using field reference data, Landsat imagery, digital elevation model data, and biophysical gradient data to model vegetation for the entire United States. The dominate vegetation type was classified within each 30-meter grid or 900-square meter/0.222394-acre area and used in the classification. The overall accuracy of the data for each region is 38% for Northwest, 32% for Northern Rockies, and 50% for Great Basin. Species-level data is not included in the LANDFIRE analysis and in some cases streams or rivers were not enforced as open water, resulting in streams and rivers not being represented as continuous linear features in the data layer.

5.5 CALCULATION OF HABITAT SERVICES PROVIDED BY PROJECT CONDITION

For each of the four states crossed by the pipeline, the service-acres provided by the aggregate vegetation type (x^j) was calculated at Baseline, Construction, Restoration, and Recovery (Equation 1).

Equation 1. $$x^j = \sum_1^{27} (V^j * J)$$

where :

x^j is the service-acres provided by the aggregate vegetation type,

V^j is the habitat quality score, calculated as the product of the vegetation type, patch size, and fire regime scores, and

J is the number of acres (Pipeline Intersect) of the aggregate vegetation type.

5.6 CALCULATION OF HABITAT SERVICES LOST OVER THE 40-YEAR ANALYSIS PERIOD

Once the habitat service level (service-acres) was calculated at each Project condition, the amount of impact (i.e., habitat injury) could be estimated. For each state and aggregate habitat type, the habitat injury (I, service-acre-years) was quantified for the year of construction and 40 years afterward for each state and vegetation type (Equation 2). Equation 2 was adapted from Equation 8.1 in Allen et al. 2005. A 40-year post-construction analysis period was initially selected because it represented the maximum number of years that most vegetation disturbed by the pipeline would need to recover (Department of the Interior 2007). Sagebrush and salt desert scrub vegetation types were given longer recovery periods (120 and 70 years, respectively). These longer recovery periods represent a conservative approach to HEA modeling; the majority of shrub steppe communities in the pipeline corridor are expected to recover to Seral Class A or B (i.e., the recovery standard for this analysis) in a shorter period of time. Furthermore, species common to shrub steppe occur most frequently in a mosaic of vegetation in various age classes due to shifting levels of disturbance, rather than contiguous monotypic patches of similar-aged individuals (West 1996). In most cases, a vegetation mosaic would be reestablished within 40 years, so the 40-year analysis period is appropriate.

In the model, Construction occurred at time (t) = 0, Restoration occurred at t = 1, and years between Restoration and Recovery were vegetation-specific as different vegetation types recover at different rates (Table 11). Aggregate vegetation recovery rates were estimated as

the average time to obtain Class A and Class B seral stages among the specific vegetation types within the aggregate in LANDFIRE Rapid Assessment Modeling and Mapping Zones: Northern and Central Rockies, Great Basin, and Northwest (Department of the Interior 2007). Seral stages used in LANDFIRE are described by the overall structural component and successional progression to a climax plant community (potential vegetation type [PVT]): class A is low cover, low height; and class B is high cover, low height. The time between Class A and Class B seral stages reflects the average amount of time it generally takes for each vegetation type, defined by dominant vegetation and/or alliances, to reestablish dominance following disturbances. In forested communities, these earlier seral stages (Class A and Class B) do not represent plant communities that have reached old-growth maturity. However, these earlier seral stages reflect the transition from pioneer plant communities to more dominant climax plant communities. Once established, these dominant plant communities typically define each vegetation type, which continue on a further successional trajectory towards dominant old-growth vegetation.

Habitat services (measured in service-acres) were calculated for each year between Restoration and Recovery assuming a linear rate of increase (Figure 3). Many vegetation types were expected to recover in less than year; loss of habitat services after recovery (Point D in Figure 3) were considered permanent injuries. The discount rate (r), which refers to a social discount rate at which services being provided in different time periods are converted into current time period equivalents (Allen et al. 2005), was set to 0.

Equation 2. $$I = \sum_{t=0}^{y} b^j * \rho_t * (b^j - x_t^j) / b^j$$

where:

$t = 0$ is the time the injury occurs (year of pipeline construction),

b^j is service-acres provided by the vegetation (x^j) at baseline,

y is the analysis period in years (i.e., 40),

ρ_t is the discount factor, where $\rho_t = 1/(1+r)^{t-C}$, and r is the discount rate for the time period and C is the time the claim is presented, and

x_t^j is service-acres provided by the injured vegetation (x^j) at the end of year t.

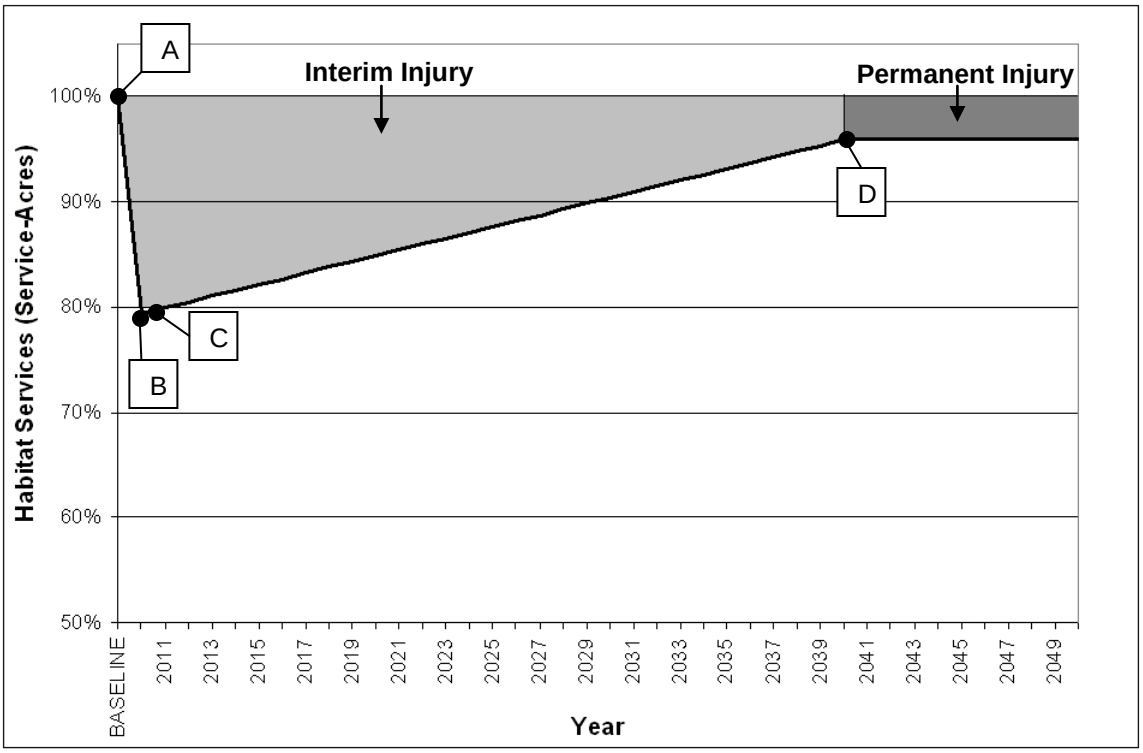


Figure 3. Example model of interim and permanent injury to habitat services over 40 years with four Project conditions: A) Baseline, B) Construction, C) Restoration, and D) Recovery.

Table 11. Recovery Times Used in the HEA Models for Aggregate Vegetation Types.

Aggregate Vegetation Types	Years from Restoration to Recovery
Agriculture/Developed	1
Conifer Forest	30
Deciduous Forest	15
Grassland/Herbaceous	5
Introduced Annual Grass and Forb	1
Introduced Perennial Grass and Forb	1
Mixed Conifer Deciduous Forest	20
Pinyon-Juniper Woodland	20
Riparian	5
Sagebrush Steppe	120
Salt Desert Shrub	70
Shrubland	20
Sparsely Vegetated	1
Wetlands	1

5.7 CALCULATION OF SCALED HABITAT COMPENSATION

An HEA typically compares project-related habitat injury (*I*) with available off-site habitats of the same type and quality; therefore, the acres of replacement habitat can be directly calculated. As the habitats analyzed in the Ruby Pipeline corridor were of varying quality, and specific compensation habitat areas have not yet been fully identified, an alternate approach was used to calculate the compensatory size of off-site replacement habitats for migratory birds by each vegetation type and state (Equation 3). Rather than providing the same habitat quality score, this approach assumes that compensatory habitats would provide the same mean habitat quality score ($\overline{V}^j$) as the injured habitats at baseline.

Equation 3.

$$P = \frac{I}{\overline{V}^j} * \frac{1}{y}$$

where:

P is the size in acres of the offsite compensation habitat that balances I (acres),
$\overline{V}^j$ is the mean habitat quality score provided at baseline, where $\overline{V}^j = b^j \div J$, and
y is the analysis period in years (i.e., 40).

The migratory bird habitat compensation necessary to off-set habitat disturbance impacts from the Project is reported both in acres of off-site habitat replacement (*P*) required and as a habitat compensation ratio. Habitat compensation ratios are commonly used in environmental compensation planning. For example, a habitat compensation ratio of 2:1 would indicate that for every 1 acre of habitat disturbed, 2 acres of habitat are needed to compensate for that loss. These 2 acres could comprise 2 off-site acres of similar quality (for Project-related permanent disturbance areas), or the restoration of the Project-disturbed acre (primary restoration) plus providing 1 additional off-site acre of similar quality, or improvements in the habitat quality that provide the same habitat services as those lost. To express the habitat compensation for the Project as a ratio, the proportion of ROW area to be replaced off site (*P* divided by the area of the Restoration ROW [Table 9]) was added to 1 (representing primary restoration of the Restoration ROW). Habitat compensation ratios were then calculated for each vegetation type and state and are interpreted as ~~a~~cres of habitat restoration and/or compensation required for every 1 acre disturbed by the pipeline Restoration ROW."

6.0 MIGRATORY BIRD HABITAT EQUIVALENCY ANALYSIS RESULTS

Results of the HEA modeling are provided below along with discussion on compensatory mitigation ratios recommended for migratory bird habitats impacted by the Ruby Pipeline Project.

6.1 PROJECT AREA HABITATS

6.1.1 Current Conditions by Habitat Quality Score

Table 12 summarizes the current conditions of migratory bird habitat for each state according to 10 habitat quality scores ranging from 1 (low) to 27 (high) used to evaluate quality of potential habitat. A large portion (approximately 51%) of habitat throughout the Project is

categorized as high-quality migratory bird habitat, either as category 27 habitat (34.9%) or category 18 habitat (16.0%); however, lower quality service level categories, such as category 9 habitat (26.1%) and category 4 habitat (19.2%), are also abundant along the pipeline (Table 12). The Wyoming and Nevada portions of the pipeline are primarily high-quality migratory bird habitat, with the greatest percentages of each state intersecting category 18 habitat and category 27 habitat. Utah and Oregon show strikingly different habitat distributions, having greater percentages of lower quality migratory bird habitat. The Utah portion of the Project is primarily category 9 habitat (42.1%) and category 4 habitat (34.1%), while the Oregon portion is predominantly category 4 habitat (51.7%).

Tables 13 through 16 and Figures 4 through 7 summarize the current conditions of migratory bird habitat in each state according to the habitat quality score ranging from 1 (low) to 27 (high) and aggregate vegetation type. Vegetation cover in all four states is predominantly sagebrush steppe, which is often high-quality migratory bird habitat (habitat quality scores 18 and 27). In Wyoming and Oregon, approximately all habitat categorized as high-quality (habitat quality scores 18 and 27) is sagebrush steppe (Figures 4 and 7). Similar trends are observed for sagebrush steppe in Utah and Nevada; however, Utah has an increased abundance of high-quality habitat in deciduous forest (Figure 5), while Nevada consists of larger portions of high-quality habitat in salt desert shrub (Figure 6). In all four states, marginal quality migratory bird habitat (habitat quality scores 4 through 12) is primarily comprised of either agriculture and developed areas or a combination of sagebrush steppe and salt desert shrub (Figures 4 through 7). As migratory bird habitat quality diminishes (habitat quality scores 1 and 2), the incidence of sparse vegetation, introduced annual and perennial grasses and forbs, and agriculture and developed areas increases. In Wyoming, habitat quality score 2 habitats are predominantly agriculture and developed areas (41.4%) and introduced annual grasses and forbs (51.9%), while habitat quality score 1 habitats are either sparsely vegetated (75.6 %) or introduced annual grasses and forbs (24.4%) (Figure 4). Utah and Oregon are comparable to patterns observed in Wyoming, where low-quality habitat is dominated by sparsely vegetated areas and introduced annual grasses and forbs (Figures 4, 5, and 7). Approximately all low-quality migratory bird habitat in Nevada consists of introduced plants (99.3% habitat quality score 2 and 89.1% habitat quality score 1) or sparsely vegetated areas (10.8% habitat quality score 1) (Figure 6). The overwhelming trend in all four states for migratory bird habitat is that high-quality habitat is predominantly sagebrush steppe and salt desert shrub, marginal habitat consists of more agriculture and developed areas or unhealthy or disturbed sagebrush or salt desert shrub communities, and low-quality habitat has increased occurrence of introduced grasses and forbs or sparsely vegetated areas.

Table 12. Acres of Migratory Bird Habitat within the Pipeline Intersect by Habitat Quality Score (1 Low to 27 High) at Baseline condition for Nevada, Oregon, Utah, and Wyoming.

Habitat Quality Score	Area (acres)								Total Acres[a]	
	Wyoming		Utah		Nevada		Oregon			
1	163.7	0.2%	2,708.6	0.6%	16,793.4	1.9%	58.3	0.0%	**19,724.0**	**1.2%**
2	13.3	0.0%	2,261.7	0.5%	12,113.1	1.4%	81.9	0.0%	**14,470.0**	**0.9%**
3	202.7	0.3%	2,209.1	0.5%	3,318.0	0.4%	1,355.9	0.7%	**7,085.7**	**0.4%**
4	4,318.0	5.9%	153,188.4	34.1%	48,683.4	5.5%	103,491.6	51.7%	**309,681.4**	**19.2%**
6	516.7	0.7%	4,983.0	1.1%	4,408.1	0.5%	3,245.8	1.6%	**13,153.6**	**0.8%**
8	20.4	0.0%	38.5	0.0%	133.8	0.0%	38.5	0.0%	**231.2**	**0.0%**
9	7,539.1	10.2%	188,879.5	42.1%	184,139.9	20.7%	40,618.2	20.3%	**421,176.7**	**26.1%**
12	208.1	0.3%	1,358.1	0.3%	3,037.4	0.3%	2,202.4	1.1%	**6,806.0**	**0.4%**
18	41,002.8	55.7%	75,014.2	16.7%	406,362.2	45.6%	40,780.3	20.4%	**563,159.5**	**34.9%**
27	19,646.3	26.7%	18,415.0	4.1%	212,187.3	23.8%	8,472.8	4.2%	**258,721.4**	**16.0%**
Total Acres*	**73,631.1**	**100.0%**	**449,056.1**	**100.0%**	**891,176.6**	**100.0%**	**200,345.7**	**100.0%**	**1,614,209.5**	**100.0%**

[a] Area for each aggregate vegetation type is rounded and does not depict specific values; thus total acres may not equal the sum of aggregate vegetation types.

Table 13. Acres of Migratory Bird Habitat in Wyoming within the Pipeline Intersect by Habitat Quality Score (1 Low to 27 High) at Baseline condition by Aggregate Vegetation.

Vegetation Type	Habitat Quality Score (acres)																				Total Acres[a]	
	1		2		3		4		6		8		9		12		18		27			
Agriculture / Developed	0.0	0.0%	5.5	41.4%	0.0	0.0%	4,318.0	100.0%	0.0	0.0%	20.4	100.0%	0.0	0.0%	15.1	7.3%	0.0	0.0%	0.0	0.0%	**4,359.0**	**5.9%**
Conifer Forest	0.0	0.0%	0.0	0.0%	0.2	0.1%	0.0	0.0%	2.0	0.4%	0.0	0.0%	22.7	0.3%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**24.9**	**0.0%**
Deciduous Forest	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	28.0	5.4%	0.0	0.0%	23.5	0.3%	102.7	49.4%	44.2	0.1%	0.0	0.0%	**198.4**	**0.3%**
Grassland / Herbaceous	0.0	0.0%	0.0	0.0%	3.3	1.6%	0.0	0.0%	32.4	6.3%	0.0	0.0%	2.7	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**38.4**	**0.1%**
Introduced Annual Grass and Forb	40.0	24.4%	6.9	51.9%	17.8	8.8%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**64.7**	**0.1%**
Introduced Perennial Grass and Forb	0.0	0.0%	0.9	6.8%	6.2	3.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**7.1**	**0.0%**
Mixed Deciduous Conifer Forest	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.0**	**0.0%**
Pinyon-Juniper Woodlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.7	0.1%	0.0	0.0%	6.0	0.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**6.7**	**0.0%**
Riparian	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	1,089.7	14.5%	0.0	0.0%	0.0	0.0%	0.2	0.0%	**1,089.9**	**1.5%**
Sagebrush Steppe	0.0	0.0%	0.0	0.0%	144.7	71.4%	0.0	0.0%	330.0	63.9%	0.0	0.0%	5,970.8	79.2%	90.3	43.4%	40,839.0	99.6%	18,817.2	95.8%	**66,192.0**	**89.9%**
Salt Desert Shrub	0.0	0.0%	0.0	0.0%	30.3	14.9%	0.0	0.0%	123.6	23.9%	0.0	0.0%	423.0	5.6%	0.0	0.0%	119.6	0.3%	828.9	4.2%	**1,525.4**	**2.1%**
Shrubland	0.0	0.0%	0.0	0.0%	0.2	0.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.7	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.9**	**0.0%**
Sparsely Vegetated	123.7	75.6%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**123.7**	**0.2%**
Wetlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.0**	**0.0%**
Total Acres*	**163.7**	**100.0%**	**13.3**	**100.0%**	**202.7**	**100.0%**	**4,318.0**	**100.0%**	**516.7**	**100.0%**	**20.4**	**100.0%**	**7,539.1**	**100.0%**	**208.1**	**100.0%**	**41,002.8**	**100.0%**	**19,646.3**	**100.0%**	**73,631.1**	**100.0%**

[a] Area for each aggregate vegetation type is rounded and does not depict specific values; thus total acres may not equal the sum of aggregate vegetation types.

Table 14. Acres of Migratory Bird Habitat in Utah within the Pipeline Intersect by Habitat Quality Score (1 Low to 27 High) at Baseline condition by Aggregate Vegetation Type.

Vegetation Type	Habitat Quality Score (acres)																				Total Acres[a]	
	1		2		3		4		6		8		9		12		18		27			
Agriculture/ Developed	0.0	0.0%	333.9	14.8%	0.0	0.0%	153,188.4	100.0%	0.0	0.0%	38.5	100.0%	0.0	0.0%	16.2	1.2%	0.0	0.0%	0.0	0.0%	**153,577.0**	**34.2%**
Conifer Forest	0.0	0.0%	0.0	0.0%	7.1	0.3%	0.0	0.0%	168.1	3.4%	0.0	0.0%	12.4	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**187.6**	**0.0%**
Deciduous Forest	0.0	0.0%	0.0	0.0%	0.2	0.0%	0.0	0.0%	288.5	5.8%	0.0	0.0%	259.3	0.1%	957.0	70.5%	6,423.5	8.6%	2,837.0	15.4%	**10,765.5**	**2.4%**
Grassland / Herbaceous	0.0	0.0%	0.0	0.0%	326.3	14.8%	0.0	0.0%	144.9	2.9%	0.0	0.0%	22.7	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**493.9**	**0.1%**
Introduced Annual Grass and Forb	701.0	25.9%	1,917.1	84.8%	29.3	1.3%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**2,647.4**	**0.6%**
Introduced Perennial Grass and Forb	28.4	1.0%	9.6	0.4%	0.7	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**38.7**	**0.0%**
Mixed Deciduous Conifer Forest	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	206.2	4.1%	0.0	0.0%	5.1	0.0%	75.8	5.6%	0.9	0.0%	0.0	0.0%	**288.0**	**0.1%**
Pinyon-Juniper Woodlands	0.0	0.0%	0.0	0.0%	8.2	0.4%	0.0	0.0%	160.5	3.2%	0.0	0.0%	165.7	0.1%	40.2	3.0%	576.0	0.8%	571.5	3.1%	**1,522.1**	**0.3%**
Riparian	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	54.3	0.0%	0.0	0.0%	198.5	0.3%	7.0	0.0%	**259.8**	**0.1%**
Sagebrush Steppe	0.0	0.0%	0.0	0.0%	1,151.7	52.1%	0.0	0.0%	1,528.9	30.7%	0.0	0.0%	70,914.1	37.5%	61.0	4.5%	56,750.4	75.7%	14,951.5	81.2%	**145,357.6**	**32.4%**
Salt Desert Shrub	0.0	0.0%	0.0	0.0%	668.7	30.3%	0.0	0.0%	2,108.5	42.3%	0.0	0.0%	117,378.2	62.1%	124.2	9.1%	9,572.5	12.8%	0.0	0.0%	**129,852.1**	**28.9%**
Shrubland	0.0	0.0%	0.0	0.0%	16.9	0.8%	0.0	0.0%	377.4	7.6%	0.0	0.0%	67.5	0.0%	83.7	6.2%	1,492.4	2.0%	48.0	0.3%	**2,085.9**	**0.5%**
Sparsely Vegetated	1,979.2	73.1%	1.1	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**1,980.3**	**0.4%**
Wetlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.2	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.2**	**0.0%**
Total Acres*	**2,708.6**	**100.0%**	**2,261.7**	**100.0%**	**2,209.1**	**100.0%**	**153,188.4**	**100.0%**	**4,983.0**	**100.0%**	**38.5**	**100.0%**	**188,879.5**	**100.0%**	**1,358.1**	**100.0%**	**75,014.2**	**100.0%**	**18,415.0**	**100.0%**	**449,056.1**	**100.0%**

[a] Area for each aggregate vegetation type is rounded and does not depict specific values; thus total acres may not equal the sum of aggregate vegetation types.

Table 15. Acres of Migratory Bird Habitat in Nevada within the Pipeline Intersect by Habitat Quality Score (1 Low to 27 High) at Baseline condition by Aggregate Vegetation Type.

Vegetation Type	Habitat Quality Score (acres)																				Total Acres[a]	
	1		2		3		4		6		8		9		12		18		27			
Agriculture / Developed	0.0	0.0%	29.3	0.2%	0.0	0.0%	48,683.4	100.0%	0.1	0.0%	133.8	100.0%	0.0	0.0%	48.5	1.6%	0.0	0.0%	0.0	0.0%	**48,895.1**	**5.5%**
Conifer Forest	0.0	0.0%	0.0	0.0%	8.9	0.3%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**8.9**	**0.0%**
Deciduous Forest	0.0	0.0%	0.0	0.0%	189.4	5.7%	0.0	0.0%	148.0	3.4%	0.0	0.0%	0.0	0.0%	0.0	0.0%	188.3	0.0%	0.0	0.0%	**525.7**	**0.1%**
Grassland / Herbaceous	0.0	0.0%	0.0	0.0%	900.1	27.1%	0.0	0.0%	246.3	5.6%	0.0	0.0%	1,226.8	0.7%	0.0	0.0%	155.1	0.0%	0.0	0.0%	**2,528.3**	**0.3%**
Introduced Annual Grass and Forb	14,965.7	89.1%	12,022.7	99.3%	971.5	29.3%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**27,959.9**	**3.1%**
Introduced Perennial Grass and Forb	6.7	0.0%	61.1	0.5%	3.1	0.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**70.9**	**0.0%**
Mixed Deciduous Conifer Forest	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.0**	**0.0%**
Pinyon-Juniper Woodlands	0.0	0.0%	0.0	0.0%	92.1	2.8%	0.0	0.0%	327.5	7.4%	0.0	0.0%	2,384.7	1.3%	85.0	2.8%	5,028.8	1.2%	3,563.3	1.7%	**11,481.4**	**1.3%**
Riparian	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	16.2	0.0%	0.0	0.0%	487.0	0.1%	47.6	0.0%	**550.8**	**0.1%**
Sagebrush Steppe	0.0	0.0%	0.0	0.0%	830.8	25.0%	0.0	0.0%	1,883.0	42.7%	0.0	0.0%	179,589.8	97.5%	511.7	16.8%	366,970.5	90.3%	157,098.5	74.0%	**706,884.3**	**79.3%**
Salt Desert Shrub	0.0	0.0%	0.0	0.0%	322.1	9.7%	0.0	0.0%	1,754.8	39.8%	0.0	0.0%	922.4	0.5%	2,392.2	78.8%	33,532.5	8.3%	51,477.8	24.3%	**90,401.8**	**10.1%**
Shrubland	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	48.4	1.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**48.4**	**0.0%**
Sparsely Vegetated	1,821.0	10.8%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**1,821.0**	**0.2%**
Wetlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.0**	**0.0%**
Total Acres*	**16,793.4**	**100.0%**	**12,113.1**	**100.0%**	**3,318.0**	**100.0%**	**48,683.4**	**100.0%**	**4,408.1**	**100.0%**	**133.8**	**100.0%**	**184,139.9**	**100.0%**	**3,037.4**	**100.0%**	**406,362.2**	**100.0%**	**212,187.2**	**100.0%**	**891,176.5**	**100.0%**

[a] Area for each aggregate vegetation type is rounded and does not depict specific values; thus total acres may not equal the sum of aggregate vegetation types.

Table 16. Acres of Migratory Bird Habitat in Oregon within the Pipeline Intersect by Habitat Quality Score (1 Low to 27 High) at Baseline condition by Aggregate Vegetation.

Vegetation Type	Habitat Quality Score (acres)																				Total Acres*	
	1		2		3		4		6		8		9		12		18		27			
Agriculture / Developed	0.0	0.0%	70.5	86.1%	0.0	0.0%	103,491.6	100.0%	0.0	0.0%	38.5	100.0%	0.0	0.0%	8.7	0.4%	0.0	0.0%	0.0	0.0%	**103,609.3**	**51.7%**
Conifer Forest	0.0	0.0%	0.0	0.0%	478.7	35.3%	0.0	0.0%	1,450.5	44.7%	0.0	0.0%	24,517.5	60.4%	923.1	41.9%	2,480.2	6.1%	244.8	2.9%	**30,094.8**	**15.0%**
Deciduous Forest	0.0	0.0%	0.0	0.0%	110.0	8.1%	0.0	0.0%	37.2	1.1%	0.0	0.0%	120.3	0.3%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**267.5**	**0.1%**
Grassland / Herbaceous	0.0	0.0%	0.0	0.0%	8.2	0.6%	0.0	0.0%	11.2	0.3%	0.0	0.0%	0.7	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**20.1**	**0.0%**
Introduced Annual Grass and Forb	5.3	9.1%	6.9	8.4%	1.6	0.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**13.8**	**0.0%**
Introduced Perennial Grass and Forb	0.2	0.3%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.2**	**0.0%**
Mixed Deciduous Conifer Forest	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.0**	**0.0%**
Pinyon-Juniper Woodlands	0.0	0.0%	0.0	0.0%	249.0	18.4%	0.0	0.0%	433.8	13.4%	0.0	0.0%	384.5	0.9%	162.9	7.4%	506.0	1.2%	0.0	0.0%	**1,736.2**	**0.9%**
Riparian	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	353.1	0.9%	0.0	0.0%	22.9	0.1%	31.7	0.4%	**407.7**	**0.2%**
Sagebrush Steppe	0.0	0.0%	0.0	0.0%	245.9	18.1%	0.0	0.0%	981.0	30.2%	0.0	0.0%	10,991.5	27.1%	1,059.4	48.1%	37,403.8	91.7%	8,196.3	96.7%	**58,877.9**	**29.4%**
Salt Desert Shrub	0.0	0.0%	0.0	0.0%	174.1	12.8%	0.0	0.0%	252.4	7.8%	0.0	0.0%	4,250.6	10.5%	0.0	0.0%	50.7	0.1%	0.0	0.0%	**4,727.8**	**2.4%**
Shrubland	0.0	0.0%	0.0	0.0%	88.4	6.5%	0.0	0.0%	79.7	2.5%	0.0	0.0%	0.0	0.0%	48.3	2.2%	316.7	0.8%	0.0	0.0%	**533.1**	**0.3%**
Sparsely Vegetated	52.8	90.6%	4.5	5.5%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**57.3**	**0.0%**
Wetlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.0**	**0.0%**
Total Acres*	**58.3**	**100.0%**	**81.9**	**100.0%**	**1,355.9**	**100.0%**	**103,491.6**	**100.0%**	**3,245.8**	**100.0%**	**38.5**	**100.0%**	**40,618.2**	**100.0%**	**2,202.4**	**100.0%**	**40,780.3**	**100.0%**	**8,472.8**	**100.0%**	**200,345.7**	**100.0%**

[a] Area for each aggregate vegetation type is rounded and does not depict specific values; thus total acres may not equal the sum of aggregate vegetation types.

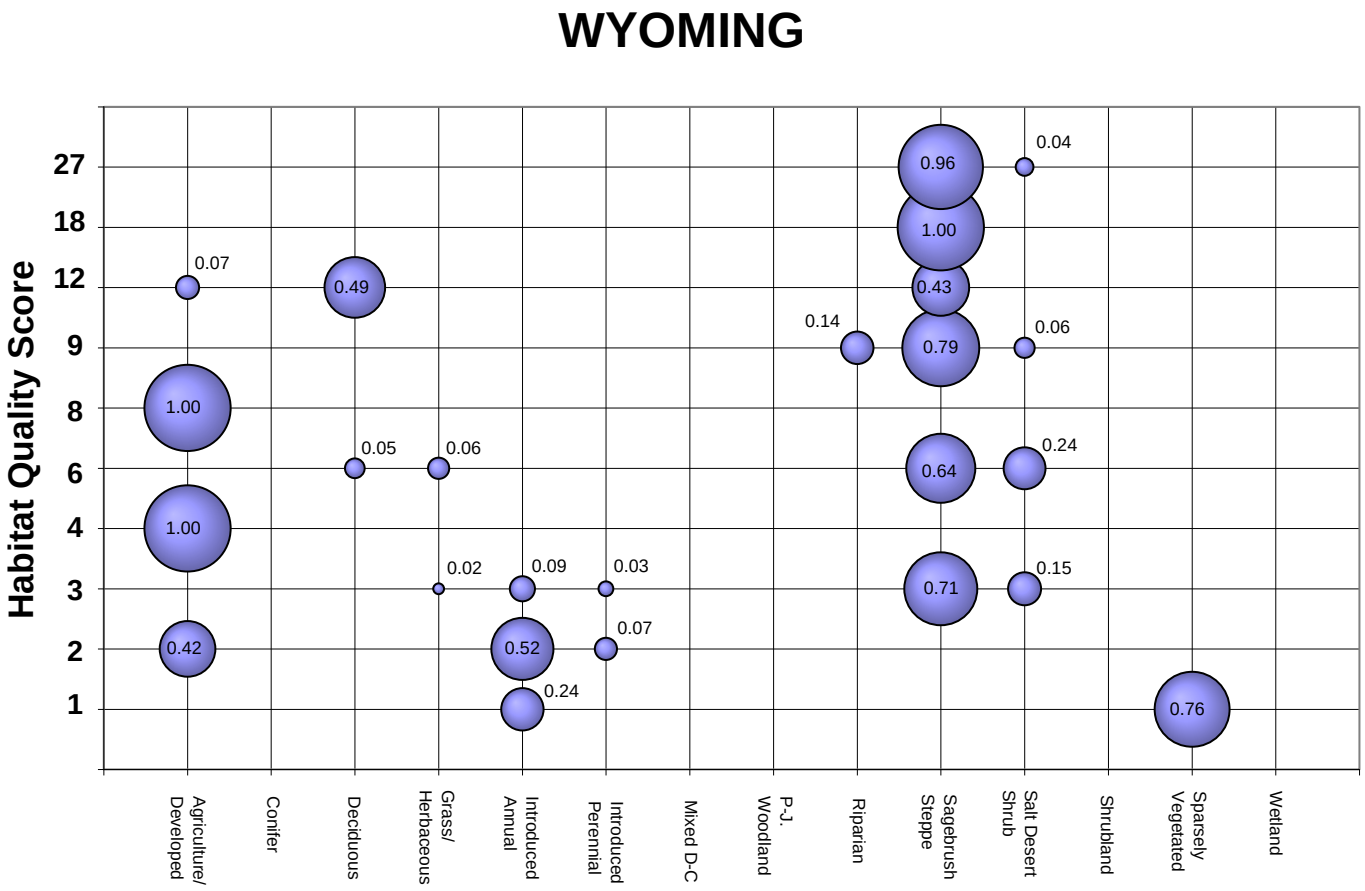


Figure 4. Percentage of aggregate vegetation type by habitat quality score for Wyoming, as measured by the acres of vegetation within the Pipeline Intersect at Baseline condition. Habitat quality scores ranged from 1 (low) to 27 (high). Individual circles represent a percentage of aggregate vegetation type that makes up each habitat quality score by state (e.g., percentages aligned horizontally within a habitat quality score equal 100%).

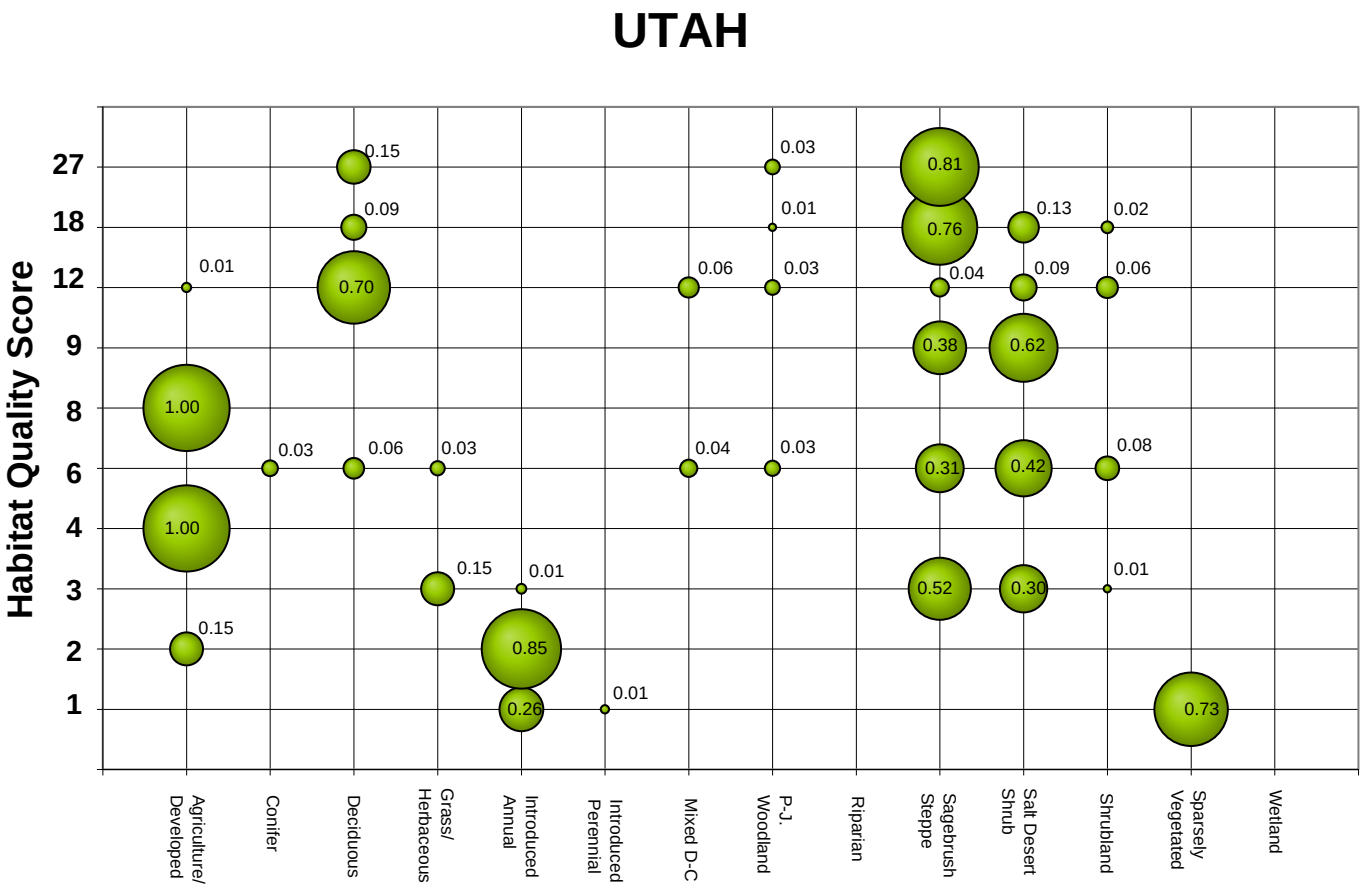


Figure 5. Percentage of aggregate vegetation type by habitat quality score for Utah, as measured by the acres of vegetation within the Pipeline Intersect at Baseline condition. Habitat quality scores ranged from 1 (low) to 27 (high). Individual circles represent a percentage of aggregate vegetation type that makes up each habitat quality score by state (e.g., percentages aligned horizontally within a habitat quality score equal 100%).

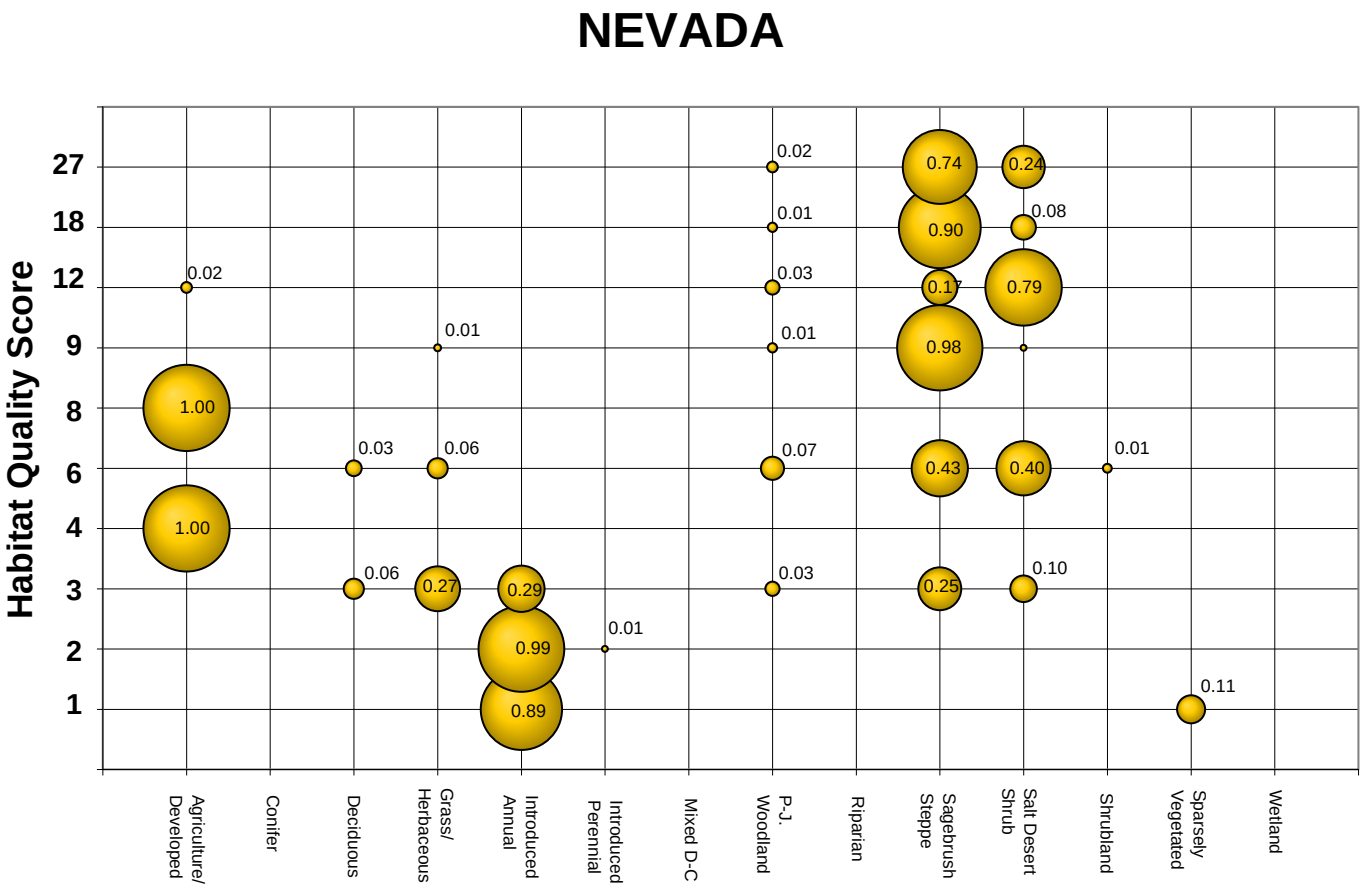


Figure 6. Percentage of aggregate vegetation type by habitat quality score for Nevada, as measured by the acres of vegetation within the Pipeline Intersect at Baseline condition. Habitat quality scores ranged from 1 (low) to 27 (high). Individual circles represent a percentage of aggregate vegetation type that makes up each habitat quality score by state (e.g., percentages aligned horizontally within a habitat quality score equal 100%).

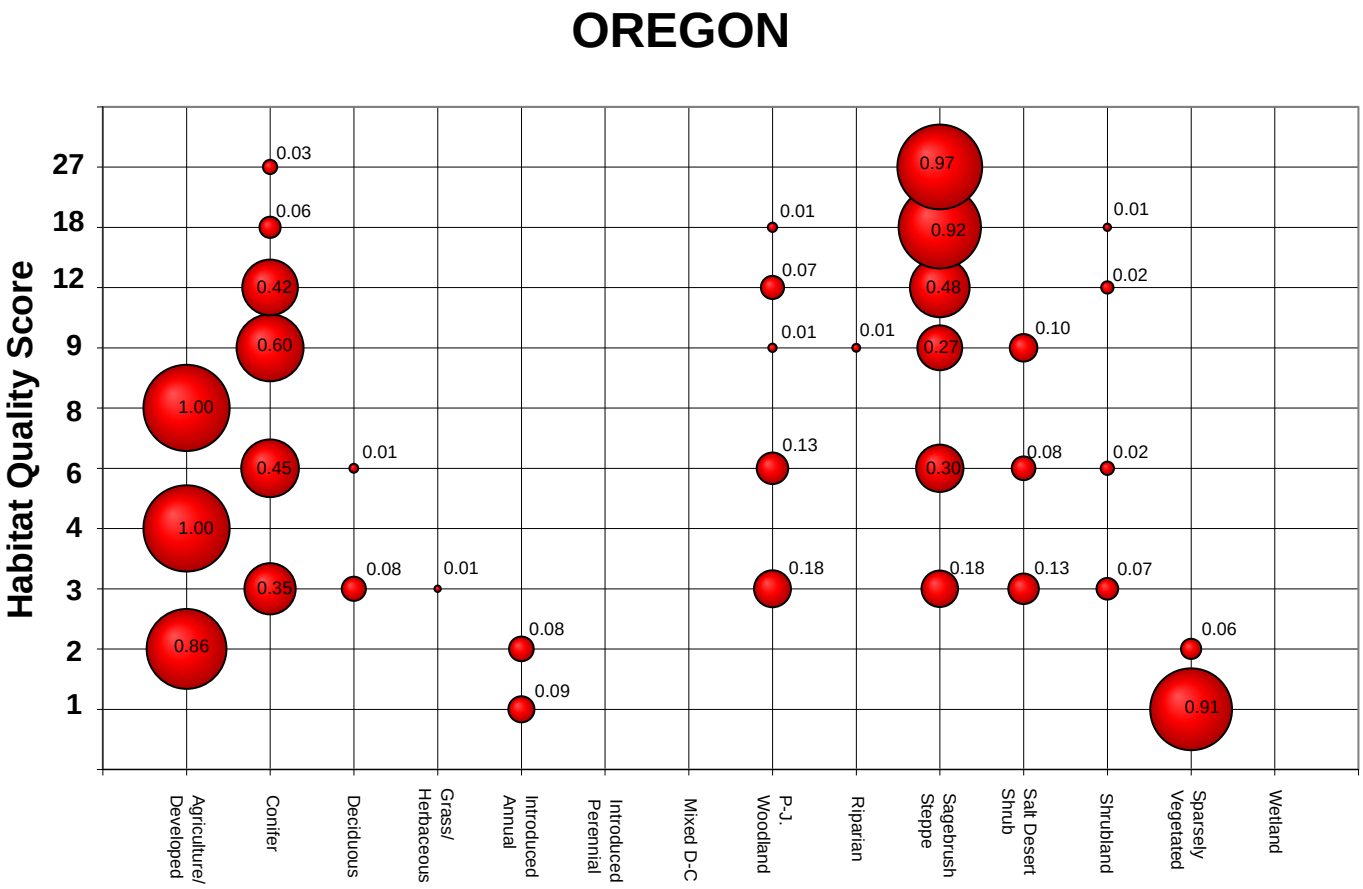


Figure 7. Percentage of aggregate vegetation type by habitat quality score for Oregon, as measured by the acres of vegetation within the Pipeline Intersect at Baseline condition. Habitat quality scores ranged from 1 (low) to 27 (high). Individual circles represent a percentage of aggregate vegetation type that makes up each habitat quality score by state (e.g., percentages aligned horizontally within a habitat quality score equal 100%).

6.1.2 Construction Disturbance and Restoration

The Construction ROW represents the acres of direct and indirect disturbance within the Pipeline Intersect during construction of the pipeline. The Construction ROW is wider than the Restoration ROW, which is the area of direct impact (i.e., the footprint of the Project). It was assumed that there would be a 100% loss of habitat functionality in the Construction ROW during construction and in the Restoration ROW in the first year after construction. The Baseline habitat condition in the area of direct Project disturbance (i.e., Restoration ROW) is characterized in Tables 17 through 20 by state and vegetation type.

Table 17. Acres of Migratory Bird Habitat in Wyoming within the Restoration Right-of-Way Assigned to Each of the Habitat Quality Scores (1 Low to 27 High) at Baseline Condition.

Aggregate Vegetation Type	Habitat Quality Score (acres)																				Total Acres[a]	
	1		2		3		4		6		8		9		12		18		27			
Agriculture / Developed	0.0	0.0%	8.0	76.9%	0.0	0.0%	22.0	100.0%	0.2	0.3%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**30.2**	**2.8%**
Conifer Forest	0.0	0.0%	0.0	0.0%	0.0	0.1%	0.0	0.0%	0.8	1.2%	0.0	0.0%	5.0	1.8%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**5.8**	**0.5%**
Deciduous Forest	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	5.0	7.4%	0.0	0.0%	0.9	0.3%	1.0	50.0%	0.0	0.0%	0.0	0.0%	**6.9**	**0.6%**
Grassland / Herbaceous	0.0	0.0%	0.0	0.0%	1.0	3.8%	0.0	0.0%	14.0	20.8%	0.0	0.0%	0.3	0.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**15.3**	**1.4%**
Introduced Annual Grass and Forb	10.0	27.8%	2.0	19.2%	5.0	19.2%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**17.0**	**1.6%**
Introduced Perennial Grass and Forb	0.0	0.0%	0.4	3.8%	1.0	3.8%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**1.4**	**0.1%**
Mixed Deciduous Conifer Forest	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.0**	**0.0%**
Pinyon-Juniper Woodlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.2	0.3%	0.0	0.0%	0.7	0.3%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.9**	**0.1%**
Riparian	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	37.0	13.4%	0.0	0.0%	0.0	0.0%	0.1	0.0%	**37.1**	**3.4%**
Sagebrush Steppe	0.0	0.0%	0.0	0.0%	13.0	49.9%	0.0	0.0%	27.0	40.2%	0.0	0.0%	162.0	58.8%	0.0	0.0%	399.0	99.5%	204.0	85.3%	**805.0**	**74.6%**
Salt Desert Shrub	0.0	0.0%	0.0	0.0%	6.0	23.0%	0.0	0.0%	20.0	29.8%	0.0	0.0%	69.0	25.1%	1.0	50.0%	2.0	0.5%	35.0	14.6%	**133.0**	**12.3%**
Shrubland	0.0	0.0%	0.0	0.0%	0.0	0.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.4	0.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.4**	**0.0%**
Sparsely Vegetated	26.0	72.2%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**26.0**	**2.4%**
Wetlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.0**	**0.0%**
Total Acres*	**36.0**	**100.0%**	**10.4**	**100.0%**	**26.1**	**100.0%**	**22.0**	**100.0%**	**67.2**	**100.0%**	**0.0**	**0.0%**	**275.3**	**100.0%**	**2.0**	**100.0%**	**401.0**	**100.0%**	**239.1**	**100.0%**	**1079.1**	**100.0%**

[a]Area for each aggregate vegetation type is rounded and does not depict specific values; thus total acres may not equal the sum of aggregate vegetation types.

Table 18. Acres of Migratory Bird Habitat in Utah within the Restoration Right-of-Way Assigned to Each of the Habitat Quality Scores (1 Low to 27 High) at Baseline Condition.

Aggregate Vegetation Type	Habitat Quality Score (acres)																				Total Acres[a]	
	1		2		3		4		6		8		9		12		18		27			
Agriculture/Developed	0.0	0.0%	108.0	70.0%	0.0	0.0%	1,003.0	100.0%	0.2	0.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**1,111.2**	**26.1%**
Conifer Forest	0.0	0.0%	0.0	0.0%	0.1	0.0%	0.0	0.0%	23.0	7.3%	0.0	0.0%	4.0	0.3%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**27.1**	**0.6%**
Deciduous Forest	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	41.0	12.9%	0.0	0.0%	56.0	4.5%	16.0	34.0%	206.0	25.8%	60.0	22.6%	**379.0**	**8.9%**
Grassland/Herbaceous	0.0	0.0%	0.0	0.0%	56.0	19.1%	0.0	0.0%	26.0	8.2%	0.0	0.0%	4.0	0.3%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**86.0**	**2.0%**
Introduced Annual Grass and Forb	48.0	34.0%	43.0	27.9%	2.0	0.7%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**93.0**	**2.2%**
Introduced Perennial Grass and Forb	11.0	7.8%	3.0	1.9%	0.2	0.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**14.2**	**0.3%**
Mixed Deciduous Conifer Forest	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	41.0	12.9%	0.0	0.0%	2.0	0.2%	11.0	23.4%	0.0	0.0%	0.0	0.0%	**54.0**	**1.3%**
Pinyon-Juniper Woodlands	0.0	0.0%	0.0	0.0%	1.0	0.3%	0.0	0.0%	33.0	10.4%	0.0	0.0%	14.0	1.1%	2.0	4.3%	30.0	3.8%	4.0	1.5%	**84.0**	**2.0%**
Riparian	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	13.0	1.1%	0.0	0.0%	61.0	7.6%	3.0	1.1%	**77.0**	**1.8%**
Sagebrush Steppe	0.0	0.0%	0.0	0.0%	169.0	57.6%	0.0	0.0%	59.0	18.6%	0.0	0.0%	372.0	30.1%	0.0	0.0%	364.0	45.6%	195.0	73.6%	**1,159.0**	**27.2%**
Salt Desert Shrub	0.0	0.0%	0.0	0.0%	59.0	20.1%	0.0	0.0%	21.0	6.6%	0.0	0.0%	758.0	61.4%	12.0	25.5%	75.0	9.4%	0.0	0.0%	**925.0**	**21.7%**
Shrubland	0.0	0.0%	0.0	0.0%	6.0	2.0%	0.0	0.0%	73.0	23.0%	0.0	0.0%	12.0	1.0%	6.0	12.8%	62.0	7.8%	3.0	1.1%	**162.0**	**3.8%**
Sparsely Vegetated	82.0	58.2%	0.3	0.2%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**82.3**	**1.9%**
Wetlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.0**	**0.0%**
Total Acres*	**141.0**	**100.0%**	**154.3**	**100.0%**	**293.3**	**100.0%**	**1,003.0**	**100.0%**	**317.2**	**100.0%**	**0.0**	**0.0%**	**1,235.0**	**100.0%**	**47.0**	**100.0%**	**798.0**	**100.0%**	**265.0**	**100.0%**	**4,253.8**	**100.0%**

[a]Area for each aggregate vegetation type is rounded and does not depict specific values; thus total acres may not equal the sum of aggregate vegetation types.

Table 19. Acres of Migratory Bird Habitat in Nevada within the Restoration Right-of-Way Assigned to Each of the Habitat Quality Scores (1 Low to 27 High) at Baseline Condition.

Aggregate Vegetation Type	Habitat Quality Score (acres)																				Total Acres[a]	
	1		2		3		4		6		8		9		12		18		27			
Agriculture/Developed	0.0	0.0%	11.0	4.2%	0.0	0.0%	119.0	100.0%	0.3	0.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**130.3**	**1.8%**
Conifer Forest	0.0	0.0%	0.0	0.0%	3.0	1.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**3.0**	**0.0%**
Deciduous Forest	0.0	0.0%	0.0	0.0%	47.0	14.9%	0.0	0.0%	11.0	3.9%	0.0	0.0%	0.0	0.0%	0.0	0.0%	13.0	0.4%	0.0	0.0%	**71.0**	**1.0%**
Grassland/Herbaceous	0.0	0.0%	0.0	0.0%	87.0	27.7%	0.0	0.0%	16.0	5.7%	0.0	0.0%	37.0	2.9%	3.0	33.3%	10.0	0.3%	0.0	0.0%	**153.0**	**2.2%**
Introduced Annual Grass and Forb	275.0	79.0%	248.0	93.9%	42.0	13.4%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**565.0**	**8.0%**
Introduced Perennial Grass and Forb	2.0	0.6%	5.0	1.9%	0.4	0.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**7.4**	**0.1%**
Mixed Deciduous Conifer Forest	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.0**	**0.0%**
Pinyon-Juniper Woodlands	0.0	0.0%	0.0	0.0%	14.0	4.5%	0.0	0.0%	48.0	17.1%	0.0	0.0%	35.0	2.7%	5.0	55.6%	30.0	1.0%	5.0	0.3%	**137.0**	**1.9%**
Riparian	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	1.0	0.1%	0.0	0.0%	32.0	1.1%	5.0	0.3%	**38.0**	**0.5%**
Sagebrush Steppe	0.0	0.0%	0.0	0.0%	93.0	29.6%	0.0	0.0%	81.0	28.9%	0.0	0.0%	1162.0	89.7%	1.0	11.1%	2412.0	82.0%	1030.0	68.1%	**4779.0**	**67.4%**
Salt Desert Shrub	0.0	0.0%	0.0	0.0%	28.0	8.9%	0.0	0.0%	109.0	38.9%	0.0	0.0%	61.0	4.7%	0.0	0.0%	446.0	15.2%	473.0	31.3%	**1117.0**	**15.8%**
Shrubland	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	15.0	5.4%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**15.0**	**0.2%**
Sparsely Vegetated	71.0	20.4%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**71.0**	**1.0%**
Wetlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.0**	**0.0%**
Total Acres*	**348.0**	**100.0%**	**264.0**	**100.0%**	**314.4**	**100.0%**	**119.0**	**100.0%**	**280.3**	**100.0%**	**0.0**	**0.0%**	**1296.0**	**100.0%**	**9.0**	**100.0%**	**2943.0**	**100.0%**	**1513.0**	**100.0%**	**7086.7**	**100.0%**

[a]Area for each aggregate vegetation type is rounded and does not depict specific values; thus total acres may not equal the sum of aggregate vegetation types.

Table 20. Acres of Migratory Bird Habitat in Oregon within the Restoration Right-of-Way Assigned to Each of the Habitat Quality Scores (1 Low to 27 High) at Baseline Condition.

Aggregate Vegetation Type	Habitat Quality Score (acres)																				Total Acres[a]	
	1		2		3		4		6		8		9		12		18		27			
Agriculture/Developed	0.0	0.0%	9.0	75.0%	0.0	0.0%	304.0	100.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**313.0**	**15.9%**
Conifer Forest	0.0	0.0%	0.0	0.0%	22.0	14.6%	0.0	0.0%	29.0	15.6%	0.0	0.0%	402.0	64.9%	9.0	29.0%	56.0	10.4%	0.8	0.8%	**518.8**	**26.4%**
Deciduous Forest	0.0	0.0%	0.0	0.0%	28.0	18.6%	0.0	0.0%	8.0	4.3%	0.0	0.0%	3.0	0.5%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**39.0**	**2.0%**
Grassland/Herbaceous	0.0	0.0%	0.0	0.0%	2.0	1.3%	0.0	0.0%	3.0	1.6%	0.0	0.0%	0.6	0.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**5.6**	**0.3%**
Introduced Annual Grass and Forb	2.0	10.5%	2.0	16.7%	0.2	0.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**4.2**	**0.2%**
Introduced Perennial Grass and Forb	0.0	0.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.0**	**0.0%**
Mixed Deciduous Conifer Forest	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.0**	**0.0%**
Pinyon-Juniper Woodlands	0.0	0.0%	0.0	0.0%	41.0	27.3%	0.0	0.0%	53.0	28.5%	0.0	0.0%	24.0	3.9%	6.0	19.4%	17.0	3.1%	13.0	12.7%	**154.0**	**7.8%**
Riparian	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	25.0	4.0%	0.0	0.0%	4.0	0.7%	0.9	0.9%	**29.9**	**1.5%**
Sagebrush Steppe	0.0	0.0%	0.0	0.0%	16.0	10.7%	0.0	0.0%	76.0	40.9%	0.0	0.0%	115.0	18.6%	11.0	35.5%	460.0	85.0%	88.0	85.7%	**766.0**	**39.0%**
Salt Desert Shrub	0.0	0.0%	0.0	0.0%	14.0	9.3%	0.0	0.0%	1.0	0.5%	0.0	0.0%	50.0	8.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**65.0**	**3.3%**
Shrubland	0.0	0.0%	0.0	0.0%	27.0	18.0%	0.0	0.0%	16.0	8.6%	0.0	0.0%	0.1	0.0%	5.0	16.1%	4.0	0.7%	0.0	0.0%	**52.1**	**2.7%**
Sparsely Vegetated	17.0	89.4%	1.0	8.3%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**18.0**	**0.9%**
Wetlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	**0.0**	**0.0%**
Total Acres*	**19.0**	**100.0%**	**12.0**	**100.0%**	**150.2**	**100.0%**	**304.0**	**100.0%**	**186.0**	**100.0%**	**0.0**	**100.0%**	**619.7**	**100.0%**	**31.0**	**100.0%**	**541.0**	**100.0%**	**102.7**	**100.0%**	**1965.6**	**100.0%**

[a]Area for each aggregate vegetation type is rounded and does not depict specific values; thus total acres may not equal the sum of aggregate vegetation types.

6.1.3 Habitat Injury and Compensation

Tables 21 through 24 summarize the estimation of habitat services and habitat injury in the Ruby Pipeline corridor over 40 years for all four states, respectively. The scaled habitat compensation to offset injury is the recommended number of acres that should be replaced *in addition to* restoration of the temporary disturbance of vegetation in the ROW, temporary roads, and equipment/materials holding yards. The habitat compensation ratio takes that number and expresses it in proportion to the acres in the restoration ROW (115 feet wide in most aggregate vegetation types). Unlike the compensatory acres reported, this ratio *includes* restoration of the temporary disturbance of vegetation in the ROW, temporary roads, and equipment/materials holding yards. For example, a mitigation ratio of 1.5:1 would read: for every 1.0 acre of this habitat disturbed in the recovery ROW (Table 9), 1.5 acres need to be restored and/or replaced (e.g., restoration of the 1.0 acre disturbed plus purchase or restoration of 0.5 acre of similar habitat).

One of the tenents of HEA is that habitat is replaced with like habitat so that there is no net loss in ecosystem services. As such, conifers should be replaced with conifers, sagebrush with sagebrush, etc. Additionally, the replacement or compensatory habitats should be of equal quality to those disturbed by a given project. The same metric that was used to determine habitat quality in the pipeline corridor could be used to determine quality of replacement habitats.

Table 21. Estimation of Migratory Bird Habitat Services and Habitat Injury in the Ruby Pipeline Corridor through Wyoming and Scaled Habitat Compensation to Offset Injury from HEA Model.

Aggregate Vegetation Type	Baseline Service Level in the Pipeline Intersect (service-acres per year)	Average Service Level per Acre (services/acre)	Baseline Services Over 40 Years (service-acre-years)	Habitat Injury (service-acre-years lost in 40 years)	Permanent Injury (% of Baseline lost)	Scaled Habitat Compensation (acres)	Compensation Ratio (acres restored:acres in Restoration ROW)
Agricultural and Developed	17,628	4.04	705,118	209	0.00%	1.29	1.04:1
Conifer Forest	217	8.71	8,667	937	2.40%	2.69	1.45:1
Deciduous Forest	2,407	12.13	96,292	813	0.50%	1.67	1.24:1
Grassland/Herbaceous	228	5.95	9,131	720	5.15%	3.03	1.20:1
Introduced Annual Grass and Forb	107	1.66	4,283	100	1.61%	1.51	1.09:1
Introduced Perennial Grass and Forb	20	2.88	818	5	0.00%	0.04	1.02:1
Mixed Deciduous Conifer Forest	0	--	0	--	--	--	--
Pinyon-Juniper Woodland	58	8.70	2,321	145	3.53%	0.42	1.45:1
Riparian	9,813	9.00	392,527	1,005	0.00%	2.79	1.08:1
Sagebrush Steppe	1,300,400	19.65	52,015,994	1,156,472	1.74%	1471.65	2.83:1
Salt Desert Shrub	29,173	19.12	1,166,933	224,405	11.28%	293.36	3.18:1
Shrubland	7	7.50	267	37	0.00%	0.12	1.31:1
Sparsely Vegetated	124	1.00	4,947	-4,528 [a]	0%	0	1:1
Wetlands	0	--	0	--	--	--	--

[a] negative number indicates a net gain in sparsely vegetated habitat.

-- indicates habitat not present in sufficient quantity to analyze.

Table 22. Estimation of Migratory Bird Habitat Services and Habitat Injury in the Ruby Pipeline Corridor through Utah and Scaled Habitat Compensation to Offset Injury from HEA Model.

Aggregate Vegetation Type	Baseline Service Level in the Pipeline Intersect (service-acres per year)	Average Service Level per Acre (services/acre)	Baseline Services Over 40 Years (service-acre-years)	Habitat Injury (service-acre-years lost in 40 years)	Permanent Injury (% of Baseline lost)	Scaled Habitat Compensation (acres)	Compensation Ratio (acres restored:acres in Restoration ROW)
Agricultural and Developed	461,606	3.73	18,464,249	8,579	0.01%	57.56	1.05:1
Conifer Forest	1,141	6.08	45,648	3,991	4.34%	16.40	1.60:1
Deciduous Forest	207,774	19.30	8,310,945	359,077	3.42%	465.13	2.22:1
Grassland / Herbaceous	2,052	4.16	82,088	1,109	0.00%	6.67	1.08:1
Introduced Annual Grass and Forb	4,623	1.75	184,930	153	0.00%	2.19	1.02:1
Introduced Perennial Grass and Forb	50	1.28	1,982	18	0.00%	0.35	1.02:1
Mixed Deciduous Conifer Forest	2,209	7.67	88,348	6,093	0.05	19.86	1.36:1
Pinyon-Juniper Woodland	28,761	18.89	1,150,424	146,147	11.85%	193.37	3.29:1
Riparian	4,253	16.37	170,136	3,891	0.00%	5.94	1.08:1
Sagebrush Steppe	2,076,785	14.29	83,071,404	1,158,122	1.09%	2,026.47	2.75:1
Salt Desert Shrub	1,244,856	9.59	49,794,260	720,121	0.85%	1,877.91	3.03:1
Shrubland	32,089	15.38	1,283,547	41,813	0.00%	67.96	1.41:1
Sparsely Vegetated	1,981	1.00	79,256	-19,945 [a]	0%	0	1:1
Wetlands	2	9.00	80	0	0.00	0.00	1.02:1

[a] negative number indicates a net gain in sparsely vegetated habitat.

-- indicates habitat not present in sufficient quantity to analyze.

Table 23. Estimation of Migratory Bird Habitat Services and Habitat Injury in the Ruby Pipeline Corridor through Nevada and Scaled Habitat Compensation to Offset Injury from HEA Model.

Aggregate Vegetation Type	Baseline Service Level in the Pipeline Intersect (service-acres per year)	Average Service Level per Acre (services/acre)	Baseline Services Over 40 Years (service-acre-years)	Habitat Injury (service-acre-years lost in 40 years)	Permanent Injury (% of Baseline lost)	Scaled Habitat Compensation (acres)	Compensation Ratio (acres restored:acres in Restoration ROW)
Agricultural and Developed	88,761	3.55	3,550,455	1,602	0.01%	11.28	1.09:1
Conifer Forest	27	3.00	1,067	231	8.86%	1.93	1.53:1
Deciduous Forest	4,846	9.22	193,824	24,552	8.79%	66.59	1.92:1
Grassland / Herbaceous	18,011	7.12	720,459	7,526	0.00%	26.41	1.17:1
Introduced Annual Grass and Forb	41,926	1.50	1,677,027	1,065	0.00%	17.75	1.03:1
Introduced Perennial Grass and Forb	138	1.95	5,527	15	0.00%	0.19	1.02:1
Mixed Deciduous Conifer Forest	0	--	0	--	--	--	--
Pinyon-Juniper Woodland	211,452	18.42	8,458,090	121,451	1.29%	164.86	2.19:1
Riparian	10,198	18.51	407,915	2,229	0.00%	3.01	1.08:1
Sagebrush Steppe	12,483,369	17.66	499,334,773	4,791,121	0.75%	6,782.56	2.42:1
Salt Desert Shrub	2,041,988	22.59	81,679,535	1,896,988	1.37%	2,099.56	2.88:1
Shrubland	290	6.00	11,606	997	0.00%	4.15	1.26:1
Sparsely Vegetated	1,821	1.00	72,842	-23,495 [a]	0%	0	1:1
Wetlands	0	--	0	--	--	--	--

[a] negative number indicates a net gain in sparsely vegetated habitat.
-- indicates habitat not present in sufficient quantity to analyze.

Table 24. Estimation of Migratory Bird Habitat Services and Habitat Injury in the Ruby Pipeline Corridor through Oregon and Scaled Habitat Compensation to Offset Injury from HEA Model.

Aggregate Vegetation Type	Baseline Service Level in the Pipeline Intersect (service-acres per year)	Average Service Level per Acre (services/acre)	Baseline Services Over 40 Years (service-acre-years)	Habitat Injury (service-acre-years lost in 40 years)	Permanent Injury (% of Baseline lost)	Scaled Habitat Compensation (acres)	Compensation Ratio (acres restored:acres in Restoration ROW)
Agricultural and Developed	414,520	4.00	16,580,781	2,928	0.01%	18.29	1.06:1
Conifer Forest	291,055	9.67	11,642,183	520,075	3.46%	1,344.39	3.58:1
Deciduous Forest	1,636	6.11	65,428	8,333	10.97%	34.07	1.86:1
Grassland / Herbaceous	98	4.88	3,922	100	0.00%	0.51	1.08:1
Introduced Annual Grass and Forb	24	1.73	951	8	0.00%	0.11	1.02:1
Introduced Perennial Grass and Forb	0	1.00	6	0	0.00%	0.00	1.04:1
Mixed Deciduous Conifer Forest	0	--	0	--	--	--	--
Pinyon-Juniper Woodland	17,873	10.29	714,927	101,639	12.62%	246.84	2.58:1
Riparian	4,446	10.91	177,857	993	0.00%	2.28	1.04:1
Sagebrush Steppe	1,012,827	17.20	40,513,084	840,104	1.62%	1,220.92	2.59:1
Salt Desert Shrub	41,204	8.72	1,648,146	46,494	1.65%	133.37	3.02:1
Shrubland	7,026	13.17	281,027	7,794	0.00%	14.79	1.28:1
Sparsely Vegetated	62	1.08	2,474	-12,290[a]	0%	0	1:1
Wetlands	0	--	0	--	--	--	--

[a] negative number indicates a net gain in sparsely vegetated habitat.

-- indicates habitat not present in sufficient quantity to analyze.

7.0 HEA RESULTS AND CONCLUSION

The HEA completed as part of the migratory bird conservation Plan quantified the compensation acreages necessary to mitigate and offset the direct and indirect impacts associated with the disturbance of all migratory bird habitats. Direct impacts considered by the HEA included loss of migratory bird habitat functionality caused by vegetation removal in the pipeline right-of-way and infrastructure footprint (e.g., roads, staging areas). Indirect impacts considered by the HEA included loss of migratory bird habitat functionality that would occur as a result of noise and dust impacts on migratory bird habitats immediately adjacent to Project construction areas, as well as the fragmentation of habitat patches that would result from pipeline and road construction. Residual impacts associated with permanent loss of migratory bird habitats and the duration of vegetation recovery were also factors in the HEA for migratory birds. Results from the HEA analysis are summarized in Tables 21 to 24 and include: the baseline migratory bird habitat services provided in the pipeline intersect; the habitat injury within the pipeline intersect; the habitat compensation acres scaled to offset the injury; and the habitat compensation ratios for all 14 migratory bird habitats.

However, Ruby Pipeline LLC also desired to complete a separate Conservation Agreement for greater sage-grouse and pygmy rabbit with the Bureau of Land Management and the States of Wyoming, Nevada, and Utah for these sagebrush-obligate species. And there was recognition and agreement that there was overlap in the 14 habitat types analyzed in the migratory bird Plan, and those used by the sagebrush-obligate species to be addressed in the Conservation Agreement for greater sage-grouse and pygmy rabbit. Recognizing this, the wildlife and natural resouce management agencies involved agreed that they would not ask Ruby Pipeline LLC to provide double compensation for the habitat types common to both the Plan and the Conservation Agreement. Hence a decision was made to divide up the 14 habitat types analyzed in the migratory bird Plan and to instead assign some to the Plan and the others to the Conservation Agreement. As a result of this decision 7 habitat types (Agriculture/Developed, Conifer Forest, Deciduous Forest, Mixed Deciduous Conifer Forest, Pinyon-Juniper Woodland, Sparsely Vegetated, and Wetlands; Table 4) were assigned to the migratory bird Plan and the other 7 habitat types (Grassland Herbaceous, Introduced Annual Grass and Forb, Introduced Perennial Grass and Forb, Riparian, Sagebrush Steppe, Salt Desert Shrub, and Shrubland; Table 4) were assigned to the Conservation Agreement for greater sage-grouse and pygmy rabbit for purposes of allocating the funding Ruby Pipeline LLC would provide to offset the loss of habitat services.

When considering just the 7 habitat types assigned to the migratory bird Plan for compensation purposes results of the HEA indicate that 2,647 compensation acres of migratory bird habitat would need to be purchased, enhanced, or created to offset the indirect and residual effects that would not be fully compensated by vegetation restoration activities in areas disturbed by the Project. This total of compensation acres is based on results for Scaled Habitat Compensation Acres for these 7 migratory bird habitat types as presented in Tables 21 to 24. These acres would need to be of a similar quality to those impacted by the Project. The 2,647 acres would be off-site and in addition to the restored Project ROW and associated temporary infrastructure.

To offset the 2,647 acres of migratory bird habitat required to compensate for injuries to migratory bird habitat associated with Project development, Ruby has agreed to place $2,827,947 into an escrow account to be used for migratory bird habitat conservation purposes as described in more detail in Ruby Pipeline LLC's Voluntary Conservation Plan for Migratory Birds. The total amount equates to approximately $1,068 per each of the 2,647 compensation acres. Determination of the amount of migratory bird Project dollars appropriated to each state will be based on the total service-acres of migratory bird habitat lost per state (Tables 21 to 24) rather than actual acres impacted. The amount of conservation Project dollars appropriated to each state for migratory birds will be roughly proportional to the migratory bird habitat service-acres lost within that state relative to the total migratory bird habitat services lost along the entire Ruby Pipeline corridor. Nevada had the most service acres lost, followed by Utah, then Oregon, and Wyoming had the least service acres lost (Tables 21 to 24).

Funds provided for the migratory bird Plan will be used for the conservation of migratory bird habitat through the acquisition of lands (through fee title or perpetual conservation easements), implementation of habitat restoration, and long-term management of the lands for the benefit of migratory birds. Other intended uses for these funds include: migratory bird habitat enhancement, maintenance, management, and improvement. The amount of the funds contributed by Ruby to ensure that the objectives of the habitat conservation are met is based on the value to migratory birds of habitats lost or degraded, land values, fee title costs, easement costs, habitat restoration costs, costs for administration of the funds, long-term management and maintenance costs, and other anticipated costs necessary to meet the agreed-upon acreage.

For the 7 habitat types assigned to the Conservation Agreement for greater sage-grouse and pygmy rabbit Ruby also has agreed to provide separate funding to offset Project impacts to these habitats. For further details on this see the Ruby Project Cooperative Conservation Agreement for the Greater Sage-Grouse and Pygmy Rabbit. USFWS expects that migratory birds associated with these other habitat types could benefit from habitat conservation measures targeted towards sage-grouse and pygmy rabbits.

8.0 REFERENCES

Adamus, P.R., K. Larsen, G. Gillson, and C.R. Miller. 2001. Oregon Breeding Bird Atlas. Oregon Field Ornithologists, P.O. Box 10373, Eugene, OR 97440.

Allen II, P.D., D.J. Chapman, and D. Lane. 2005. Scaling environmental restoration to offset injury using habitat equivalency analysis. Edited by R.F. Bruins and M.T. Heberling, Economics and Ecological Risk Assessment: Applications to Watershed Management. CRC Press, Boca Raton, FL.

American Bird Conservancy. 2007. Cats Indoors! The Campaign for Safer Birds and Cats. Available online at http://www.abcbirds.org/abcprograms/policy/cats/index.html. Accessed September 2009.

American Ornithologists' Union [A.O.U.]. 1998. Check-list of North American Birds. Lawrence, KS: Allen Press.

Ammon, E. 2004. Nevada Bird Count: 2003 Status Report. Great Basin Bird Observatory Technical Report No. 04-01. Great Basin Bird Observatory, Reno, NV.

Arsenault, D. 2002. Final Concept Paper, Nevada Partners In Flight All Bird Monitoring Program. Prepared for Nevada Partners In Flight Bird Monitoring Committee. Avian Research Center of Nevada, Reno.

Balda, R. P. 2002. Pinyon Jay (*Gymnorhinus cyanocephalus*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available online at: http://bna.birds.cornell.edu. Accessed August 2009.

Balda, R. P. and G. C. Bateman. 1972. The breeding biology of the Piñon Jay. Living Bird 11: 5–42.

Brown, S., C. Hickey, B. Harrington, B., and R. Gill (eds.). 2001. The United States Shorebird Conservation Plan. 2nd edition. Manomet Center for Conservation Sciences, Manomet, Massachusetts. 61 pp. http://www.fws.gov/shorebirdplan/USShorebird/downloads/USShorebirdPlan2Ed.pdf.

Butcher, G.S., B. Peterjohn, and C.J. Ralph. 1993. Overview of national bird population monitoring programs and databases. *In* D.M. Finch and P.W. Stangel (eds.). Status and management of neotropical migratory birds: September 21-25, 1992, Estes Park, Colorado. Gen. Tech. Rep. RM-229. Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, U.S. Dept. of Agriculture, Forest Service: 192-203.

Carson, R. 1962. Silent Spring. Houghton Mifflin, Boston, MA.

Chesser, T.R., Banks, R.C., Barker, F.K., Cicero, C., Dunn, J.L., Kratter, A.W., Lovette, I.J., Rasmussen, P.C., Remsen, Jr., J.V., Rising, J.D., Stotz, D.F., and K. Winker. 2009. Fiftieth Supplement to the American Ornithologists' Union Check-list of North

American Birds. Auk 126(3): 705-714.

Cicero, C. 2000. Juniper Titmouse (*Baeolophus ridgwayi*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available online at: http://bna.birds.cornell.edu. Accessed August 2009.

Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines to manage sage grouse populations and their habitats. Wildlife Society Bulletin 28:967-985.

Crawford, J. A., R. A. Olson, N. E. West, J. C. Mosley, M. A. Schroeder, T. D. Whitson, R. F. Miller, M. A. Gregg, and C. S. Boyd. 2004. Ecology and management of sage-grouse and sage-grouse habitat. Journal of Range Management 57:2-19.

Dixon. R.D. 1995. Density, Nest-site and Roost-site Characteristics, Home-range, Habitat-use and Behaviour of White-headed Woodpeckers: Deschutes and Winema National Forests, Oregon. Oregon Dept. Fish and Wildl. Nongame Report. 93-3-01.

Dobbs, R. C., P. R. Martin and T. E. Martin. 1998. Green-tailed Towhee (*Pipilo chlorurus*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology.

Dotson, R. A. 1971. The breeding biology and ethology of the Green-tailed Towhee. Master's Thesis. Univ. of Utah, Salt Lake City.

Dunford, R.W., T.C. Ginn, and W.H. Desvousges. 2004. The use of habitat equivalency analysis in natural resource damage assessments. Ecological Economics 48(2004):49–70.

Dunn, E.H., B.L. Altman, J. Bart, C.J. Beardmore, H. Berlanga, P.J. Blancher, G.S. Butcher, D.W. Demarest, R. Dettmers, W.C. Hunter, E.E. Iñigo-Elias, A.O. Panjabi, D.N. Pashley, C.J. Ralph, T.D. Rich, K.V. Rosenberg, C.M. Rustay, J.M. Ruth, and T.C. Will. 2005. High priority needs for range-wide monitoring of North American landbirds. Partners in Flight Technical Series No. 2. Available online at http://www.partnersinflight.org/pubs/ts/02-MonitoringNeeds.pdf. Accessed September 2009.

Environmental System Research Institute (ESRI). 2008. Data and Maps 9.3 DVD Media Kit.

Federal Energy Regulatory Commission (FERC). 2009. Ruby Pipeline Project, Resource Report 3 – Fish, Wildlife, and Vegetation. Appendix C, figure 3C-5. Available online at http://www.rubypipeline.com/report3.shtm.

Federal Energy Regulatory Commission (FERC). 2010. Ruby Pipeline Project Final Environmental Impact Statement. Docket Nos. CP09-54-000. Office of Energy Projects, Washington, D.C. January 8, 2010.

Fellows, S. D. and S. L. Jones. 2009. Status assessment and conservation action plan for the Long-billed Curlew (*Numenius americanus*). U.S. Department of Interior, Fish and

Wildlife Service, Biological Technical Publication, FWS/BTP-R6012-2009, Washington, D.C.

Floyd, T. C.S. Elphick, G. Chisholm, K. Mack, R. Elston, E.S. Ammon, and J.D. Boone. 2007. Atlas of the Breeding Birds of Nevada. University of Nevada Press, Reno, Nevada.

Fischer, J. M. 1978. A natural history study of the Virginia's Warbler (*Vermivora virginiae*) in the Ponderosa Pine community. Master's Thesis. Northern Arizona Univ., Flagstaff.

Gardali, T. and G. Ballard. 2000. Warbling Vireo (*Vireo gilvus*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology.

Great Basin Bird Observatory. 2005. Landbirds of Nevada and the habitats they need: A resource manager's guide to conservation priority species. Great Basin Bird Observatory Technical Report No. 05-01. Great Basin Bird Observatory, Reno, Nevada.

Intergovernmental Panel on Climate Change. 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

King, D.M. 1997. Comparing ecosystem services and values, with illustrations for performing habitat equivalency analysis. Prepared by King and Associates, Inc., Washington, D.C., for U.S. Department of Commerce, Silvery Spring, MD.

Kohler, K.E., and R.E. Dodge. 2006. Visual_HEA: Habitat equivalency analysis software to calculate compensatory restoration following natural resource injury. Proceedings of 10th International Coral Reef Symposium:1611–1616.

Kushlan, J.A., M.J. Steinkamp, K.C. Parsons, J. Capp, M.A. Cruz, M. Coulter, I. Davidson, L. Dickson, N. Edelson, R. Elliot, and others. 2002. Waterbird Conservation for the Americas: the North American Waterbird Conservation Plan, version 1. Waterbird Conservation for the Americas. Washington, DC.

Leukering, T., M. Carter, A. Panjabi, D. Faulkner, and R. Levad. 2001. Monitoring Wyoming's Birds: The Plan for Count-based Monitoring. Unpublished document, Rocky Mountain Bird Observatory, Brighton, CO.

Montana Natural Heritage Program. No date. Flammulated Owl. Animal Field Guide. Available online at: http://fwp.mt.gov/fieldguide/detail_ABNSB01020.aspx. Accessed August 2009.

Nicholoff, S.H., compiler. 2003. Wyoming Bird Conservation Plan, Version 2.0. Wyoming Partners In Flight. Wyoming Game and Fish Department, Lander, WY.

North American Bird Conservancy Initiative, U.S. Committee. 2009. The State of the Birds, United States of America, 2009. U.S. Department of Interior, Washington, D.C.

National Audubon Society. 2009. Christmas Bird Count, History. Available online at http://www.audubon.org/Bird/cbc/. Accessed September 2009.

National Oceanic and Atmospheric Administration. 2006. Habitat equivalency analysis: an overview. Available online at www.darrp.noaa.gov/library/pdf/heaoverv.pdf. Accessed July 2009.

_____. 2009. Restoration economics, habitat equivalency analysis. Available online at http://www.csc.noaa.gov/coastal/economics/habitatequ.htm. Accessed July 2009.

Olson, C. R. and T. E. Martin. 1999. Virginia's Warbler (*Vermivora virginiae*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology.

Panik, H. R. 1976. The vertebrate structure of a pinyon-juniper woodland community in northwestern Nevada. PhD Thesis. University of Nevada, Reno.

Parrish, J.R., R.E. Norvell, D. Roberts, H. White, and F.P. Howe. 2007. Population Monitoring of Neotropical Migratory Birds in Riparian Habitats of Utah, 1992–2005 Summary Report. Publication Number 07-17. Utah Division of Wildlife Resources, Utah Partners in Flight Program, Salt Lake City, UT.

Paton, P. W. C. and J. Dalton. 1994. Breeding ecology of Long-billed Curlews at Great Salt Lake, Utah. Great Basin Naturalist 54:79-85.

Rich, T.D., C.J. Beardmore, H. Berlanga, P.J. Blancher, M.S.W. Bradstreet, G.S. Butcher, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Iñigo-Elias, and others. 2004. Partners in Flight U.S. Fish and Wildlife Service North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY. Partners in Flight website. http://www.partnersinflight.org/cont_plan/.

Ruby Pipeline, LLC (Ruby). 2009. Draft Plan of Development. Docket No. CP09-54-000. Appendix I - Biological Resources Conservation Measure Plan. August 11, 2009.

Robinson, S.K., F.R. Thompson, T.M. Donovan, D.R. Whitehead, and J. Faaborg. 1995. Regional Forest Fragmentation and the Nesting Success of Migratory Birds. Science 267:1987–1990.

Saracco, J.F., and D.F. DeSante. 2008. Identifying Proximate Causes of Population Trends in Migratory Birds. Institute for Bird Populations, Point Reyes Station, CA.

Saracco, J.F., D.F. DeSante, and D.R. Kaschube. 2008. Assessing Landbird Monitoring Programs and Demographic Causes of Population Trends. Journal of Wildlife Management 72:1665–1673.

Sauer, J.R., J.E. Hines, and J. Fallon. 2008. The North American Breeding Bird Survey, Results and Analysis 1966–2007, Version 5.15.2008. U.S. Geologic Survey, Patuxent Wildlife Research Center, Laurel, MD.

Sauer, J.R., J.E. Hines, G. Gough, I. Thomas, and B.G. Peterjohn. 1997. The North American Breeding Bird Survey Results and Analysis. Version 96.4. Patuxent Wildlife Research Center, Laurel, MD.

Thomas, J. W., R. J. Miller, C. Maser, R. G. Anderson, and B. E. Carter. 1979. Plant communities and successional stages. Pages 22-39 in Wildlife habitats in managed forests: the Blue Mountains of Oregon and Washington. (Thomas, J. W., Ed.) U.S. Dep. Agric., For. Serv. Washington, DC.

USDA Bureau of Land Management (BLM), Nevada Department of Wildlife, Oregon Department of Fish and Wildlife, Utah Division of Wildlife Resources, Wyoming Game and Fish Department, and Ruby Pipeline LLC. 2009. Draft Conservation Agreement for the Greater Sage-Grouse and Pygmy Rabbit. In prep.

U.S. Department of the Interior. 2006. The National Map LANDFIRE: LANDFIRE National Existing Vegetation Type layer. Last updated September 2006. Department of the Interior, Geological Survey. Available online at http://gisdata.usgs.net/website/landfire/. Accessed August 2009.

_____. 2007. The National Map LANDFIRE: LANDFIRE National Fire Regime Condition Class layer. Last updated 2007. Department of Interior, Geological Survey. Available online at http://gisdata.usgs.net/website/landfire/. Accessed August 2009.

_____. 2008. LANDFIRE Rapid Assessment Reference Condition Models. U.S. Department of Agriculture (USDA), Forest Service; U.S. Department of Interior. Available online at http://www.landfire.gov/models_EW.php. Accessed August 2009.

U.S. Fish and Wildlife Service (FWS). 2002. Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbance. January 2002 Updates. Utah Field Office, Salt Lake City.

_____. 2007. National Bald Eagle Management Guidelines. Available online at http://www.fws.gov/midwest/Eagle/guidelines/NationalBaldEagleManagementGuidelines.pdf. Accessed February 2010.

_____. 2008. Birds of Conservation Concern 2008. U.S. Fish and Wildlife Service, Division of Migratory Bird Management. Arlington, VA. Available online at: http://library.fws.gov/Bird_Publications/BCC2008.pdf. Accessed September 2009.

U.S. Forest Service. 2009. Klamath Bird Monitoring Network webpage. Available online at http://www.fs.fed.us/psw/topics/wildlife/birdmon/landbird/klamath/. Accessed September 2009.

U.S. Shorebird Conservation Plan. 2004. High priority shorebirds ─ 2004. Unpublished Report, U. S. Fish and Wildlife Service, Arlington, Virginia. 5 pp. Available online at http://www.fws.gov/shorebirdplan/USShorebird/downloads/ShorebirdPriorityPopulationsAug04.pdf.

Walters, E. L., E. H. Miller and P. E. Lowther. 2002. Red-naped Sapsucker (Sphyrapicus nuchalis). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology.

West, N. E. 1996. Strategies for maintenance and repair of biotic community diversity on rangelands. Biodiversity in managed landscapes: Theory and practice (R. C. Szaro and D. W. Johnston, Eds.). New York: Oxford Univ. Press.

White, C., and R. Sparks. 2008. Monitoring Wyoming's Birds: 2007 Field Season Report. Technical Report M-MWB07-01. Rocky Mountain Bird Observatory, Brighton, CO.

Wyoming Game and Fish Department (WGFD). 2005. Comprehensive Wildlife Conservation Strategy for Wyoming. Available online at: http://gf.state.wy.us/wildlife/CompConvStrategy/Species/Birds/index.asp. Accessed August 2009.