Nichols Ranch ISR Project
U.S.N.R.C Source Material
SUA-1597
Jane Dough Amendment

Volume X

Appendix JD-D7, Addendums JD-D7-A and JD-D7-B, Appendix JD-D8, Addendums JD-D8-A through JD-D8-D, Appendix JD-D9, Addendums JD-D9-A and JD-D9-B, Appendix JD-D10, Addendums JD-D10-A and JD-D10-B, Appendix JD-D11, and Figures and Exhibits

Uranerz
ENERGY CORPORATION

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April 2014

APPENDIX JD-D7:

SOIL ASSESSMENT

April 2014

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LIST OF ABBREVIATIONS AND ACRONYMS

ISR	In-Situ Recovery
NRCS	Natural Resources Conservation Service
TRC	TRC Environmental Corporation
USDA	U.S. Department of Agriculture
WDEQ/LQD	Wyoming Department of Environmental Quality, Land Quality Division

JD-D7.1.0 SOILS

JD-D7.1.1 INTRODUCTION

This appendix provides a detailed inventory of premine soil characteristics within the Jane Dough Unit in accordance with Wyoming Department of Environmental Quality, Land Quality Division (WDEQ/LQD) Guideline No. 1 (1994). The information in this appendix includes an inventory of soil types (soil map units) and soil series based on the 2011 Order 2 soil survey, a base map delineating the soil types, and physical characteristics.

The Jane Dough Unit is located in southwest Campbell County and southeast Johnson County approximately 46 miles southwest of Gillette, Wyoming. The Jane Dough project area is located south and adjacent to the approved Uranerz Nichols Ranch Unit and is located about 5.0 miles southwest of the Uranerz Hank Unit. The Jane Dough Unit encompasses approximately 3,680 acres in portions of Sections 20, 21, 27, 28, 29, 30, 31, 32, 33, and 34, T43N, R76W (refer to Exhibit JD-D7-1). Access is by way of the Iberlin Road north from Wyoming Highway 387. Production from the Jane Dough Unit will be transported to the production plant facility located in the Nichols Ranch Unit via a system of pipelines.

Baseline soil information for the Jane Dough Unit consisted of mapping, but no sampling for laboratory analysis since the facilities for this area are located in the Nichols Ranch Unit. Because of the soil resource similarities within the proposed Jane Dough Unit and the adjacent Nichols Ranch Unit, map units comparable to those found in the Nichols Ranch Unit will be noted. Soils information presented in this appendix was collected following the Nichols Ranch ISR Project Soils Baseline Study Plan approved by WDEQ/LQD in August 2006. Overall, 54 soil profiles were exposed and described for soil mapping.

The project area is within the 10- to 14-inch Northern Plains (10-14NP) zone of northeastern Wyoming (Natural Resources Conservation Service [NRCS] 1988). Topographic relief ranges from 4,670 to 4,960 feet above mean sea level in the Jane Dough Unit. Annual precipitation varies from 10 to 14 inches, with approximately 35-41% falling during the normal growing

season (NRCS 1988). Growth of native cool-season plants begins about April 1 and continues to about July 1. Growth of native warm-season plants begins about May 15 and continues to about August 15. According to Wyoming Gap data, three primary vegetation types occur in the project area--Wyoming big sagebrush, grass dominated riparian, and mixed grass prairie (Wyoming Gap Analysis 2000).

Soils in the Jane Dough Unit are typical for the semi-arid grasslands of the western United States. Parent materials included residuum, alluvium, eolian deposits, and colluvium. Soils were classified taxonomically as Ustic Haplargids, Ustic Torifluvents, Ustic Torriorthents, Ustic Calciargids, and Ustic Haplocambids. Rock outcrops were observed and mapped.

Addendums JD-D7-A through JD-D7-B contains information about soils within the Jane Dough Unit. Refer to Addendum JD-D7-A for the Soil Mapping Unit descriptions. Soil Series descriptions for the project area are presented in Addendum D7-B of WDEQ/LQD Permit 778. Refer to Addendum JD-D7-B for the Prime Farmland Designation. The Baseline Soils Map is presented in Exhibit JD-D7-1. Refer to the baseline soil survey information in Appendix D7 of the Nichols Ranch ISR (WDEQ/LQD Permit 778) for laboratory analysis of similar soils.

JD-D7.2.0 METHODOLOGY

JD-D7.2.1 LITERATURE REVIEW

The soils in the southern portions of Johnson and Campbell counties (including the Jane Dough Unit) were mapped by the NRCS to an Order 3 scale in 1975 and 1991 respectively (NRCS 1975; 1991). The baseline soils inventory for the Jane Dough Unit area consisted of verification and further delineation of the existing NRCS mapping for these portions of Johnson and Campbell counties, Wyoming.

Previous NRCS mapping of the Jane Dough Unit and 2006 mapping of the adjacent Nichols Ranch Unit was reviewed prior to fieldwork.

JD-D7.2.2 PROJECT PARTICIPANTS

BKS Environmental Associates, Inc. of Gillette, Wyoming, performed the soil survey fieldwork and compiled a draft report. TRC of Laramie, Wyoming, provided project direction and editing and quality assurance on the soils assessment report.

JD-D7.2.3 SOIL SURVEY

Field mapping was conducted and soil maps were prepared according to techniques and procedures outlined in the National Cooperative Soil Survey. WDEQ/LQD Guideline 1 (August 1994 Revision) was used as a guide during all phases of the study.

An Order 2 soil survey was completed in September 2010. Soil profiles were examined on a widely scattered basis according to physiographic configuration. Information derived from these profiles was used to determine which soils are likely to occur on specific landscape positions. The soil boundaries were delineated on a photographic base map with a scale of 1 inch = 500 feet for purposes of permit submittal. Refer to Table JD-D7-1 for project soil mapping units, Addendum JD-D7-A for map unit descriptions. Soil Series descriptions for the Jane Dough Unit are presented in Addendum D7-B of WDEQ/LQD Permit 778 and will not be repeated here.

Table JD-D7-1 Soil Map Units and Acreage Within the Jane Dough Unit.

Map Symbol	Map Unit Description	Permit Acreage	% Total Permit Area
Bo	Bowbac fine sandy loam	54.83	1.49
Cu	Cushman loam	191.36	5.20
D	Disturbed	6.62	0.18
Fo	Forkwood loam	207.92	5.65
Ha	Haverdad loam	390.08	10.60
Hi	Hiland fine sandy loam	62.56	1.70
Ki	Kishona loam	121.80	3.31
Ma	Maysdorf fine sandy loam	98.62	2.68
Pu	Pugsley loam	155.66	4.23
Sa	Samday clay loam	37.54	1.02
Sh	Shingle loam	812.91	22.09
Ta	Taluce sandy loam	96.41	2.62
Th	Theedle loam	357.70	9.72
Ul	Ulm clay loam	58.88	1.60
UTG	Ustic Torriorthents-Gullied	871.09	23.67
Vo	Vonalee fine sandy loam	62.92	1.71
W	Water	8.83	.24
Zi	Zigweid loam	84.27	2.29
Total		3,680.00	100.00

JD-D7.2.4 SOIL SAMPLING

There will be no processing plant facilities within the Jane Dough Unit. Because the proposed project involves the in situ recovery of uranium resources, WDEQ/LQD agreed that soil samples would only be collected from the disturbance areas associated with the two proposed plant areas (one in the Nichols Ranch Unit and one in the Hank Unit). Therefore, the reader should refer to Appendix D7 in the Nichols Ranch Unit (WDEQ/LQD Permit 778) for laboratory analysis of similar soils.

All soil profiles were collected with a Giddings truck mounted auger to paralithic contact or a maximum depth of 60 inches, whichever was encountered first. Approximately half of the holes encountered paralithic contacts prior to reaching a depth of 60 inches. Soil profiles were described in the field, to the extent possible, by the physical and chemical nature of each profile horizon. Backhoe pits were not utilized for soil mapping.

Soil mapping verification locations were identified on a photographic base map and global positioning system (GPS) locations were collected with hand-held Garmin GPS units.

JD-D7.2.5 LABORATORY ANALYSIS

Refer to the Appendix D7 of the Nichols Ranch ISR Project (WDEQ/LQD Permit 778) for laboratory analysis of similar soils.

JD-D7.3.0 RESULTS AND DISCUSSION

JD-D7.3.1 SOIL SURVEY-GENERAL

General topography of the area consists of hilly terrain with many large deep drainages. The soils occurring in the Jane Dough Unit were generally loamy or fine-loamy. Moderately deep soils to very deep are present throughout most of the project area.

JD-D7.3.2 SOIL MAPPING UNIT INTERPRETATION

Soils in the Jane Dough Unit were mapped in during the 2010 fieldwork and an Order 2 soil survey map was prepared (refer to Exhibit JD-D7-1). Refer to Addendum JD-D7-A for soil mapping unit descriptions.

A total of 3,680 acres was included in the final soil mapping of the Jane Dough Unit. Overall, 54 soil profiles were exposed and described for soil mapping.

Salvage depths for the Jane Dough Unit area were evaluated during mapping. Soil depths within a given mapping unit will vary based on any combination of the five primary soil forming factors (i.e., climate including effective precipitation, organisms, relief or topography, parent material, and time). Subtle differences in any one of the previously mentioned factors will impact development between series and within series designation; however, it may not be as noticeable as when topography is a major factor.

All soils have at least some suitable topsoil and/or subsoil. Due to rock outcrops and slope, topsoil salvage in the Samday clay loam and Ustic Torriorthents-Gullied may be impractical with heavy machinery. The primary limiting factor within the Jane Dough Unit area was calcium carbonate.

JD-D7.3.3 PRIME FARMLAND ASSESSMENT

No prime farmland was indicated within the Jane Dough Unit based on a reconnaissance survey by the NRCS. Refer to Addendum JD-D7-B, Prime Farmland Designation, for copies of letters from NRCS offices in Campbell and Johnson counties for negative determinations.

JD-D7.4.0 REFERENCES

Natural Resource Conservation Service. 1988. Technical guide to range sites and range condition 7-9 inch, Green River and Great Divide Basins. Technical Guide Notice No. WY-99, Section IIB. U.S. Department of Agriculture, Natural Resources Conservation Service, Casper, Wyoming.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Official Soil Series Descriptions. [Online WWW]. Available URL: "http://soils.usda.gov/technical/classification/osd/index.html" [Accessed January 2011]. USDA-NRCS, Lincoln, Nebraska.

U.S. Department of Agriculture, Natural Resource Conservation Service. 2004. Soil Survey: Campbell County, Southern Part, Wyoming.

U.S. Department of Agriculture, Natural Resource Conservation Service. 1975. Soil Survey: Johnson County, Southern Part, Wyoming.

U.S. Department of Agriculture. 1975. Soil Taxonomy. U.S. Dept. of Agriculture. Handbook 436, 754 pp. Government Printing Office.

U.S. Department of Agriculture. 1993. Soil Survey Manual. U.S. Dept. of Agriculture. Handbook 18, 437 pp. Government Printing Office.

Wyoming Department of Environmental Quality, Land Quality Division. 1994. Guideline 1, Topsoil and Overburden.

Wyoming Gap Analysis. 2000. A geographic analysis of biodiversity. Prepared in cooperation with the Wyoming Cooperative Fish and Wildlife Research Unit and University of Wyoming, Laramie. 109 pp.

ADDENDUM JD-D7-A

SOIL MAPPING UNIT DESCRIPTIONS

April 2014

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Bo: Bowbac fine sandy loam[1]

The Bowbac fine sandy loam map unit consists of moderately deep, well-drained soils that developed from alluvium and eolian deposits over residuum weathered from calcareous sandstone. It occurs on hills and ridges at elevations between 4,100 and 5,300 feet above mean sea level (AMSL).

The average annual precipitation ranges from 10 to 14 inches. The average annual air temperature is approximately 43 to 51 degrees F., and the average frost-free season is approximately 105 to 130 days.

This map unit is approximately 80 percent Bowbac fine sandy loam. Within this map unit the following additional components are found: Cushman, Forkwood, Hiland, Terro, and Vonalee. Inclusions comprise approximately 20 percent of the map unit.

Permeability within the Bowbac fine sandy loam soil is moderate. The available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Surface runoff is slow and the hazard of water erosion is slight. The hazard of wind erosion is severe.

Topsoil Suitability

This map unit is a fair source of topsoil.

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[1] Map unit description based on current and 2004 Southern Campbell County NRCS information.

Cu: Cushman loam[1] [2]

The Cushman loam map unit consists of moderately deep, well-drained soils that developed from alluvium over residuum weathered from sandstone and shale. It occurs on hills and ridges at elevations between 4,100 and 5,200 feet AMSL.

The average annual precipitation ranges from 10 to 14 inches. The average annual air temperature is approximately 43 to 51 degrees F., and the average frost-free season is approximately 105 to 130 days.

This map unit is approximately 80 percent Cushman loam. Within this map unit the following additional components are found: Bowbac, Cambria, Forkwood, Worf, and Zigweid. Inclusions comprise approximately 20 percent of the map unit.

Permeability within the Cushman loam soil is moderate. The available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Surface runoff is moderate and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil.

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[1] Map unit description based on current and 2004 Southern Campbell County NRCS information.

[2] Map unit most similar to 121-1: Cushman Loam from 2006 Nichols Ranch D-7.

Fo: Forkwood loam[1] [2]

The Forkwood loam map unit consists of very deep, well-drained soils that developed from alluvium derived from sandstone and shale. It occurs on alluvial fans and fan remnants at elevations between 4,100 and 5,200 feet AMSL.

The average annual precipitation ranges from 10 to 14 inches. The average annual air temperature is approximately 43 to 51 degrees F., and the average frost-free season is approximately 105 to 130 days.

This map unit is approximately 80 percent Forkwood loam. Within this map unit the following additional components are found: Cambria, Ulm, and Wyotite. Inclusions comprise approximately 20 percent of the map unit.

Permeability within the Forkwood loam soil is moderate. The available water capacity is high. Effective rooting depth is 60 inches or more. Surface runoff is slow and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil.

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[1] Map unit description based on current and 2004 Southern Campbell County NRCS information.

[2] Map unit most similar to STe-2: Forkwood Association from 2006 Nichols Ranch D-7.

Ha: Haverdad loam[1] [2]

The Haverdad loam map unit consists of very deep, well-drained soils that developed from alluvium derived from sandstone and shale. It occurs on stream terraces and flood plains at elevations between 3,500 and 6,500 feet AMSL.

The average annual precipitation ranges from 10 to 17 inches. The average annual air temperature is approximately 43 to 52 degrees F., and the average frost-free season is approximately 105 to 130 days.

This map unit is approximately 80 percent Haverdad loam. Within this map unit the following additional components are found: Clarkelen, Boruff, Draknab, and Kishona. Inclusions comprise approximately 20 percent of the map unit.

Permeability within the Haverdad loam soil is moderate. The available water capacity is high. Effective rooting depth is 60 inches or more. Surface runoff is slow and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil.

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[1] Map unit description based on current and 2004 Southern Campbell County NRCS information.

[2] Map unit most similar to 152: Haverdad Clarkelen Complex from 2006 Nichols Ranch D-7.

Hi: Hiland fine sandy loam[1]

The Hiland fine sandy loam map unit consists of very deep, well-drained soils that developed from alluvium or eolian deposits on relict surfaces consisting of terraces, fans, fan remnants, pediments, ridges, hills and stabilized dunes. It is found at elevations between 3,500 and 6,300 feet AMSL.

The average annual precipitation ranges from 10 to 14 inches. The average annual air temperature is approximately 43 to 51 degrees F., and the average frost-free season is approximately 105 to 130 days.

This map unit is approximately 85 percent Hiland fine sandy loam. Within this map unit the following additional components are found: Forkwood, Vonalee, and Moskee. Inclusions comprise approximately 15 percent of the map unit.

Permeability within the Hiland fine sandy loam soil is moderate. The available water capacity is moderate. Effective rooting depth is 60 inches or more. Surface runoff is low or medium and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil.

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[1] Map unit description based on current and 2004 Southern Campbell County NRCS information.

Ki: Kishona loam[1] [2]

The Kishona loam map unit consists of very deep, well-drained soils that developed from alluvium derived from sandstone and shale. It occurs on alluvial fans and fan remnants at elevations between 4,100 and 5,200 feet AMSL.

The average annual precipitation ranges from 10 to 14 inches. The average annual air temperature is approximately 43 to 51 degrees F., and the average frost-free season is approximately 105 to 130 days.

This map unit is approximately 80 percent Kishona loam. Within this map unit the following additional components are found: Cambria, Cushman, Forkwood, poorly drained soils, Ulm, and Zigweid. Inclusions comprise approximately 20 percent of the map unit.

Permeability within the Kishona loam soil is moderate. The available water capacity is high. Effective rooting depth is 60 inches or more. Surface runoff is slow and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil.

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[1] Map unit description based on current and 2004 Southern Campbell County NRCS information.

[2] Map unit most similar to 216-2: Kishona Loam from 2006 Nichols Ranch D-7.

Ma: Maysdorf fine sandy loam[1] [2]

The Maysdorf fine sandy loam map unit consists of very deep, well-drained soils that developed from alluvium and eolian deposits on terraces, fan remnants, alluvial fans, hills, and ridges. It is found at elevations between 3,800 and 5,500 feet AMSL.

The average annual precipitation ranges from 10 to 14 inches. The average annual air temperature is approximately 45 to 50 degrees F., and the average frost-free season is approximately 105 to 130 days.

This map unit is approximately 75 percent Maysdorf fine sandy loam. Within this map unit the following additional components are found: Decolney, Hiland, Forkwood, and Pugsley. Inclusions comprise approximately 25 percent of the map unit.

Permeability within the Maysdorf fine sandy loam soil is moderate. The available water capacity is moderate. Effective rooting depth is 60 inches or more. Surface runoff is medium and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil.

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[1] Map unit description based on current and 2004 Southern Campbell County NRCS information.

[2] Map unit most similar to MP-1: Maysdorf Association from 2006 Nichols Ranch D-7.

Pu: Pugsley loam[1] [2]

The Pugsley loam map unit consists of moderately deep, well-drained soils that developed from weathered sedimentary rocks. It occurs on hills and ridges at elevations between 4,000 and 5,500 feet AMSL.

The average annual precipitation ranges from 10 to 14 inches. The average annual air temperature is approximately 47 to 54 degrees F., and the average frost-free season is approximately 110 to 130 days.

This map unit is approximately 50 percent Pugsley loam. Within this map unit the following additional components are found: Decolney, Hiland, and Bowbac. Inclusions comprise approximately 50 percent of the map unit.

Permeability within the Pugsley loam soil is moderate. The available water capacity is low. Effective rooting depth is 20 to 40 inches. Surface runoff is medium to low and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil.

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[1] Map unit description based on current and 1975 Southern Johnson County NRCS information.

[2] Map unit most similar to 194-1: Pugsley Association from 2006 Nichols Ranch D-7.

Sa: Samday clay loam[1]

The Samday clay loam map unit consists of very shallow to shallow, well-drained soils that developed from residuum, slope alluvium, and colluvial slopewash derived from clay shale. It occurs on upland ridgetops, shoulders, and backslope positions at elevations between 3,500 and 6,500 feet AMSL.

The average annual precipitation ranges from 10 to 17 inches. The average annual air temperature is approximately 44 to 49 degrees F., and the average frost-free season is approximately 105 to 130 days.

This map unit is approximately 30 percent Samday clay loam. Within this map unit the following additional components are found: Shingle, Badland, Cushman, Rock Outcrop, and Theedle. Inclusions comprise approximately 70 percent of the map unit.

Permeability within the Samday clay loam soil is slow. The available water capacity is low. Effective rooting depth is 10 to 20 inches. Surface runoff is medium to rapid and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

Topsoil Suitability

This map unit is an unsuitable source for topsoil.

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[1] Map unit description based on current and 2004 Southern Campbell County NRCS information.

Sh: Shingle loam[1] [2]

The Shingle loam map unit consists of shallow, well-drained soils that developed from residuum weathered from sandstone and shale. It occurs on hills and ridges at elevations between 4,100 and 5,400 feet AMSL.

The average annual precipitation ranges from 10 to 14 inches. The average annual air temperature is approximately 43 to 51 degrees F., and the average frost-free season is approximately 105 to 130 days.

This map unit is approximately 80 percent Shingle loam. Within this map unit the following additional components are found: Cambria, Cushman, Renohill, Samday, Theedle, and Worf. Inclusions comprise approximately 20 percent of the map unit.

Permeability within the Shingle loam soil is moderate. The available water capacity is very low. Effective rooting depth is 10 to 20 inches. Surface runoff is very high and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil.

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[1] Map unit description based on current and 2004 Southern Campbell County NRCS information.

[2] Map unit most similar to 124-2: Shingle Loam from 2006 Nichols Ranch D-7.

Ta: Taluce sandy loam[1]

The Taluce sandy loam map unit consists of very shallow to shallow, well-drained soils that developed from residuum and slope alluvium derived from sandstone. It occurs on ridges and hills at elevations between 3,500 and 6,500 feet AMSL.

The average annual precipitation ranges from 10 to 17 inches. The average annual air temperature is approximately 42 to 51 degrees F., and the average frost-free season is approximately 100 to 130 days.

This map unit is approximately 40 percent Taluce sandy loam. Within this map unit the following additional components are found: Shingle, Terro, Theedle and Badlands. Inclusions comprise approximately 60 percent of the map unit.

Permeability within the Taluce sandy loam soil is rapid. The available water capacity is very low. Effective rooting depth is 10 to 20 inches. Surface runoff is medium to rapid and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil.

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[1] Map unit description based on current and 2004 Southern Campbell County NRCS information.

Th: Theedle loam[1] [2]

The Theedle loam map unit consists of moderately deep, well-drained soils that developed from alluvium over residuum weathered from sandstone and shale. It occurs on hills and ridges at elevations between 4,100 and 5,200 feet AMSL.

The average annual precipitation ranges from 10 to 14 inches. The average annual air temperature is approximately 45 to 51 degrees F., and the average frost-free season is approximately 105 to 130 days.

This map unit is approximately 80 percent Theedle loam. Within this map unit the following additional components are found: Cambria, Cushman, Kishona, and Shingle. Inclusions comprise approximately 20 percent of the map unit.

Permeability within the Theedle loam soil is moderate. The available water capacity is low. Effective rooting depth is 20 to 40 inches. Surface runoff is high and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil.

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[1] Map unit description based on current and 2004 Southern Campbell County NRCS information.

[2] Map unit most similar to 217-1: Theedle Loam from 2006 Nichols Ranch D-7.

Ul: Ulm clay loam[1]

The Ulm loam map unit consists of very deep, well-drained soils that developed from alluvium derived from calcareous shale. It occurs on alluvial fans and fan remnants at elevations between 4,100 and 5,000 feet AMSL.

The average annual precipitation ranges from 10 to 14 inches. The average annual air temperature is approximately 46 to 51 degrees F., and the average frost-free season is approximately 105 to 130 days.

This map unit is approximately 85 percent Ulm loam. Within this map unit the following additional components are found: Bidman and Forkwood. Inclusions comprise approximately 15 percent of the map unit.

Permeability within the Ulm loam soil is slow. The available water capacity is high. Effective rooting depth is 60 inches or more. Surface runoff is moderate and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil.

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[1] Map unit description based on current and 2004 Southern Campbell County NRCS information.

UTG: Ustic Torriorthents - Gullied[1] [2]

The Ustic Torriorthents - Gullied map unit consists of moderately deep, well drained soils that developed from alluvium and/or residuum weathered from sandstone and shale. The soils are indistinct and vary in both texture and thickness. It occurs on hills and gullies at elevations between 3,500 and 5,400 feet AMSL. These soils are dissected and entrenched by deep gullies.

The average annual precipitation ranges from 10 to 17 inches. The average annual air temperature is approximately 45 to 50 degrees F., and the average frost-free season is approximately 105 to 130 days.

This map unit is approximately 90 percent gullied Theedle or similar soils. Within this map unit the following additional components are found: riverwash and unnamed wet soils. Inclusions comprise approximately 10 percent of the map unit.

Permeability within the Ustic Torriorthents - Gullied soil is moderate. The available water capacity is low. Effective rooting depth is 20-40 inches. Surface runoff is severe and the hazard of water erosion is severe. The hazard of wind erosion is severe.

Topsoil Suitability

This map unit is an unsuitable source for topsoil.

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[1] Map unit description based on current and 2004 Southern Campbell County NRCS information.

[2] Map unit most similar to 233: Ustic Torriorthents Gullied from 2006 Nichols Ranch D-7.

Vo: Vonalee fine sandy loam[1]

The Vonalee fine sandy loam map unit consists of very deep, well-drained soils that developed from alluvium and eolian deposits derived from calcareous sandstone. It occurs on alluvial fans and fan remnants at elevations between 4,100 and 5,200 feet AMSL.

The average annual precipitation ranges from 10 to 14 inches. The average annual air temperature is approximately 44 to 49 degrees F., and the average frost-free season is approximately 105 to 130 days.

This map unit is approximately 80 percent Vonalee fine sandy loam. Within this map unit the following additional components are found: Hiland, Keeline, and Terro. Inclusions comprise approximately 20 percent of the map unit.

Permeability within the Vonalee fine sandy loam soil is moderately rapid. The available water capacity is high. Effective rooting depth is 60 inches or more. Surface runoff is low and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

Topsoil Suitability

This map unit is a fair source of topsoil.

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[1] Map unit description based on current and 2004 Southern Campbell County NRCS information.

Zi: Zigweid loam[1]

The Zigweid loam map unit consists of very deep, well-drained soils that developed from alluvium derived from mixed sedimentary sources. It occurs on alluvial fans, fan aprons, fan piedmonts, fan remnants, terraces, ridges, and hills at elevations between 3,500 and 6,600 feet AMSL.

The average annual precipitation ranges from 10 to 14 inches. The average annual air temperature is approximately 43 to 51 degrees F., and the average frost-free season is approximately 105 to 130 days.

This map unit is approximately 85 percent Zigweid loam. Within this map unit the following additional components are found: Cambria, Kishona, Cushman, Forkwood, and Ulm. Inclusions comprise approximately 15 percent of the map unit.

Permeability within the Zigweid loam soil is moderate. The available water capacity is high. Effective rooting depth is 60 inches or more. Surface runoff is medium to rapid and the hazard of water erosion is moderate. The hazard of wind erosion is slight.

Topsoil Suitability

This map unit is a fair source of topsoil.

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[1] Map unit description based on current and 1975 Southern Johnson County NRCS information.

ADDENDUM JD-D7-B:

PRIME FARMLAND DESIGNATION LETTERS

April 2014

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
Gillette Field Office
601 4J Court, Suite C
Gillette, WY 82716

Phone: (307) 682-8843 x3
Fax: (307) 682-3813
Website: http://www.wy.nrcs.usda.gov

Date: February 2, 2011

Cody Bank
BKS Environmental Associates
PO Box 3467
Gillette, WY 82717

Dear Mr. Bank,

The Natural Resources Conservation Service has reviewed the following list of legal descriptions that you submitted:

- Sections 20, 21, 27, 28, 29, 32, 33 and 3 of T43N R76W

There is no prime farm land or agricultural land of state wide importance contained within this legal description.

If you have any questions, or need to discuss this comment with us, please contact me at 307-682-8843 ext. 101.

Sincerely,

Timothy Kellogg
District Conservationist

USDA United State Department of Agriculture | Natural Resources Conservation Service | 350 Nolan Ave. (PO Box48) Kaycee, WY 82639 (307) 738-2321

February 3, 2011

BKS Environmental Associates, Inc.
PO Box 3467
Gillette, WY 82717-3467

Subject: Prime Farm Land

Cody,

I have looked over your legal description to determine if it is prime farmland.

Sections 20, 29, 30, 31, and 32 of T43N R76W

I have determined it is not prime farmland using the NRCS Soil Data Mart. The soil types within the described area do not match the listed soil types deemed prime.

Sincerely,

Kassie Bales

Kassie Bales
Rangeland Management Specialist

cc:
Allison McKenzie, District Conservation-Johnson County

APPENDIX JD-D8:

VEGETATION

April 2014

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LIST OF ABBREVIATIONS AND ACRONYMS

CBM	Coalbed methane
GIS	Geographic information system
GPS	Global positioning system
ISR	In Situ Recovery
NRCS	Natural Resources Conservation Service
T&E	Threatened and endangered
TRC	TRC Environmental Corporation
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WDEQ/LQD	Wyoming Department of Environmental Quality, Land Quality Division
WYNDD	Wyoming Natural Diversity Database

JD-D8.1.0 INTRODUCTION

Baseline vegetation studies of the Jane Dough Unit were conducted in July 2010 by TRC Environmental Corporation (TRC) in accordance with a vegetation study plan approved by the Wyoming Department of Environmental Quality, Land Quality Division (WDEQ/LQD) for noncoal project areas. The sampling design and methods used for the vegetation studies followed Rule 1-V (revegetation performance standards): Noncoal Rules, Chapter 3 (WDEQ/LQD, amended April 25, 2006), WDEQ/LQD Guideline Number 2 (WDEQ/LQD 1997), and WDEQ/LQD Draft Guideline 2 Rewrite (WDEQ/LQD 2004).

The objectives of the vegetation studies are: 1) to establish a detailed inventory of the premine vegetation characteristics within and adjacent to the project area; and 2) to provide baseline vegetation information for evaluating future reclamation success within the project area.

The information presented herein includes a description of the vegetation types and their distribution, species diversity, and composition; percent vegetative and percent total ground cover; and existing disturbances within the project area. Baseline data will be used to assess reclamation success during bond release.

The extended reference area concept was employed for this study.

JD-D8.2.0 LOCATION

The Jane Dough ISR Unit is located in Campbell and Johnson counties, Wyoming. Uranerz's Nichols Unit is located north of and immediately adjacent to the Jane Dough Unit (refer to Exhibit JD-D8-1). Production from the Jane Dough Unit will be transported to the production plant facility located in the Nichols Ranch Unit via a system of pipelines. The Jane Dough Unit encompasses approximately 3,680 acres in portions of Sections 20, 21, 27, 28, 29, 30, 31, 32, 33, and 34, T43N, R76W (refer to Exhibit JD-D8-1). Access is by way of the Iberlin Road north from Wyoming Highway 387. The project area is within the 10- to 14-inch Northern Plains (10-14NP) zone of northeastern Wyoming (Natural Resources Conservation Service [NRCS] 1988). Topographic relief ranges from 4,670 to 4,960 ft above mean sea level in the Jane Dough Unit. Annual precipitation varies from 10 to 14 inches, with approximately 35 through 41% falling during the normal growing season (NRCS 1988). Growth of native cool-season plants begins about April 1 and continues to about July 1. Growth of native warm-season plants begins about May 15 and continues to about August 15. According to Wyoming Gap data, three primary vegetation types occur in the project area--Wyoming big sagebrush, grass dominated riparian, and mixed grass prairie (Wyoming Gap Analysis 2000).

There are no perennial streams in the project area; however, the Jane Dough Unit is located in an area of active coalbed methane (CBM) production; therefore, ponds associated with CBM development are scattered throughout the project area. At the time of the July 2010 site visits, all of the CBM ponds contained water. Cottonwood Creek and Seventeenmile, both ephemeral streams, are the main drainages in the Jane Dough Unit. Cottonwood Creek occurs in the north portion of the Jane Dough Unit and the Seventeenmile drainage occurs in the southwestern corner of the Jane Dough Unit (refer to Exhibit JD-D8-1). Cottonwood Creek, Seventeenmile Drainage, and all other unnamed tributaries were dry at the time of the July 2010 site visits. No springs occur in the project area. Within the project area, both Cottonwood Creek and Seventeenmile drainage have been physically altered by local ranches, and a system of irrigation ditches has been constructed to supply water to the area for hay production; therefore, there is no defined bed/bank with a typical pool-riffle riverine system in the project area. Current land use in the project area is primarily livestock grazing, wildlife habitat, and CBM and natural gas development.

JD-D8.3.0 METHODS

Procedures used in conducting the vegetation studies followed Rule 1-V (revegetation performance standards): Noncoal Rules, Chapter 3 (WDEQ/LQD, amended April 25, 2006), WDEQ/LQD Guideline Number 2 (WDEQ/LQD 1997), and WDEQ/LQD Draft Guideline 2 Rewrite (WDEQ/LQD 2004).

Sampling included the collection of percent vegetative and total ground cover data. A plant species list was compiled (Addendum JD-D8-B), and searches were conducted within the project area for species of special concern, noxious weeds, and selenium indicator species. Premine sampling methods followed the requirements for using an extended reference area for postmine bond release studies.

JD-D8.3.1 MAPPING

Vegetation communities, including wetlands (in accordance with U.S. Army Corps of Engineers 1987; Wetland Training Institute, Inc. 1995; refer to Appendix JD-D10), were delineated in the field by TRC using U.S. Geological Survey (USGS) quadrangles and aerial photograph imagery and are presented on a 1 inch = 500 feet enlargement of the USGS 7.5' quadrangles (Dry Fork Ranch [USGS 1953, photorevised 1972], Rolling Pin Ranch [USGS 1953, photorevised 1972). Vegetation communities were based on dominant plant species. Vegetation mapping included the project area and a 0.5-mile wide buffer adjacent to the project area. Photographs were taken of each vegetation community and are presented in Addendum JD-D8-A.

JD-D8.3.2 SAMPLE SITE LOCATION

Sample sites were randomly selected in the office, prior to conducting the vegetation sampling using the ArcView 9.0 Hawth's tool in the geographic information system (GIS) for each vegetation community. The sample sites were downloaded into a handheld Trimble GeoExplorer global position system (GPS) unit and located in the field. Transect direction was determined by tossing a 12-inch spike in the air at each sample site. The pointed end of the spike

determined the transect direction. The locations of the randomly selected sample sites and the direction of each transect are presented on Exhibit JD-D8-1.

JD-D8.3.3 COVER

Vegetative cover by species for graminoides, grass-like species, forbs, subshrubs, shrubs, succulents, and other species (i.e., lichen) was determined along each of the 50-meter long point-intercept transects within the sagebrush grassland, mixed grassland, and bottomland communities. Sampling was conducted July 26 through July 30, 2010. Under the extended reference area concept, each vegetation community to be affected was sampled as one unit, with affected and unaffected areas combined according to the baseline sampling methodology outlined in WDEQ/LQD (1997, 2004, 2006). The point-intercept method was used to record primary and secondary hits (occurrences) of the current year's vegetative growth at 50 points spaced at 1-meter intervals. Litter (previous years' growth or dead material), lichen, rock, and bare ground were also recorded along each transect. Sampling intensity and maximum sample size for each vegetation community was based on WDEQ/LQD Regulations (2004: Table D8-1). In accordance with the approved vegetation sampling plan, rock outcrop, wetlands, and disturbed lands including CBM developed areas (i.e., ponds and pads) were not sampled for cover. Each transect was analyzed as one sample (n), with primary hits used for total cover estimates (absolute) and for relative cover by species. Formulas used to calculate cover (absolute and relative) followed those presented in the WDEQ/LQD (1997) Guideline No. 2 and as revised in WDEQ/LQD Regulations (2004).

The following parameters were determined for each vegetation community:

- percent total vegetation cover (i.e., sum of all species),
- percent total ground cover (i.e., vegetation + litter + rock), and
- percent bare ground.

JD-D8.3.4 STATISTICAL EVALUATIONS

Sample adequacy (i.e., the minimum number of required samples [Nmin]) for vegetation cover was determined based on those tests outlined in WDEQ/LQD Guideline No. 2. The sample adequacy formula provided below was used to determine the minimum number of sample points needed in the sagebrush grassland, mixed grassland, and bottomland communities. The number of sample points was based on WDEQ/LQD (2004) Draft Guidelines and consultation with Stacy Page, WDEQ/LQD, in July 2010. A minimum of 20 cover transects were sampled prior to determining sample adequacy.

Sample Adequacy Formula:

$$Nmin = \frac{2(sz)^2}{(dx)^2}$$

where:

Nmin	=	minimum required size of the sample population
s	=	sample standard deviation
z	=	the z statistic (1.28)
d	=	the acceptable amount of inherent variability between the sample mean and the true population (0.1)
x	=	sample mean for cover

JD-D8.3.5 SPECIES LIST

A plant species list was compiled during the vegetation mapping and sampling tasks. Plants are listed by scientific and common names, and life form (i.e., annual grass, perennial grass, other grasslike species, annual and perennial forb, succulent, subshrub, full shrub, and tree) for the project area. Plant species were identified and named using taxonomic keys including Dorn (1988), Beetle and Johnson (1996), Fertig et al. (1994), Hallsten et al. (1987), Stubbendieck et al. (1997), and Whitson et al. (1991). Plant species that could not be identified in the field were collected and taken to the Rocky Mountain Herbarium, University of Wyoming, for identification.

JD-D8.3.6 THREATENED AND ENDANGERED SPECIES, SPECIES OF CONCERN, NOXIOUS WEEDS, AND SELENIUM INDICATOR SPECIES

The U.S Fish and Wildlife Service (USFWS), Wyoming Ecological Services Office, Cheyenne, Wyoming was consulted for the potential occurrences of federally-listed threatened or endangered (T&E) plant species in the Jane Dough Unit. The USFWS indicated that Ute ladies'-tresses, based on geographic location and elevation was the only T&E plant species with the potential to occur in the Jane Dough Unit (refer to Addendum JD-D9-A).

In addition, a data request was submitted to the Wyoming Natural Diversity database (WYNDD), Laramie, Wyoming, for recorded occurrences of any T&E species in and/or in the vicinity of the Jane Dough Unit (refer to Addendum JD-D9-A).

A list of prohibited, restricted, and declared weeds was obtained from the Wyoming Weed and pest Council website at www.wyoweed.org. A list of selenium indicator plant species was obtained from WDEQ/LQD Guideline No. 2.

An assessment of suitable habitat for the Ute's ladies-tresses was conducted in conjunction with the wetland inventories within the Jane Dough Unit in July and August, 2012. An inventory of any prohibited, restricted, or declared weeds, and the locations of any selenium indicator species were recorded in conjunction with all field visits to the Jane Dough Unit.

JD-D8.4.0 RESULTS

Field mapping and sampling were conducted in July 2010 and the results are included in this section. The types and acreages of each vegetation community/habitat type are presented in Table JD-D8-1.

Construction of project wells, pipelines, and additional access roads will likely occur in all vegetation and habitat types located within the project area (see Exhibit JD-D8-1). Because the sagebrush grassland occupies approximately 72.9% of the project area (Table JD-D8-1), it is likely that most of the project disturbances would occur in this vegetation type. This assumes that the injection, recovery, and monitoring wells would be located over the uranium ore body as shown on Exhibit JD-D8-1.

Table JD-D8-1 Vegetation/Habitat Types, Number of Acres, and Sampling Intensity, Jane Dough Unit, 2010.

Vegetation/ Habitat Type	Premine No. of Acres	Percent of Project Area	Estimated Affected Acres[1]	Minimum Sample Size[2]	Adequate Sample Size (Nmin) for Vegetative Cover[3]
Sagebrush grassland	2,682.7	72.9	61.7	20	2.6
Mixed grassland	754.4	20.5	39.3	20	4.7
Bottomland	114.1	3.1	<1	20	0.2
Hay meadow	66.2	1.8	0	Not sampled	--
Wetland	2.1	<0.1	0	Not sampled	--
Rock outcrop	5.3	<0.1	<1	Not sampled	--
Disturbed lands[4]	55.2	1.5	0	Not sampled	--
Total	3,680.0	100	101		

1 Estimated disturbance from wells, pipelines, and additional access roads is estimated.
2 Based on WDEQ/LQD (2004) and on approved sampling plan for the project submitted WDEQ/LQD prior to sampling.
3 See Table JD-D8-7.
4 Includes 9.3 acres of previously disturbed lands from CBM pads and ponds, and 12.6 miles (46.6 acres) of roads (30-foot wide disturbance).

One additional vegetation community--wetlands--also occurs in the project area. The wetland community was not sampled for cover; however, the boundary was delineated following the *Wetlands Delineation Manual* (U.S. Army Corps of Engineers 1987) so it could be avoided by project activities. A detailed description of the wetland community is presented in Appendix JD-D10.

Photographs of each vegetation community within the project area are provided in Addendum JD-D8-A, the plant species list is provided in Addendum JD-D8-B, cover data for each transect are presented in Addendum JD-D8-C, and Addendum JD-D8-D presents correspondence with the USFWS and WYNDD.

JD-D8.4.1 MAPPING AND DESCRIPTION OF VEGETATION COMMUNITIES

Five vegetation communities--sagebrush grassland, mixed grassland, bottomland, hay meadow and wetland, and two habitat types--disturbed lands and rock outcrop--were identified within the project area (Exhibit JD-D8-1). Approximately 55.9 acres (1.5%) of the 3,680-acre project area have been disturbed by coalbed methane, and oil and gas development, and existing access roads. The injection, recovery, and monitoring wells are expected to disturb unknown amounts of each of the five vegetation communities and the rock-out crop habitat type. Wetlands and CBM pads and ponds will be avoided and will not be disturbed.

JD-D8.4.1.1 Sagebrush Grassland Community

The sagebrush grassland community occurs on approximately 2,721.9 acres (72.9%) within the project area. This vegetation community generally occurs on loamy moderately deep soils on gently sloping uplands, upland ridges, shoulders, and hillslopes. Vegetation is dominated by Wyoming sagebrush (*Artemisia tridentata wyomingensis*) and perennial grasses--needleandthread (*Stipa comata*), prairie junegrass (*Koeleria macrantha*), and blue grama (*Bouteloua gracilis*)--and annual grasses--Sixweeksgrass (*Vulpia octoflora*) and Japanese and downy brome (*Bromus japanicus* and *B. tectorum*). A grass-like species--threadleaf sedge (*Carex filifolia*)--is a dominate species in this community. Annual forbs such as alyssum

(*Alyssum parvifolia*) and scurfpea (*Psoralea teniflora)* are more common in this community than any perennial forb. Several scattered cottonwood also occur in this community and are generally found growing along the drainages (see Exhibit JD-D8-1).

JD-D8.4.1.2 Mixed Grassland Community

The mixed grassland community occurs on approximately 766.5 acres (20.5%) within the project area. This vegetation community generally occurs on shallow sandy soils on upland ridges and gently sloping shoulders and hillslopes, as well as on nearly level uplands. Vegetation is mainly perennial grasses such as needleandthread, Sandberg bluegrass (*Poa secunda*), blue grama, western wheatgrass (*Elymus smithii*), and bluebunch wheatgrass (*Elymus spicatus*), and grasslike species such as threadleaf sedge. Annual grasses are also a major component of this community occurring in previously disturbed areas such as along roads or areas were cattle congregated. Hoods phlox (*Phlox hoodsii*), Scurfpea, yucca (*Yucca glauca*), and globemallow (*Sphaeralcea coccinea*) are the common perennial forbs, and alyssum (*Alysuum parvifolia*) is the dominate annual forb in this community. Wyoming sagebrush and rabbitbrush (*Chrysothamnus* spp.) occur in scattered low-density stands throughout this community. Subshrubs such as fringed sage (*Artemisia fridiga*) also occur throughout this community. No trees occur in this plant community.

JD-D8.4.1.3 Bottomland Community and Wetland Complex

The bottomland community occurs on approximately 116.1 acres (3.1%) within the Jane Dough Unit area adjacent the Cottonwood Creek and Seventeenmile drainages. This community is used for livestock grazing, but historically this community has been managed for hay production. Hay production varies from year to year in bottomland community. Currently, the hay meadows are not actively managed (i.e., cultivation, irrigation, seeding, fertilizing, etc.) to produce a crop; but rather, the grass growth is strictly based upon the amount of precipitation that occurs during the growing season. In productive years, as in 2010 the grass was mowed and harvested. Prior to mowing in 2010 and during community mapping, grass height in the bottomlands ranged from 24 to 40 inches tall. In 2012, which was a very dry and hot year, there was little growth and the

hay meadows in the bottomland areas along Cottonwood and Seventeenmile Creeks within the Jane Dough Unit were not harvested.

In the project area, Cottonwood Creek has no defined channel. The drainage in the area has been modified by a system of irrigation canals that meander throughout this vegetation community. The vegetation is composed of mainly grasses with scattered mature or dead plains cottonwood (*Populus deltoides*) trees ranging from 20 to 60 feet tall. In 2010, when this area was sampled, a significant portion of the bottomland community included weedy annuals such as kochia (*Kochia scorparia*), flixweed tanseymustard (*Descurainia sophia*), and Canada thistle (*Cirsium arvense*). In 2010, few weedy annuals were observed and perennial grasses predominated with smooth brome (*Bromus inermis*), several wheatgrass species (*Elymus intermedium*, *E. smithii*, and *E. trachycaulus*), foxtail barley (*Hordeum jubatum*), Sandberg bluegrass, and several other bluegrass species.

Portions of the bottomland community located in the Seventeenmile drainage was similar in grass species composition as occurring in the Cottonwood Creek; however, a wetland complex of sedges such as Baltic rush (*Juncus balticus*), clustered field sedge (*Carex praegracilis*), and horsetails (*Equisetum* spp.) also occur. The wetland community occurs on approximately 2.1 acres (<0.1%) within the Jane Dough Unit of the project area. A detailed description of this community is presented in Appendix JD-D10. The wetland community was not sampled for cover. Scattered cottonwood trees also occur in the Seventeenmile bottomland community (see Exhibit JD-D8-1).

JD-D8.4.1.4 Hay Meadow

The hay meadow community occurs along the western boundary of the Jane Dough Unit on approximately 68.2 acres (1.8%). The hay meadow community was not sampled for cover.

JD-D8.4.1.5 Rock Outcrop Habitat

The rock outcrop habitat occurs on approximately 3.5 acres (<0.1%) within the project area. This habitat type is scattered throughout the project area as small inclusions generally occurring on the sides of exposed ridgetops, is composed of rocks, and is void of vegetation. The rock outcrop habitat was not sampled for cover.

JD-D8.4.1.6 Disturbed Lands

Approximately 55.9 acres (1.5%) of the project area have been disturbed or are currently disturbed by coalbed methane development activities and existing access roads. This total includes 9.3 acres of CBM lands, as evidenced by pads and ponds and 12.6 miles (46.6 acres) of roads (30-feet wide disturbance). Prior to disturbance, vegetation in these areas was probably similar to that of the vegetation communities immediately adjacent to the disturbed areas. Vegetated disturbed lands include monocultures of Japanese brome, downy brome, and crested wheatgrass (*Agropyron cristatum*). The disturbed lands community was not sampled for cover.

JD-D8.4.2 COVER

Cover data were collected in accordance with the methods presented in Section JD-D8.3.3. Tables JD-D8-2 to JD-D8-4 summarize the mean, absolute and relative cover by species, and life form for each vegetation community sampled. Tables JD-D8-C-1 to JD-D8-C-3 in Addendum JD-D8-C present data by transect for each vegetation community sampled. The locations of trees are provided on Exhibits JD-D8-1. Results of percent absolute and relative vegetative cover and total ground cover by life form and species for each transect are presented in Addendum JD-D8-C. Cover transect data were not collected from the wetland, rock outcrop, or disturbed land types.

Table JD-D8-2 Total Number of Hits, Mean, Percent Absolute Cover, and Percent Relative Vegetative Cover, Sagebrush Grassland, Jane Dough Unit, 2010.

Life Form	Total Number of Primary Hits	Mean	Percent Absolute Cover	Percent Relative Vegetation Cover[1]
Perennial Grass				
Aristida purpurea longiseta	4	0.20	0.4	0.5
Bouteloua gracillis	59	2.95	5.9	7.4
Bromus ciliatus	1	0.05	0.1	0.1
Elymus intermedium	27	1.35	2.7	3.4
Elymus spicatus	16	0.80	1.6	2.0
Elymus smithii	4	0.20	0.4	0.5
Elymus trachycaulus	14	0.70	1.4	1.7
Koeleria macrantha	49	2.45	4.9	6.1
Poa secunda	2	0.10	0.2	0.2
Stipa comata	209	10.45	20.9	26.1
Subtotal	385	19.25	38.5	48.0
Annual Grass				
Vulpia octoflora	25	1.25	2.5	3.1
Bromus japanicus	81	4.05	8.1	10.1
Bromus tectorum	22	1.10	2.2	2.7
Subtotal	128	6.40	12.8	15.9
Other Grass-like Species				
Carex filifolia	119	5.95	11.9	14.9
Subtotal	119	5.95	11.9	14.9
Perennial Forb				
Astragulus spp.	4	0.20	0.4	0.5
Cirsium arvense	1	0.05	0.1	0.1
Heterotheca villosa	4	0.20	0.4	0.5
Iva axillaris	6	0.30	0.6	0.7
Lomatium spp.	1	0.05	0.1	0.1
Melilotus officinalis	1	0.05	0.1	0.1
Lygodesmia juncea	3	0.15	0.3	0.4
Penstemon spp.	3	0.15	0.3	0.4
Phlox hoodii	17	0.85	1.7	2.1
Psoralea tenuiflora	14	0.70	1.4	1.7
Sphaeralcea coccinea	4	0.20	0.4	0.5
Unknown Perennial Forb	4	0.20	0.4	0.5
Subtotal	62	3.10	6.2	7.6

Table JD-D8-2 (Continued)

Life Form	Total Number of Primary Hits	Mean	Percent Absolute Cover	Percent Relative Vegetation Cover [1]
Annual Forbs				
Alyssum parvifolia	8	0.40	0.8	1.0
Thalspi arvense	1	0.05	0.1	0.1
Unknown annual forb	0	0.00	0.0	0.0
Subtotal	9	0.45	0.9	1.1
Subshrub				
Artemisia fridiga	6	0.30	0.6	0.7
Artemisia pedifida	3	0.15	0.3	0.4
Subtotal	9	0.45	0.9	1.1
Succulent				
Opuntia polyacantha	4	0.20	0.4	0.5
Subtotal	4	0.20	0.4	0.5
Shrub				
Artemisia tridentata wyomingensis	79	3.95	7.9	9.9
Chrysothamnus nauseous	1	0.05	0.1	0.1
Chrysothamnus viscidiflorus	4	0.20	0.4	0.5
Krascheninnikovia lanata	1	0.05	0.1	0.1
Subtotal	85	4.25	8.5	10.6
Total Number of Hits	801		80.1	99.7[1]
% Vegetative Cover		80.10		
Ground Cover				
Lichen	0	0.00	0.0	
Litter	130	6.50	13.0	
Rock	2	0.10	0.2	
Subtotal	132	6.60	13.2	
% Total Ground Cover		93.60		
Bare Ground Number of Hits	64	3.80		
% Bare Ground		6.40		

[1] May not total to 100 due to rounding.

Table JD-D8-3 Total Number of Hits, Mean, Percent Absolute Cover, and Percent Relative Vegetative Cover, Mixed Grassland, Jane Dough Unit, 2010.

Life Form	Total Number of Primary Hits	Mean	Percent Absolute Cover	Percent Relative Vegetation Cover[1]
Perennial Grass				
Aristida purpurea longiseta	1	0.05	0.1	0.1
Bouteloua gracillis	53	2.65	5.3	6.3
Bromus ciliatus	4	0.20	0.4	0.5
Bromus inermis	1	0.05	0.1	0.1
Elymus intermedium	22	1.10	2.2	2.6
Elymus spicatus	36	1.80	3.6	4.3
Elymus smithii	10	0.50	1.0	1.2
Elymus trachycaulus	17	0.85	1.7	2.0
Koeleria macrantha	26	1.30	2.6	3.1
Poa secunda	10	0.50	1.0	1.2
Oryzopsis hymenoides	1	0.05	0.1	0.1
Stipa comata	272	13.60	27.2	32.3
Stipa viridula	1	0.05	0.1	0.1
Unknown perennial grass	1	0.05	0.1	0.1
Subtotal	455	22.75	45.5	54.0
Annual Grass				
Vulpia octoflora	27	1.35	2.7	3.2
Bromus japanicus	68	3.40	6.8	8.1
Bromus tectorum	101	5.05	10.1	12.0
Subtotal	196	9.80	19.6	23.3
Other Grass-like Species				
Carex filifolia	107	5.35	10.7	12.7
Subtotal	107	5.35	10.7	12.7
Perennial Forb				
Arenaria hookeri	1	0.05	0.1	0.1
Astragulus spp.	2	0.10	0.2	0.2
Eriogonium spp.	1	0.05	0.1	0.1
Heterotheca villosa	1	0.05	0.1	0.1
Lygodesmia juncea	3	0.15	0.3	0.4
Phlox hoodii	14	0.70	1.4	1.7
Psoralea tenuiflora	5	0.25	0.5	0.6
Sphaeralcea coccinea	3	0.15	0.3	0.4
Yucca glacca	1	0.05	0.1	0.1
Subtotal	31	1.55	3.1	3.7

Table JD-D8-3 (Continued)

Life Form	Total Number of Primary Hits	Mean	Percent Absolute Cover	Percent Relative Vegetation Cover[1]
Annual Forbs				
Alyssum parvifolia	7	0.35	0.7	0.8
Kochia scoparia	1	0.05	0.1	0.1
Salsola tragus	1	0.05	0.1	0.1
Subtotal	9	0.45	0.9	1.0
Subshrub				
Artemisia fridiga	7	0.35	0.7	0.8
Subtotal	7	0.35	0.7	0.8
Succulent	0	0.00	0.0	0.0
Opuntia polyacantha	5	0.25	0.5	0.6
Subtotal	5	0.25	0.5	0.6
Shrub				
Artemisia tridentata wyomingensis	28	1.40	2.8	3.3
Chrysothamnus nauseous	1	0.05	0.1	0.1
Chrysothamnus viscidiflorus	1	0.05	0.1	0.1
Krascheninnikovia lanata	1	0.05	0.1	0.1
Subtotal	31	1.55	3.1	3.6
Total Number of Hits	841		84.1	99.7[1]
% Vegetative Cover		84.10		
Ground Cover				
Lichen	1	0.05	0.1	
Litter	95	4.75	9.5	
Rock	10	0.50	1.0	
Subtotal	106	5.05	10.6	
% Total Ground Cover		94.70		
Bare Ground Number of Hits	53	3.80		
% Bare Ground		5.30		

[1] May not total to 100 due to rounding.

Table JD-D8-4 Total Number of Hits, Mean, Percent Absolute Cover, and Percent Relative Vegetative Cover, Bottomland, Jane Dough Unit, 2010.

Life Form	Total Number of Primary Hits	Mean	Absolute Cover	Percent Relative Vegetation Cover[1]
Perennial Grass				
Agropyron cristatum	2	0.10	0.2	0.2
Alopecurus arundinacea	9	0.45	0.9	0.9
Bouteloua gracillis	2	0.10	0.2	0.2
Bromus ciliatus	43	2.15	4.3	4.4
Bromus inermis	207	10.35	20.7	21.1
Elymus intermedium	94	4.70	9.4	9.6
Elymus smithii	12	0.60	1.2	1.2
Elymus trachycaulus	24	1.20	2.4	2.4
Elymus sp.	2	0.10	0.2	0.2
Hordeum jubatum	7	0.35	0.7	0.7
Koeleria macrantha	0	0.00	0.0	0.0
Poa secunda	5	0.25	0.5	0.5
Poa spp.	11	0.55	1.1	1.1
Stipa comata	40	2.00	4.0	4.1
Unknown perennial grass	334	16.70	33.4	34.1
Subtotal	792	39.60	79.2	80.7
Annual Grass				
Bromus japonicus	63	3.15	6.3	6.4
Bromus tectorum	42	2.10	4.2	4.3
Subtotal	105	5.25	10.5	10.7
Other Grasslike Species				
Carex sp.	1	0.05	0.1	0.1
Equisetum spp.	5	0.25	0.5	0.5
Juncus balticus	1	0.05	0.1	0.1
Subtotal	7	0.35	0.7	0.7
Perennial Forb				
Asclepias specious	1	0.05	0.1	0.1
Astragulus spp.	1	0.05	0.1	0.1
Cirsium arevense	1	0.05	0.1	0.1
Grindellia squarosa	1	0.05	0.1	0.1
Melilotus officinalis	3	0.15	0.3	0.3
Phlox hoodii	2	0.10	0.2	0.2
Unknown aster	2	0.10	0.2	0.2
Subtotal	11	0.55	1.1	1.1

Table JD-D8-4 (Continued)

Life Form	Total Number of Primary Hits	Mean	Absolute Cover	Percent Relative Vegetation Cover[1]
Annual Forbs				
Alyssum parvifolia	5	0.25	0.5	0.5
Descurainia sophia	4	0.20	0.4	0.4
Salsola tragus	1	0.05	0.1	0.1
Thalspi arvense	9	0.45	0.9	0.9
Subtotal	19	0.95	1.9	1.9
Subshrub				
Artemisia fridiga	1	0.05	0.1	0.1
Artemisia pedifida	2	0.10	0.2	0.2
Subtotal	3	0.15	0.3	0.3
Shrub				
Artemisia cana	27	1.35	2.7	2.8
Artemisia tridentata wyomingensis	8	0.40	0.8	0.8
Atriplex canescens	7	0.35	0.7	0.7
Chrysothamnus spp.	1	0.05	0.1	0.1
Subtotal	43	2.15	4.3	4.4
Total Number of Hits	980		98.0	99.8[1]
% Vegetative Cover		98.00		
Ground Cover				
Litter	14	1.40	1.4	
Lichen	0	0.00	0.0	
Rock	0	0.00	0.0	
Subtotal	14	1.40	1.4	
% Total Ground Cover	994	99.40		
Bare Ground Number of Hits	6	1.20		
% Bare Ground		0.60		

[1] May not total to 100 due to rounding.

JD-D8.4.2.1 Sagebrush Grassland Community

Absolute and relative cover by species and life form for the sagebrush grassland is presented in Table JD-D8-2. The mean vegetative cover in this community is 80.1%, and the mean total ground cover is 93.6%, with litter contributing an average 6.5% of the ground cover. Bare ground ranges from 0 to 16% and averaged 6.4%. The relative vegetative cover within this community averages approximately 48.0% perennial grasses, 15.9% annual grasses, 14.9% grass-like species (i.e., sedges), 7.6% perennial forbs, 1.1% annual forbs, 1.1% subshrubs, 10.6% shrubs, and 0.5% succulents (refer to Table JD-D8-2). Wyoming sagebrush and needleandthread are the dominant species of this vegetation community. Representative photographs of the sagebrush grassland community are presented in Addendum JD-D8-A. The photograph locations are identified in Exhibit JD-D8-1 and cover data for each transect are presented in Addendum JD-D8-C, Table JD-D8-C-1.

JD-D8.4.2.2 Mixed Grassland Community

Absolute and relative cover by species and life form for the mixed grassland community is presented in Table JD-D8-3. The mean vegetative cover in this community is 84.1%, and the mean total ground cover is 94.7%, with litter contributing an average 4.7% of the ground cover. Bare ground ranges from 0 to 11% and averaged 5.3%. Relative vegetative cover averages approximately 54.0% perennial grasses, 23.3% annual grasses, 12.7% grass-like species (i.e., sedges), 3.7% perennial forbs, 1.0% annual forbs, 0.8% subshrubs, 3.6% shrubs, and 0.6% succulents (Table D8-3). Needleandthread is the dominate species of this vegetation community comprising 32.3 % of the relative vegetative cover. Representative photographs of the mixed grassland community are presented in Addendum JD-D8-A, and cover data for each transect are presented in Addendum JD-D8-C, Table JD-D8-C-2.

JD-D8.4.2.3 Bottomland Community

Absolute and relative cover by species and life form for the bottomland is presented in Table JD-D8-5. The mean vegetative cover in this community is 98%, and the mean total

ground cover is 99.4%. Bare ground ranges from 0 to 2% and averages 0.6%. Relative vegetative cover within this community averages approximately 80.7% perennial grasses, 10.7% annual grasses, 0.7% grass-like species (i.e., sedges), 1.1% perennial forbs, 1.9% annual forbs, 0.3% subshrubs, and 4.4% shrubs (refer to Table JD-D8-5). No succulents were observed in the bottomland community. At the time of the vegetation sampling, half of the bottomland community habitat had been mowed; therefore, a majority of the species in mowed areas were recorded as unknown perennial grass. Cover of the unmowed areas ranged from 92 to 98%, whereas cover in the mowed areas ranged from 96 to 100% cover (Table JD-D8-5). Based on the species list compiled during the vegetation mapping site visit, the areas unmowed and sampled for cover are representative and similar in species composition of areas mowed, where species could not be readily available. WDEQ/LQD was contacted to determine if additional transects should be established in the remaining unmowed areas and be evaluated for cover and species composition. The WDEQ/LQD determined that based on the Nmin value of 0.2, with the combination of cover values of mowed and unmowed, that no further sampling would be required (personal communication with Stacy Page, WDEQ/LQD August 3, 2010).

Although cottonwood trees are scattered throughout the bottomland community, none occurred in the cover transects. The bottomland community is the only community in the Jane Dough Unit where silver sage was recorded. Representative photographs of the bottomland community are presented in Addendum JD-D8-A, and cover data for each transect are presented in Addendum JD-D8-C, Table JD-D8-C-4.

JD-D8.4.3 STATISTICAL EVALUATIONS

Sample adequacy (i.e., the minimum number of required samples [Nmin], see Table JD-D8-5) for cover was achieved for each of the sampled vegetation communities in accordance with the WDEQ/LQD Guideline No. 2. Table JD-D8-5 presents a summary of the statistical evaluation for the percent cover.

Table JD-D8-5 Summary of Statistical Evaluation for Percent Cover for Three Vegetation Communities, Jane Dough Unit, 2010.

	Sagebrush Grassland	Mixed Grassland	Bottomland[1]
Transect	Vegetative Cover (%)	Vegetative Cover (%)	Vegetative Cover (%)
1	78	90	96 (mowed)
2	82	74	100 (mowed)
3	70	82	92
4	78	78	98
5	70	86	98
6	80	82	96
7	86	90	98
8	80	86	100 (mowed)
9	96	84	100 (mowed)
10	76	92	94
11	86	92	98
12	76	66	100 (mowed)
13	92	98	100 (mowed)
14	92	66	98 (mowed)
15	74	94	100 (mowed)
16	80	88	96
17	76	94	98 (mowed)
18	80	72	100 (mowed)
19	74	98	100 (mowed)
20	76	70	98
Mean	80.1	84.1	98.0
St Dev	7.12	10.13	2.25
d	0.1	0.1	0.1
z	1.28	1.28	1.28
Nmin[2]	2.6	4.7	0.2
N	20	20	20
C.I.	82.14	87.00	98.64
C.I.	78.06	81.20	97.36

[1] Transects in mowed portions of the bottomland community.
[2] Nmin = Sample adequacy (refer to Section JD-D8.3.4).

JD-D8.4.4 SPECIES LIST

The list of plant species identified in the project area is presented in Addendum JD-D8-B. The number of species by life form and number of species greater than 2% relative cover for each vegetation community sampled is presented in Table JD-D8-6.

JD-D8.4.5 THREATENED AND ENDANGERED SPECIES, NOXIOUS WEEDS, AND SELENIUM INDICATOR SPECIES

The only T&E plant species listed to potentially occur in Johnson and Campbell counties is the Ute Ladies'-tresses (USFWS 2012). Ute Ladies'-tresses prefer moist soils near wetland meadows, springs, lakes and perennial streams where it colonizes early successional point bars or sandy ledges. Soils where Ute ladies'-tresses have been typically found are fine silt/sand, gravels and cobbles, and highly organic and or peaty soils. This species is not found in heavy or tight clay soils or growing in saline or alkaline soils (USFWS 2012). Based on an assessment of suitable habitat for Ute Ladies'-tresses, no suitable habitat occurs within the Jane Dough Unit and subsequently to site specific surveys were conducted.

Based on the *Wyoming Weed and Pest Control Act* designated list (W.S.11-5-102 (a) (xi) and W.S.11-12-104), Canada thistle (*Cirsium arvense*) is the only prohibited and designated noxious weed species observed on the project area. Plants are concentrated around well pads and in the bottomland community where cattle tend to congregate. None of these areas are greater than 3- acres in size. No other declared weed species that are listed for Campbell or Johnson counties (W.S.11-5-102 (a) (vii) and W.S.11-5-102(a)(viii)) occur in the project area.

No selenium indicator species were was observed within the project area.

Table JD-D8-6 Species Composition and Species Diversity, Jane Dough Unit, 2010.

Life Form	Sagebrush Grassland		Mixed Grassland		Bottomland[1]	
	Total No. Species	No. Species >2% Relative Cover	Total No. Species	No. Species >2% Relative Cover	Total No. Species	No. Species >2% Relative Cover
Perennial Grass	10	5	13	6	14	5
Annual Grass	3	3	3	3	2	2
Other Grasslike Species	1	1	1	1	3	0
Perennial Forb	12	1	9	0	7	0
Annual Forb	3	1	3	0	4	0
Subshrub	3	0	1	0	2	0
Succulent	1	0	1	0	0	0
Shrub	4	1	4	1	4	1
Tree	0	0	0	0	0	0

[1] Trees occur in bottomland; however, none of the randomly located sample point transects resulted in a hit.

JD-D8.5.0 CONCLUSIONS

This vegetation study provides baseline data for a noncoal large or regular permit application, and was conducted in accordance with a study plan approved by WDEQ/LQD. This information will be used in the future by WDEQ/LQD to assess reclamation success. The methods used in this study comply with those outlined in WDEQ/LQD Guideline No. 2 for vegetation mapping, sampling, and statistical evaluation.

JD-D8.6.0 REFERENCES

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ADDENDUM JD-D8-A:

PHOTOGRAPHS OF VEGETATION COMMUNITIES
(Photograph locations are illustrated on Exhibit JD-D8-1)

Photograph JD-D8-A-1 Sagebrush Grassland with Disturbed Area (i.e., Roads), Jane Dough Unit, 2010.

Photograph JD-D8-A-2 Mixed Grassland in Foreground with Sagebrush Grassland and Outcrop Areas. Note South Pumpkin Butte in Background, Which is Outside the Jane Dough Unit, 2010.

Photograph JD-D8-A-3 Bottomland in Cottonwood Creek, Jane Dough Unit, 2010.

Photograph JD-D8-A-4 Wetland in Bottomland Habitat in Seventeenmile Drainage, Jane Dough Unit, 2010.

Photograph JD-D8-A-5 Typical CBM Pond, Jane Dough Unit, 2010.

ADDENDUM JD-D8-B:

SPECIES LIST

Table JD-D8-B-1 Plant Species List and Occurrence, Jane Dough Unit, 2010.

Scientific Name	Common Name	Sagebrush Grassland	Mixed Grassland	Bottomland
Perennial Grass				
Agropyron cristatum	Crested wheatgrass			X
Aristida purpurea longiseta	Three-awn	X	X	
Alopecurus arundinacea	Foxtail			X
Bromus ciliatus	Fringed brome	X	X	X
Bromus inermis	Smooth brome		X	
Bouteloua gracilis	Blue grama	X	X	X
Elymus cinereus	Basin wild rye			
Elymus intermedium	Intermediate wheatgrass	X	X	X
Elymus spicatus	Bluebunch wheatgrass	X	X	
Elymus smithii	Western wheatgrass	X	X	X
Elymus trachycaulus	Slender wheatgrass	X	X	X
Elymus sp.	Wheatgrass			X
Hordeum jubatum	Foxtail barley			X
Koeleria macrantha	Prairie junegrass	X	X	X
Poa secunda	Sandberg bluegrass	X	X	X
Poa spp.	Bluegrass species			X
Oryzopsis hymenoides	Indian ricegrass		X	
Stipa comata	Needleandthread	X	X	X
Stipa viridula	Green needlegrass		X	
Unknown perennial grass	--		X	X
Annual Grass				
Vulpia octoflora	Sixweeksgrass	X	X	
Bromus japanicus	Japanese brome	X	X	X
Bromus tectorum	Cheatgrass (Downy brome)	X	X	X
Other Grasslike Species				
Carex filifolia	Threadleaf sedge	X	X	
Carex sp.	Sedge			X
Equisetum spp.	Scouring rush			X
Juncus balticus	Baltic rush			X
Perennial Forb				
Arenaria hookeri	Sandwort		X	
Asclepias specious	Milkweed			X
Astragalus sp.	Locoweed	X	X	X
Cirsium arvense	Canada thistle	X		X
Eriogonium spp.	Buckwheat		X	
Grindellia squarosa	Curlycup gumweed			X
Heterotheca villosa	Golden aster	X	X	

Table JD-D8-B-1 (Continued)

Scientific Name	Common Name	Sagebrush Grassland	Mixed Grassland	Bottomland
Iva axillaris	Poverty sumpweed	X		
Lygodesmia juncea	Skeletonweed	X	X	
Lomatium spp.	Lomatium	X		
Melilotus officinalis	Yellow sweetclover	X		X
Penstemon spp.	Penstemon	X		
Phlox hoodii	Hood's phlox	X	X	X
Psoralea tenuiflora	Scurfpea	X	X	
Sphaeralcea coccinea	Globe mallow	X	X	
Unknown forb	--	X		
Unknown aster	--			X
Yucca glauca	Yucca		X	
Annual Forb				
Alyssum parvifolia	Alyssum	X	X	X
Descurainia sophia	Flixweed tansymustard			X
Kochia scoparia	Summer cypress		X	
Salsola tragus	Prickly Russian thistle		X	X
Thalspi arvense	Field pennycress	X		X
Unknown annual forb	--	X		
Subshrub				
Artemisia frigida	Fringed sage	X	X	X
Artemisia pedatifida	Birdfoot sage	X		X
Succulent				
Opuntia polyacantha	Prickly pear cactus	X	X	
Shrub				
Artemisia cana	Silver sagebrush			X
Artemisia tridentata wyomingensis	Wyoming big sagebrush	X	X	X
Atriplex canescens	Fourwing saltbush			X
Chrysothamnus nauseosus	Rubber rabbitbrush	X	X	
Chrysothamnus viscidiflorus	Douglas rabbitbrush	X	X	
Chrysothamnus spp.	Rabbitbrush			X
Trees			X	
Juniperus scopulorum	Rocky Mountain juniper			
Pinus flexilis	Limber pine			
Populus deltoides	Plains cottonwood	X		

ADDENDUM JD-D8-C:

COVER DATA BY TRANSECT FOR
EACH VEGETATION COMMUNITY SAMPLED

Table JD-D8-C-1 Sagebrush Grassland, Percent Absolute and Relative Cover and Species by Transect, Jane Dough Project, 2010.

	Number of Hits																						
Life Form	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Transect 7	Transect 8	Transect 9	Transect 10	Transect 11	Transect 12	Transect 13	Transect 14	Transect 15	Transect 16	Transect 17	Transect 18	Transect 19	Transect 20	Total Number	Mean	Percent Absolute Cover	Percent Relative Vegetation Cover
Perennial Grass																								
Aristida purpurea longiseta					1							1			2						4	0.20	0.4	0.5
Bouteloua gracillis	6		1	2	3	3	5	9	2	1	2	6		1	2	2	4	2	5	3	59	2.95	5.9	7.4
Bromus ciliatus										1											1	0.05	0.1	0.1
Elymus intermedium	5	10								1				9					2		27	1.35	2.7	3.4
Elymus spicatus	1	7													7			1			16	0.80	1.6	2.0
Elymus smithii		2																2			4	0.20	0.4	0.5
Elymus trachycaulus										6			4	1			1			2	14	0.70	1.4	1.7
Koeleria macrantha		10		1	1	8	1			1	1	4			10	2	5	3	1	1	49	2.45	4.9	6.1
Poa secunda												1								1	2	0.10	0.2	0.2
Stipa comata	2	1	12	18	10	5	24	12	30	8	18	11	8	7	5	4	11	15	4	4	209	10.45	20.9	26.1
Subtotal	14	30	13	21	15	16	30	21	32	18	21	23	12	18	26	8	21	23	12	11	385	19.25	38.5	48
Annual Grass																								
Vulpia octoflora	3							15		1		2							3	1	25	1.25	2.5	3.1
Bromus japanicus	3	2	10	1		4		1	13	2	8	1	10	14					4	8	81	4.05	8.1	10.1
Bromus tectorum								1		2	2		1	8					6	2	22	1.10	2.2	2.7
Subtotal	6	2	10	1	0	4	0	17	13	5	10	3	11	22	0	0	0	0	13	11	128	6.40	12.8	15.9
Other Grasslike species																								
Carex filifolia	15	2	6	6	14	7	9	1	3	6	7		9			13	6	7	6	2	119	5.95	11.9	14.9
Subtotal	15	2	6	6	14	7	9	1	3	6	7	0	9	0	0	13	6	7	6	2	119	5.95	11.9	14.9
Perennial Forb																								
Astragulus spp.					1											3					4	0.20	0.4	0.5
Cirsium arvense		1																			1	0.05	0.1	0.1
Heterotheca villosa						1						2				1					4	0.20	0.4	0.5
Iva axillaris		1	1		1	2											1				6	0.30	0.6	0.7
Lomatium spp.															1						1	0.05	0.1	0.1
Melilotus officinalis						1															1	0.05	0.1	0.1
Lygodesmia juncea								1				2									3	0.15	0.3	0.4
Penstemon spp.				1												1		1			3	0.15	0.3	0.4
Phlox hoodii			1	1	2		1					4	1		4	1		2			17	0.85	1.7	2.1
Psoralea tenuiflora				1		1				3	1	2	2			2	2				14	0.70	1.4	1.7
Sphaeralcea coccinea				2		1										1					4	0.20	0.4	0.5
Unknown perennial forb											1				3						4	0.20	0.4	0.5
Subtotal	0	2	2	5	4	6	1	1	0	3	2	10	3	0	8	9	3	3	0	0	62	3.1	6.2	7.6
Annual Forb																								
Alyssum parvifolia	1					1					1			2			1			2	8	0.40	0.8	1.0
Thalspi arvense										1											1	0.05	0.1	0.1
Unknown annual forb																					0	0.00	0.0	0.0
Subtotal	1	0	0	0	0	1	0	0	0	1	1	0	0	2	0	0	1	0	0	2	9	0.45	0.9	1.1
Subshrub																								
Artemisia fridiga											1	2				1		1	1		6	0.30	0.6	0.7
Artemisia pedifida				2											1						3	0.15	0.3	0.4
Subtotal	0	0	0	2	0	0	0	0	0	0	1	2	0	0	1	1	0	1	1	0	9	0.45	0.9	1.1
Succulent																								
Opuntia polyacantha							2											1	1		4	0.20	0.4	0.5
Subtotal	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	1	0	4	0.20	0.4	0.5
Shrub																								
Artemisia tridentata wyomingensis	3	5	4	2	1	6	1			5	1		11	4		8	7	5	4	12	79	3.95	7.9	9.9
Chrysothamnus nauseous															1						1	0.05	0.1	0.1
Chrysothamnus viscidiflorus				2	1											1					4	0.20	0.4	0.5
Krascheninnikovia lanata															1						1	0.05	0.1	0.1
Subtotal	3	5	4	4	2	6	1	0	0	5	1	0	11	4	2	9	7	5	4	12	85	4.25	8.5	10.6
Total Number of Hits	39	41	35	39	35	40	43	40	48	38	43	38	46	46	37	40	38	40	37	38	801	40.05	80.1	99.7
% Vegetative Cover	78	82	70	78	70	80	86	80	96	76	86	76	92	92	74	80	76	80	74	76		80.10		
Lichen												3									2			
Litter	7	6	12	4	10	6	5	8	2	6	7	4	2	4	5	4	10	5	12	11	130	6.50	13.0	
Rock															2						2	0.10	0.2	
Subtotal (Hits)	7	6	12	4	10	6	5	8	2	6	7	7	2	4	7	4	10	5	12	11	134	7	13	
% Total Ground Cover	92	94	94	86	90	92	96	96	100	88	100	90	96	100	88	88	96	90	98	98		93.60		
Bare Ground Number of Hits	4	3	3	7	5	4	2	2		6		5	2		6	6	2	5	1	1	64	3.80		
% Bare Ground	8	6	6	14	10	8	4	4	0	12	0	10	4	0	12	12	4	10	2	2		6.40		

Table JD-D8-C-2 Mixed Grasslands, Percent Absolute Relative Cover and Species by Transect, Jane Dough Project, 2010.

	Number of Hits																							
Life Form	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Transect 7	Transect 8	Transect 9	Transect 10	Transect 11	Transect 12	Transect 13	Transect 14	Transect 15	Transect 16	Transect 17	Transect 18	Transect 19	Transect 20	Total Number	Mean	Percent Absolute Cover	Percent Relative Vegetation Cover
Perennial Grass																								
Aristida purpurea longiseta																				1	1	0.05	0.1	0.1
Bouteloua gracillis	4	3	3	5	1	3	5	2	2	1	2	2				2	5	12	1		53	2.65	5.3	6.3
Bromus ciliatus										4											4	0.20	0.4	0.5
Bromus inermis																1					1	0.05	0.1	0.1
Elymus intermedium	2				5	3	1			3			3				1	1	3		22	1.10	2.2	2.6
Elymus spicatus	6											12		3						15	36	1.80	3.6	4.3
Elymus smithii				6										1						3	10	0.50	1.0	1.2
Elymus trachycaulus								8					5		1		3				17	0.85	1.7	2.0
Koeleria macrantha	2	2		1		3	4	2	4					4						4	26	1.30	2.6	3.1
Poa secunda			1	1			4				1								2	1	10	0.50	1.0	1.2
Oryzopsis hymenoides							1														1	0.05	0.1	0.1
Stipa comata	4	20	19	6	23	26	21	21	18	1	21	1	16	3	23	14	20	4	8	3	272	13.60	27.2	32.3
Stipa viridula	1																				1	0.05	0.1	0.1
Unknown perennial grass	1																				1	0.05	0.1	0.1
Subtotal	20	25	23	19	29	35	36	33	24	9	24	15	24	11	24	17	29	17	14	27	455	22.75	45.5	54
Annual Grass																								
Vulpia octoflora			1		3						12		1			5			5		27	1.35	2.7	3.2
Bromus japanicus	11				1			1		36	3	1	6		7		1			1	68	3.40	6.8	8.1
Bromus tectorum	2		7	4	9	1							17		11	21	4		25		101	5.05	10.1	12.0
Subtotal	13	0	8	4	13	1	0	1	0	36	15	1	24	0	18	26	5	0	30	1	196	9.80	19.6	23.3
Other grasslike species																								
Carex filifolia	7	7	3	8		4	5	5	12		5	11		14	3		7	10	4	2	107	5.35	10.7	12.7
Subtotal	7	7	3	8	0	4	5	5	12	0	5	11	0	14	3	0	7	10	4	2	107	5.35	10.7	12.7
Perennial Forb																								
Arenaria hookeri																				1	1	0.05	0.1	0.1
Astragulus spp.	1													1							2	0.10	0.2	0.2
Eriogonium spp.												1									1	0.05	0.1	0.1
Heterotheca villosa														1							1	0.05	0.1	0.1
Lygodesmia juncea							1										2				3	0.15	0.3	0.4
Phlox hoodii				2			1		4					5						2	14	0.70	1.4	1.7
Psoralea tenuiflora		1	1				1	1						1							5	0.25	0.5	0.6
Sphaeralcea coccinea		1									2										3	0.15	0.3	0.4
Yucca glacca							1														1	0.05	0.1	0.1
Subtotal	1	2	1	2	0	0	4	1	4	0	2	1	0	8	0	0	2	0	0	3	31	1.55	3.1	3.7
Annual Forb																								
Alyssum parvifolia	1		1		1										2	1	1				7	0.35	0.7	0.8
Kochia scoparia	1																				1	0.05	0.1	0.1
Salsola tragus						1															1	0.05	0.1	0.1
Subtotal	2	0	1	0	1	1	0	0	0	0	0	0	0	0	2	1	1	0	0	0	9	0.45	0.9	1.0
Subshrub																								
Artemisia fridiga			3	3													1				7	0.35	0.7	0.8
Subtotal	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	7	0.35	0.7	0.8
Succulent																								
Opuntia polyacantha			1	2															1	1	5	0.25	0.5	0.6
Subtotal	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	5	0.25	0.5	0.6
Shrub																								
Artemisia tridentata wyomingensis	1	3		1				3	2	1		4	1				2	9		1	28	1.40	2.8	3.3
Chrysothamnus nauseous												1									1	0.05	0.1	0.1
Chrysothamnus viscidiflorus			1																		1	0.05	0.1	0.1
Krascheninnikovia lanata	1																				1	0.05	0.1	0.1
Subtotal	2	3	1	1	0	0	0	3	2	1	0	5	1	0	0	0	2	9	0	1	31	1.55	3.1	3.6
Total Number of Hits	45	37	41	39	43	41	45	43	42	46	46	33	49	33	47	44	47	36	49	35	841	42.05	84.1	99.7
% Vegetative Cover	90	74	82	78	86	82	90	86	84	92	92	66	98	66	94	88	94	72	98	70		84.10		
Lichen				1																	1	0.05	0.1	
Litter	2	6	8	6	5	3	4	7	5	4	2	7		9	3	6	3	11	1	3	95	4.75	9.5	
Rock									1			2								7	10	0.50	1.0	
Subtotal (Hits)	2	6	8	7	5	3	4	7	6	4	2	9	0	9	3	6	3	11	1	10	106	5.30	11	
% Total Ground Cover	94	86	98	92	96	88	98	100	96	100	96	84	98	84	100	100	100	94	100	90		94.70		
Bare Ground Number of Hits	3	7	1	4	2	6	1		2		2	8	1	8				3		5	53	3.80		
% Bare Ground	6	14	2	8	4	12	2	0	4	0	4	16	2	16	0	0	0	6	0	10		5.30		

Table JD-D8-C-3 Bottomland, Percent Absolute Relative Cover and Species by Transect, Jane Dough Project, 2010.

	Number of Hits																							
Life Form	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Transect 7	Transect 8	Transect 9	Transect 10	Transect 11	Transect 12	Transect 13	Transect 14	Transect 15	Transect 16	Transect 17	Transect 18	Transect 19	Transect 20	Total Number of Primary Hits	Mean	Absolute Cover	Percent Relative Vegetation Cover
Perennial Grass																								
Agropyron cristatum			1			1															2	0.10	0.2	0.2
Alopecurus arundinacea					9																9	0.45	0.9	0.9
Bouteloua gracillis											1					1					2	0.10	0.2	0.2
Bromus ciliatus			12				1	1	25					4							43	2.15	4.3	4.4
Bromus inermis	20	14	6	43	13	36	25	2	6	1		2		5	22	1		10		1	207	10.35	20.7	21.1
Elymus intermedium	1		7	4		6	10				12	1		15				3		35	94	4.70	9.4	9.6
Elymus smithii					2					1	7					1		1			12	0.60	1.2	1.2
Elymus trachycaulus	1		9		4							2		5						3	24	1.20	2.4	2.4
Elymus sp.																				2	2	0.10	0.2	0.2
Hordeum jubatum					4	1							2								7	0.35	0.7	0.7
Koeleria macrantha																					0	0.00	0.0	0.0
Poa secunda										4						1					5	0.25	0.5	0.5
Poa spp.					11																11	0.55	1.1	1.1
Stipa comata										16	16					8					40	2.00	4.0	4.1
Unknown Perennial Grass	25	29						46	13			4	48	10	28		49	33	49		334	16.70	33.4	34.1
Subtotal	47	43	35	47	43	44	36	49	44	22	36	9	50	39	50	12	49	47	49	41	792	39.6	79.2	80.7
Annual Grass																								
Bromus japonicus			5				4		4	9	5			7		21		3		5	63	3.15	6.3	6.4
Bromus tectorum										1		37				2			1	1	42	2.10	4.2	4.3
Subtotal	0	0	5	0	0	0	4	0	4	10	5	37	0	7	0	23	0	3	1	6	105	5.25	10.5	10.7
Other Grasslike Species																								
Carex sp.		1																			1	0.05	0.1	0.1
Equisetum spp.		5																			5	0.25	0.5	0.5
Juncus balticus		1																			1	0.05	0.1	0.1
Subtotal	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0.35	0.7	0.7
Perennial Forb																								
Asclepias speciosa					1																1	0.05	0.1	0.1
Astragulus spp.							1														1	0.05	0.1	0.1
Cirsium arevense					1																1	0.05	0.1	0.1
Grindellia squarosa							1														1	0.05	0.1	0.1
Melilotus officinalis						2					1										3	0.15	0.3	0.3
Phlox hoodii										1						1					2	0.10	0.2	0.2
Unknown aster						2															2	0.10	0.2	0.2
Subtotal	0	0	0	0	2	4	2	0	0	1	1	0	0	0	0	1	0	0	0	0	11	0.55	1.1	1.1
Annual Forb																								
Alyssum parvifolia												4								1	5	0.25	0.5	0.5
Descurainia sophia					4																4	0.20	0.4	0.4
Salsola tragus											1										1	0.05	0.1	0.1
Thalspi arvense	1		4					1						3							9	0.45	0.9	0.9
Subtotal	1	0	4	0	4	0	0	1	0	0	1	4	0	3	0	0	0	0	0	1	19	0.95	1.9	1.9
Subshrub																								
Artemisia fridiga																1					1	0.05	0.1	0.1
Artemisia pedifida									2												2	0.10	0.2	0.2
Subtotal	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	3	0.15	0.3	0.3
Shrub																								
Artemisia cana				2						14	4					7					27	1.35	2.7	2.8
Artemisia tridentata wyomingensis			2								2					4					8	0.40	0.8	0.8
Atriplex canescens							7														7	0.35	0.7	0.7
Chrysothamnus spp.																				1	1	0.05	0.1	0.1
Subtotal	0	0	2	2	0	0	7	0	0	14	6	0	0	0	0	11	0	0	0	1	43	2.15	4.3	4.4
Total Number of Hits	48	50	46	49	49	48	49	50	50	47	49	50	50	49	50	48	49	50	50	49	980		98.0	99.8
% Vegetative Cover	96	100	92	98	98	96	98	100	100	94	98	100	100	98	100	96	98	100	100	98		98.00		
Litter	1		4	1	1	2	1			1	1			1		1					14	1.40	1.4	
Lichen																					0	0.00	0.0	0.0
Rock																					0		0.0	
Subtotal (Hits)	1	0	4	1	1	2	1	0	0	1	1	0	0	1	0	1	0	0	0	0	14	1.40	1.4	
% Total Ground Cover	98	100	100	100	100	100	100	100	100	96	100	100	100	100	100	98	98	100	100	98	994	99.40		
Bare Ground Number of Hits	1									2						1	1			1	6	1.20	0.6	
% Bare Ground	2	0	0	0	0	0	0	0	0	4	0	0	0	0	0	2	2	0	0	2		0.60	0.0	

ADDENDUM JD-D8-D:

CORRESPONDENCE WITH THE
U.S. FISH AND WILDLIFE SERVICE

[redacted]

From: Hart, Jan (Laramie,WY-US)
Sent: Monday, September 10, 2012 9:43 AM
To: Decastro, Genial (Laramie,WY-US)
Subject: FW: data request results
Attachments: TRC 120720 Invoice.pdf; Shapefiles.zip

From: Melanie Arnett [mailto:Arnett@uwyo.edu]
Sent: Monday, July 23, 2012 8:07 AM
To: Hart, Jan (Laramie,WY-US)
Subject: data request results

UNIVERSITY OF WYOMING

Wyoming Natural Diversity Database
Department 3381 • 1000 E. University Avenue • Laramie, WY 82071
(307) 766-3023 • fax (307) 766-3026 • e-mail: arnett@uwyo.edu • www.uwyo.edu/wyndd

Jan Hart
TRC
[redacted]05 Skyline Dr
Laramie, WY 82072

23 July 2012

Dear Jan,

Attached are the invoice and results for your 7/20/2012 request for documented rare species occurrences in T43N R76 W, Campbell and Johnson Counties, Wyoming. Observations within 4 miles of the request area were also included to provide adequate information for the appropriate application of these data (records distinguished by "Request" or "Buffer" in the Area field). We are unable to offer biologist comments at this time because our biologists are all engaged in field work.

Two shapefiles in UTM zone 13 NAD83 are included in the Shapefiles.zip file (because some email systems filter out emails with .zip attachments, please reply as soon as possible and let me know if you received this email and attached data):

1) **The source.shp file contains complete WYNDD occurrence record data for this request**. The polygons represent the locational uncertainty of observations (as indicated in the MAP_PRECIS field in meters). Please pay attention to the ID_CONFIRM and ID_NOTES fields as many records may not be positively identified, at least to our knowledge. This shapefile contains a complete metadata file, however, please check out our online Data Dictionary if you have further questions or would like more information about our sensitive data policy or the abbreviations found in the attribute tables of the shapefiles.
2) The **request_area.shp** file contains the boundaries of the area referred to in the results as the "request area" (see the Area field).

The fee for your invoice in the amount of $112.50 was determined based on the following formula: 1 Townships X 625 Taxa = 625 (if<6251 fee = $112.50, if between 6250-62500 then multiply by 0.030 for fee, if >62500 then multiply by 0.0495 for fee). Please pay within 30 days.

[redacted]ecommended citation:
Wyoming Natural Diversity Database. 2012. Data compilation for J. Hart, completed July 23, 2012. Unpublished report. Wyoming Natural Diversity Database, University of Wyoming, Laramie, Wyoming.

WYNDD would benefit greatly from the sharing of any new information on species locations that result from your project. [redacted]lease contact us about our data trading policy, which would help your organization reduce costs while improving and [redacted]pdating our database.

Thank you for your data request. Please do not hesitate to call if you have any questions about the search. We ask that you do not disseminate these data without our permission, they are provided here for use in your WY DEQ Land Quality and FERC permit requirement for Uranerz Uranuin company.

Sincerely,

Melanie Arnett
Database Specialist
Wyoming Natural Diversity Database
University of Wyoming
315 Berry Center, Dept. 3381
1000 E. University Ave
Laramie, WY 82071-3381
Phone: 307.766.2296
Email: arnett@uwyo.edu
Web: http://www.uwyo.edu/wyndd

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
5353 Yellowstone Road, Suite 308A
Cheyenne, WY 82009

AUG 0 9 2012

In Reply Refer To:
06E13000/WY12SL0319

8/13/12
JKH
SWK
File # 11236 2-02.4
T&E Background

Jan K. Hart, Senior Project Manager/Biologist
TRC Environmental Corporation
605 Skyline Drive
Laramie, Wyoming 82070

Dear Ms. Hart:

Thank you for your letter of July 24, 2012, received in our office on July 25, regarding the Jane Dough In-Situ Uranium Recovery Project (Project) for Uranerz Energy Corporation. This Project will be located in portions of Sections 19, 20, 21, 27, 28, 29, 30, 31, 32, and 33, Township 43 North, Range 76 West in Campbell and Johnson Counties, Wyoming. The Project includes land administered by the U.S. Bureau of Land Management (BLM).

Pursuant to Wyoming regulations, mining applicants are required to consult with the U.S. Fish and Wildlife Service (Service) prior to submission of the permit application to the Wyoming Department of Environmental Quality (Chapter 2, Regular Noncoal Mine Permit Applications, Section 1(f)). Therefore, we are providing general information that may assist the applicant in preparing their application. Please also note that because the project requires an action (e.g., an approval) from another Federal agency, the Service is required to consult directly with the other Federal agency related to endangered and threatened species, unless that agency formally designates a non-Federal representative (50 CFR 402.08). The BLM will evaluate and consult with the Service as may be appropriate concerning the effects of this project to listed species and other areas of Service responsibility.

You have requested information regarding species listed under the Endangered Species Act of 1973, as amended (Act), 16 U.S.C. 1531 *et seq.* In response to your request, the Service is providing recommendations for protective measures for threatened and endangered species in accordance with the Act. We are also providing recommendations concerning migratory birds in accordance with the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703, and the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668. Wetlands are afforded protection under Executive Orders 11990 (wetland protection) and 11988 (floodplain management), as well as section 404 of the Clean Water Act. Other fish and wildlife resources are considered under the Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 *et seq.*, and the Fish and Wildlife Act of 1956, as amended, 16 U.S.C. 742a-742j.

In your letter, you also request that we address the potential for Migratory Birds of High Federal Interest (MBHFI) to nest within or adjacent to the proposed permit area. The Service does not maintain site-specific information on the nesting locations of the birds on the MBHFI list (copy enclosed). Site-specific nest location information may be available from the Wyoming Game and Fish Department (WGFD), applicable land management agencies, or through species-specific surveys conducted on site. If site-specific information indicates that MBHFI do occur at or in the vicinity (e.g., 1 mile) of the proposed project area, we can provide additional site and species-specific recommendations.

The Service has transitioned to a new online system to deliver species lists: the Information, Planning, and Consultation (IPaC) system. To obtain a current list of endangered, threatened, proposed, and candidate species and their designated and proposed critical habitat that occur within the boundaries of or may be affected by actions associated with your proposed project, please visit our website at http://ecos.fws.gov/ipac/. The system will provide you with an immediate response to your species list request. The response will also include information regarding other Service trust authorities.

In accordance with section 7(c) of the Act, we have determined that the following species or their designated habitat may be present in the proposed project area. We would appreciate receiving information as to the current status of each of these species within the proposed project area.

Endangered, Threatened, Proposed, and Candidate Species
And Their Designated and Proposed Critical Habitat That Occur
In or May Be Affected by Actions in the Proposed Project Area
August 2012

Species	Scientific Name	Status	Habitat
Ute Ladies'-tresses	*Spiranthes diluvialis*	Threatened	Seasonally moist soils and wet meadows of drainages below 7,000 ft. elevation
Greater Sage-grouse	*Centrocercus urophasianus*	Candidate	Sagebrush communities

Ute Ladies'-tresses: Ute ladies'-tresses (*Spiranthes diluvialis*) is a perennial orchid, 8 to 20 inches tall, with white or ivory flowers clustered into a spike arrangement at the top of the stem. Ute ladies'-tresses typically blooms from late July through August. However, it may bloom in early July or still be in flower as late as early October, depending on location and climatic conditions. Ute ladies'-tresses is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges. The elevation range of known occurrences is 4,200 to 7,000 feet (although no known populations in Wyoming occur above 5,500 feet). Soils where Ute ladies'-tresses have been found typically range from fine silt/sand, to gravels and cobbles, as well as to highly organic and peaty soil types. Ute ladies'-tresses is not found in heavy or tight clay soils or in extremely saline or alkaline soils. Ute ladies'-tresses typically occurs in small, scattered groups found primarily in areas where vegetation is relatively open.

Many orchid species take 5 to 10 years to reach reproductive maturity; this appears to be true for Ute ladies'-tresses (FR 57 2048). Furthermore, reproductively mature plants do not flower every year. For these reasons, 2 to 3 years of surveys are necessary to determine presence or absence of Ute ladies'-tresses. Surveys should be conducted by knowledgeable botanists trained in conducting rare plant surveys.

Greater Sage-grouse: The Service has determined that the greater sage-grouse (*Centrocercus urophasianus*) warrants listing under the Act, but the development of a proposed listing rule is precluded by other higher priority listing actions. As a result, the greater sage-grouse has been placed on the list of candidate species. Candidates are reviewed annually to determine if they continue to warrant listing or to reassess their listing priority. Ideally, sufficient threats can be removed to eliminate the need for listing, in which case sage-grouse would no longer be a candidate. If threats are not addressed or the status of the species declines, a candidate species can move up in priority for a listing proposal.

Please see our recent *Federal Register* notice (75 FR 13910; March 23, 2010: available at http://www.fws.gov/wyominges/Pages/Species/Findings/GrtSageGrouse_CandidateBulletin.html) on greater sage-grouse for detailed information concerning the status of the species. Greater sage-grouse are dependent on sagebrush habitats year-round. Habitat loss and degradation, as well as loss of population connectivity have been identified as important factors contributing to the decline of greater sage-grouse populations rangewide. Therefore, any activities that result in loss or degradation of sagebrush habitats that are important to this species should be closely evaluated for their impacts to sage-grouse.

We recommend you contact the Wyoming Game and Fish Department to identify important greater sage-grouse habitats, recommended seasonal restrictions within the project area, and appropriate measures to minimize potential impacts from the proposed project. The Service recommends surveys and mapping of important greater sage-grouse habitats where local information is not available. The results of these surveys should be used in project planning to minimize potential impacts to this species. No project activities that may exacerbate habitat loss or degradation should be permitted in important habitats.

Species of Concern

Black-tailed Prairie Dog: The range of the black-tailed prairie dog (*Cynomys ludovicianus*) once spanned the short and mixed grass prairies of North America east of the Rockies from southern Canada to northern Mexico. This species still occurs over much of its historic range; although, in more widely scattered large colonies. Black-tailed prairie dogs occur within the eastern third of Wyoming. A population thought to have been intentionally introduced outside of this range also occurs in the Bighorn Basin. We encourage the conservation of prairie dog colonies for their value to the prairie ecosystem and the many species that rely on them. Threats that may be significant to conserving black-tailed prairie dog populations include disease (sylvatic plague) and some control programs (poisoning). Prairie dogs serve as the primary prey species for the black-footed ferret (*Mustela nigripes*) and several raptors, including the golden eagle (*Aguila chrysaetos*) and ferruginous hawk (*Buteo regalis*). Prairie dog colonies and burrows also provide shelter or nest sites for species like the mountain plover (*Charadrius montanus*) and burrowing owl (*Athene cunicularia*). Because black-tailed prairie dog colonies in Wyoming do not currently support any ferret populations, black-footed ferret surveys are not

necessary within Wyoming. However, we do encourage evaluating black-tailed prairie dog colonies for the potential reintroduction of black-footed ferrets.

Mountain Plover: On May 12, 2011, the Service announced the decision to withdraw the proposed listing of the mountain plover (*Charadrius montanus*) as a threatened species under the Act (76 FR 27756). The mountain plover is a migratory, terrestrial shorebird averaging 8 inches (21 centimeters) in body length. Mountain plovers are light brown above and white below, but lack the contrasting band characteristic of other plovers. They feed on invertebrates, primarily beetles, crickets, and ants. Mountain plovers arrive at their breeding grounds in the western Great Plains and Rocky Mountain states in the spring. Southbound migration is prolonged, starting in late June and continuing through October.

We encourage project planners to develop and implement protective measures if mountain plovers, or suitable mountain plover habitat, occur within project areas. Measures to protect the mountain plover from further decline may include: (1) avoidance of suitable habitat during the plover nesting season (April 10 through July 10), (2) prohibition of ground disturbing activities in prairie dog towns, and (3) prohibition of any permanent above ground structures that may provide perches for avian predators or deter plovers from using preferred habitat. Suitable habitat for nesting mountain plovers includes grasslands, mixed grassland areas and short-grass prairie, shrub-steppe, plains, alkali flats, agricultural lands, cultivated lands, sod farms, and prairie dog towns.

Migratory Birds: The MBTA, enacted in 1918, prohibits the taking of any migratory birds, their parts, nests, or eggs, except as permitted by regulations, and does not require intent to be proven. Section 703 of the MBTA states, "Unless and except as permitted by regulations ... it shall be unlawful at any time, by any means or in any manner, to ... take, capture, kill, attempt to take, capture, or kill, or possess ... any migratory bird, any part, nest, or eggs of any such bird..." The BGEPA prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing. Work that could lead to the take of a migratory bird or eagle, their young, eggs, or nests (for example, if you are going to erect new roads, or power lines in the vicinity of a nest), should be coordinated with our office before any actions are taken.

Removal or destruction of such nests, or causing abandonment of a nest could constitute violation of one or both of the above statutes. Removal of any active migratory bird nest or nest tree is prohibited. For golden eagles, inactive nest permits are limited to activities involving resource extraction or human health and safety. Mitigation, as determined by the local Service field office, may be required for loss of these nests. No permits will be issued for an active nest of any migratory bird species, unless removal of an active nest is necessary for reasons of human health and safety. Therefore, if nesting migratory birds are present on, or near the project area, timing is a significant consideration and needs to be addressed in project planning.

If nest manipulation is proposed for this project, the project proponent should contact the Service's Migratory Bird Office in Denver at 303-236-8171 to see if a permit can be issued for this project. No nest manipulation is allowed without a permit. If a permit cannot be issued, the project may need to be modified to ensure take of a migratory bird or eagle, their young, eggs or nest will not occur.

The Service's Wyoming Field Office has compiled a list of Migratory Bird Species of High Federal Interest (Enclosure) from the ongoing work among State and Federal agencies, non-governmental organizations, and the interested public that produced the Wyoming Bird Conservation Plan. This list will now serve as our list of Migratory Bird Species of Management Concern in Wyoming, in place of the previous list based on the Migratory Nongame Birds of Management Concern in the United States: the 1995 List.

Eagle/Raptor: Enclosed please find our general recommendations for the protection of eagles and other raptor species. We strongly encourage project proponents to fully implement the protective measures described in the enclosures in order to help ensure compliance with the MBTA and the BGEPA. We are also available to assist you in developing a project specific plan to address the MBTA and BGEPA concerns.

Wetlands/Riparian Areas: Wetlands or riparian areas may be impacted by the proposed project. Wetlands perform significant ecological functions which include: (1) providing habitat for numerous aquatic and terrestrial wildlife species, (2) aiding in the dispersal of floods, (3) improving water quality through retention and assimilation of pollutants from storm water runoff, and (4) recharging the aquifer. Wetlands also possess aesthetic and recreational values. If wetlands may be destroyed or degraded by the proposed action, those wetlands in the project area should be inventoried and fully described in terms of their functions and values. Acreage of wetlands, by type, should be disclosed and specific actions should be outlined to avoid, minimize, and compensate for all unavoidable wetland impacts.

Riparian or streamside areas are a valuable natural resource and impacts to these areas should be avoided whenever possible. Riparian areas are the single most productive wildlife habitat type in North America. They support a greater variety of wildlife than any other habitat. Riparian vegetation plays an important role in protecting streams, reducing erosion and sedimentation as well as improving water quality, maintaining the water table, controlling flooding, and providing shade and cover. In view of their importance and relative scarcity, impacts to riparian areas should be avoided. Any potential, unavoidable encroachment into these areas should be further avoided and minimized. Unavoidable impacts to streams should be assessed in terms of their functions and values, linear feet and vegetation type lost, potential effects on wildlife, and potential effects on bank stability and water quality. Measures to compensate for unavoidable losses of riparian areas should be developed and implemented as part of the project.

Plans for mitigating unavoidable impacts to wetland and riparian areas should include mitigation goals and objectives, methodologies, time frames for implementation, success criteria, and monitoring to determine if the mitigation is successful. The mitigation plan should also include a contingency plan to be implemented should the mitigation not be successful. In addition, wetland restoration, creation, enhancement, and/or preservation does not compensate for loss of stream habitat; streams and wetlands have different functions and provide different habitat values for fish and wildlife resources.

Best Management Practices (BMPs) should be implemented within the project area wherever possible. BMPs include, but are not limited to, the following: installation of sediment and erosion control devices (*e.g.*, silt fences, hay bales, temporary sediment control basins, erosion control matting); adequate and continued maintenance of sediment and erosion control devices to insure their effectiveness; minimization of the construction disturbance area to further avoid streams, wetlands, and riparian areas; location of equipment staging, fueling, and maintenance

areas outside of wetlands, streams, riparian areas, and floodplains; and re-seeding and re-planting of riparian vegetation native to Wyoming in order to stabilize shorelines and streambanks.

In-Situ Uranium Mining: High selenium concentrations can occur in wastewater from in-situ mining of uranium ore as uranium-bearing formations are usually associated with seleniferous strata (Boon 1989). Boon (1989) reported that uranium deposits in Converse County, Wyoming can contain up to 4,500 µg/g (ppm) of selenium. In-situ mining of uranium is done by injecting a leaching solution of native ground water containing dissolved oxygen and carbon dioxide into the uranium-bearing formation through injection wells. The leaching solution dissolves selenium present in the formation. The disposal of this wastewater can expose migratory birds to selenium, which is known to cause impaired reproduction and mortality in sensitive species of birds such as waterfowl.

The in-situ mining wastewater is typically disposed of through deep-well injection or discharge into large evaporation ponds. One mining operation in Converse County disposes of the wastewater through land application using center-pivot irrigation after treatment for removal of uranium and radium. In 1998 the Service conducted a study of grassland irrigated with wastewater from an in-situ uranium mine and found that selenium was mobilized into the food chain and bioaccumulated by grasshoppers and songbirds (Ramirez and Rogers 2002). Disposal of the in-situ wastewater through irrigation is not recommended by the Service due to the potential for selenium bioaccumulation in the food chain and adverse effects to migratory birds. Additionally, land application may result in the contamination of groundwater and eventually seep out and reach surface waters. Furthermore, the selenium-contaminated groundwater could seep into low areas or basins in upland sites and create wetlands, which would attract migratory birds and other wildlife.

The Service is also concerned with the potential for elevated selenium in evaporation ponds receiving in-situ wastewater. Waterborne selenium concentrations $\geq$ 2 µg/L are considered hazardous to the health and long-term survival of fish and wildlife (Lemly 1996). Additionally, water with more than 20 µg/L (ppm) is considered hazardous to aquatic birds (Skorupa and Ohlendorf 1991). Chronic effects of selenium manifest themselves in immune suppression to birds (Fairbrother et al. 1994), which can make affected birds more susceptible to disease and predation. Selenium toxicity will also cause embryonic deformities and mortality (See et al. 1992; Skorupa and Ohlendorf 1991; Ohlendorf 2002)

If submerged aquatic vegetation and/or aquatic invertebrates are present in evaporation ponds with high waterborne selenium concentrations, extremely high dietary levels of this contaminant can be available to aquatic migratory birds. Ramirez and Rogers (2000) documented selenium concentrations ranging from 434 to 508 µg/g in pondweed (*Potamogeton vaginatus*) collected from a uranium mine wastewater storage reservoir that had waterborne selenium concentrations ranging from 260 to 350 µg/L.

The potential for selenium and other contaminants to impact migratory birds should be assessed if the proposed facility will use ponds to store or dispose of the wastewater or if the wastewater will be disposed of in such a manner as to potentially expose migratory birds or other wildlife to contaminants. Accidental releases/spills of uranium in-situ production water can result in the ponding or pooling of this production water, which could be ingested by wildlife, including

migratory birds thus exposing them to uranium, radionuclides, and selenium. Spills or releases of production water could also reach surface waters, which could impact aquatic organisms inhabiting the affected waters.

The following safeguards or management actions should be incorporated into the permit to prevent or minimize the adverse impacts from contaminants to our trust resources:

- Leak detection systems should be installed in all injection wells and production wells to enable operators to immediately respond to releases of injection or production water onto the environment.
- A spill contingency plan should be prepared for the project area.
- Land application of in-situ wastewater through irrigation or other disposal methods should not be allowed if this disposal option presents a risk for selenium bioaccumulation in the food chain and adverse effects to migratory birds, and a risk for soil, surface water and ground water contamination.
- Annual monitoring of wastewater evaporation ponds should be conducted to determine waterborne selenium concentrations and to determine if submerged aquatic vegetation and/or aquatic invertebrates are present and provide a pathway for selenium bioaccumulation by birds using the evaporation ponds. If submerged aquatic vegetation and/or aquatic invertebrates are present and waterborne selenium is > 2 µg/L, please contact our office for further guidance.

For our internal tracking purposes, the Service would appreciate notification of any decision made on this project (such as issuance of a permit or signing of a Record of Decision or Decision Memo). Notification can be sent in writing to the letterhead address or by electronic mail to FW6_Federal_Activities_Cheyenne@fws.gov.

We appreciate your efforts to ensure the conservation of endangered, threatened, and candidate species and migratory birds. If you have questions regarding this letter or your responsibilities under the Act and/or other authorities or resources described above, please contact Genevieve Skora of my office at the letterhead address or phone (307) 772-2374, extension 225.

Sincerely,

for R. Mark Sattelberg
Field Supervisor
Wyoming Field Office

Enclosures (2)

cc: BLM, Endangered Species Program Lead, Cheyenne, WY (C. Keefe) (e-mail)
WDEQ-LQD, District 3 Supervisor, Sheridan, WY (M. Rogaczewski)
WGFD, Non-game Coordinator, Lander, WY (B. Oakleaf)
WGFD, Statewide Habitat Protection Coordinator, Cheyenne, WY (M. Flanderka)

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Boon, D.Y. 1989. Potential selenium problems in Great Plains soils. Pages 107-121 *in* L.W. Jacobs (ed.). Selenium in agriculture and the environment. American Society of Agronomy, Inc, and Soil Science Society of America. SSSA Special Pub. No. 23. Madison, WI.

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Skorupa, J.P., and H.M. Ohlendorf. 1991. Contaminants in drainage water and avian risk thresholds. Pages 345-368 *in* A. Dinar and D. Zilberman (eds.). The economics and management of water and drainage in agriculture. Kluwer Academic Publishers, Boston, MA.

Migratory Bird Species of Management Concern in Wyoming
(Migratory Birds of High Federal Interest)
Based on the *Wyoming Bird Conservation Plan* (Cerovski et al. 2000)

May 2, 2002

U.S. Fish and Wildlife Service, Wyoming Field Office,
5353 Yellowstone Road - Suite 308A, Cheyenne, Wyoming 82009

The Wyoming Field Office of the U.S. Fish and Wildlife Service (Service) has compiled the following list from the ongoing work among State and Federal agencies, non-governmental organizations, and the interested public that produced the Wyoming Bird Conservation Plan. This list will now serve as our list of Migratory Bird Species of Management Concern in Wyoming, in place of the previous list based on the Migratory Nongame Birds of Management Concern in the United States: the 1995 List. The Wyoming Bird Conservation Plan identified priority species based on a number of criteria (see below) using the best information available for these generally un-studied species. In many cases, this list reflects identified threats to habitat because no information is available on the species population trends. In some cases it reflects identified population declines though no causal factors have been identified.

The following tables and explanatory text are taken directly from the Wyoming Bird Conservation Plan (Cerovski et al. 2000). For more information on this listing process, this report is available from our Wyoming Field Office, 5353 Yellowstone Road, Suite 308A, Cheyenne, Wyoming 82009; or Wyoming Game and Fish Department (WGFD), Nongame Branch, 260 Buena Vista, Lander, Wyoming 82520.

Table 1. **Level I Species (Conservation Action)**. Species clearly needs conservation action. Includes species of which Wyoming has a high percentage of and responsibility for the breeding population, and the need for additional knowledge through monitoring and research into basic natural history, distribution, etc.

Species	PIF Score[a]	AI[b]	PT[c]	Primary Habitat Type(s)
Mountain Plover[d]	28	4	3	Shortgrass Prairie, Shrub-steppe
Trumpeter Swan	26	3	3	Wetlands
Sage Grouse	26	5	3	Shrub-steppe
McCown's Longspur	26	3	2	Shortgrass Prairie, Shrub-steppe
Baird's Sparrow	26	2	3	Shortgrass Prairie
Ferruginous Hawk	23	4	3	Shrub-steppe, Shortgrass Prairie
Brewer's Sparrow	23	5	5	Shrub-steppe, Mountain-foothills Shrub
Wilson's Phalarope	22	3	5	Wetlands
Franklin's Gull	22	3	3	Wetlands
Sage Sparrow	22	5	2	Shrub-steppe, Mountain-foothills Shrub

Table 1. **Level I Species (Conservation Action)**, continued.

Species	PIF Score[a]	AI[b]	PT[c]	Primary Habitat Type(s)
Swainson's Hawk	21	3	3	Plains/Basin Riparian
Long-billed Curlew	21	2	3	Shortgrass Prairie
Short-eared Owl	20	3	3	Shortgrass Prairie
Northern Goshawk	19	4	3	High Elevation Conifer, Mid Elevation Conifer, Aspen
Peregrine Falcon	19	3	3	Specialized (cliffs)
Burrowing Owl	19	3	4	Shortgrass Prairie
Forster's Tern	19	2	3	Wetlands
Bald Eagle	18	3	3	Montane Riparian, Plains/Basin Riparian
Upland Sandpiper	18	2	2	Shortgrass Prairie
Black Tern	18	3	3	Wetlands
Whooping Crane	n/a	n/a	n/a	Wetlands
Piping Plover	n/a	n/a	n/a	Wetlands, Aquatic

[a] From the PIF Priority Database (Carter et al. 1997).
[b] AI ' Area Importance (from the PIF Priority Database, Carter et al. 1997).
[c] PT ' Population Trend (from the PIF Priority Database, Carter et al. 1997).
[d] Species in all capital letters previously appeared on the Service's 1995 list.

Table 2. **Level II Species (Monitoring).** The action and focus for the species is monitoring. Includes species of which Wyoming has a high percentage of and responsibility for the breeding population, species whose population trend is unknown, species that are peripheral for breeding in the habitat or state, or species for which additional knowledge is needed.

Species	PIF Score[a]	AI[b]	PT[c]	Primary Habitat Type(s)
Calliope Hummingbird	23	5	3	Mid Elevation Conifer, Montane Riparian
Lewis' Woodpecker	23	3	3	Low Elevation Conifer, Plains/Basin Riparian
Cassin's Kingbird	22	3	3	Juniper Woodland, Plains/Basin Riparian
Lark Bunting	22	4	4	Shortgrass Prairie, Shrub-steppe
American White Pelican	21	3	3	Aquatic
Williamson's Sapsucker	21	3	3	Mid Elevation Conifer
Black-backed Woodpecker	21	3	3	Mid Elevation Conifer, High Elevation Conifer
Gray Flycatcher	21	3	3	Juniper Woodland, Mountain-foothills Shrub
Juniper Titmouse[d]	21	3	3	Juniper Woodland
Dickcissel	21	3	3	Shortgrass Prairie
Chestnut-collared Longspur	21	2	3	Shortgrass Prairie
Harlequin Duck	20	3	3	Montane Riparian
Snowy Plover	20	3	3	Wetlands
Black-chinned Hummingbird	20	2	3	Plains/Basin Riparian, Shrub-steppe
Rufous Hummingbird	20	2	3	Mid Elevation Conifer
Red-naped Sapsucker	20	3	2	Aspen
Three-toed Woodpecker	20	4	3	Mid Elevation Conifer, High Elevation Conifer
Willow Flycatcher	20	3	4	Montane Riparian, Plains/Basin Riparian
Hammond's Flycatcher	20	2	3	High Elevation Conifer with Aspen, Montane Riparian
Cordilleran Flycatcher	20	3	3	Montane Riparian, Mid Elevation Conifer
Pygmy Nuthatch	20	3	3	Low Elevation Conifer
Marsh Wren	20	3	4	Wetlands
American Dipper	20	3	3	Montane Riparian
Plumbeous Vireo	20	3	3	Mid Elevation Conifer, Low Elevation Conifer
Townsend's Warbler	20	3	3	High Elevation Conifer, Mid Elevation Conifer
Dusky Flycatcher	19	3	2	Low Elevation Conifer, Aspen, Mountain-foothills Shrub

Table 2. **Level II Species (Monitoring)**, continued.

Species	PIF Score[a]	AI[b]	PT[c]	Primary Habitat Type(s)
Western Bluebird	19	3	3	Juniper Woodland, Low Elevation Conifer
Sage Thrasher	19	5	2	Shrub-steppe
Grasshopper Sparrow	19	3	5	Shortgrass Prairie, Shrub-steppe
Bobolink	19	2	3	Shortgrass Prairie, Shrub-steppe
Common Loon	18	3	3	Wetlands
Black-billed Cuckoo	18	2	3	Plains/Basin Riparian
Red-headed Woodpecker	18	2	3	Plains/Basin Riparian, Low Elevation Conifer
Yellow-billed Cuckoo	18	3	3	Plains/Basin Riparian
Eastern Screech-Owl	18	3	3	Plains/Basin Riparian
Western Screech-Owl	18	3	3	Plains/Basin Riparian
Great Gray Owl	18	3	3	Mid Elevation Conifer, High Elevation Conifer
Boreal Owl	18	3	3	High Elevation Conifer
Broad-tailed Hummingbird	18	2	2	Montane Riparian, Plains/Basin Riparian, Mid Elevation Conifer
Western Scrub-Jay[d]	18	3	3	Juniper Woodland
Loggerhead Shrike	18	3	3	Shrub-steppe
Vesper Sparrow	18	5	4	Shrub-steppe
Lark Sparrow	18	3	4	Shrub-steppe
Golden-crowned Kinglet	17	3	3	High Elevation Conifer
MacGillivray's Warbler	17	3	1	Montane Riparian, Plains/Basin Riparian
Ash-throated Flycatcher[d]	16	2	3	Juniper Woodland
Bushtit[d]	16	3	3	Juniper Woodland
Brown Creeper	16	3	3	Mid Elevation Conifer, High Elevation Conifer
Merlin	15	3	3	Low Elevation Conifer
Sprague's Pipit	n/a	n/a	n/a	Grassland, Plains/Basin Riparian, Shortgrass Prairie
Barn Owl	n/a	n/a	n/a	Shortgrass Prairie, Urban
White-faced Ibis	n/a	n/a	n/a	Wetlands, Aquatic
American Bittern	n/a	n/a	n/a	Wetlands, Aquatic
Common Tern	n/a	n/a	n/a	Wetlands, Aquatic
Purple Martin	n/a	n/a	n/a	Wetlands, Aquatic/Basin Riparian, Montane Riparian

[a] From the PIF Priority Database (Carter et al. 1997).
[b] AI ' Area Importance (from the PIF Priority Database).
[c] PT ' Population Trend (from the PIF Priority Database).
[d] Nicholoff, S. 2002. Wyoming Bird Conservation Plan, Version 1.1. Wyoming Partners In Flight and Wyoming Game and Fish Department, Lander. In press.

Wyoming Partners In Flight Process for Prioritizing Species

Wyoming Partners In Flight participants developed the current list of priority species based on a combination of the seven criteria in the national Partners In Flight Priority Database (Carter et al. 1997). This database serves as a defensible method of prioritizing both species and habitats in need of conservation. The criteria include Wyoming-dependent and Wyoming-independent factors. The Wyoming-independent criteria are constant over a species' range and do not vary for each species. The Wyoming-dependent criteria were the key components used to prioritize species and their conservation action needs. In the absence of any more rigorous statewide surveys, Breeding Bird Survey data dating back to 1968 were used to determine population trends in Wyoming.

Criteria

Within each criterion below, a species was given a rank score ranging from 1 to 5, with 1 being the least critical rank and 5 the most critical. Each ranked species could potentially receive a low score of 7 and a high score of 35. However, setting conservation goals based only on total score could be misleading; therefore, each total score was reviewed in conjunction with its component parts. In Wyoming, species were initially ranked using total score, area importance, and population trend.

1. Relative Abundance (RA) - The abundance of a bird, in appropriate habitat within its entire range, relative to other bird species. This criterion gives an indication of a species' vulnerability to withstand cataclysmic environmental changes. A low score would indicate a higher relative abundance, therefore reducing the risk of complete extirpation from losses in one or more regions. Higher scores indicate a lower relative abundance, thus more vulnerability to drastic losses or population changes.

2. Breeding Distribution (BD) - A relative measure of breeding range size as a proportion of North America (defined as the main body of the continent, excluding Greenland, through Panama and the islands of the Caribbean, comprising an area of 22,059,680 km^2 [National Geographic Society 1993]), and as such it provides an index of a species' vulnerability to random environmental events. High scores indicate localized breeding, thus a higher likelihood of serious decline from drastic environmental changes. Low scores indicate wide breeding distribution, therefore less likelihood of extirpation. Used for breeding birds only.

3. Non-breeding Distribution (ND) - A relative measure of non-breeding, or winter, range size as a proportion of North America, and as such it provides an index of a species' vulnerability to random environmental events. High scores indicate localized distribution on the non-breeding grounds. Low scores indicate wide distribution on the non-breeding grounds, therefore less likelihood of extirpation. Used for wintering birds only.

4. Threats on Breeding Grounds (TB) - The ability of a habitat in an area to support populations of a species in that area. Two factors are considered here: 1) each species' demographic and ecological vulnerability (the potential inability of a species to recover from population loss by normal reproductive effort due to low reproductive rate, high juvenile mortality, or both; and the level of ecological specialization of a species and, hence, its potential

inability to withstand environmental change), and 2) habitat loss or disruption (a combination of the amount of habitat or conditions necessary for survival and reproductive success that has been lost since 1945, and the amount that is anticipated to be lost in the future). High scores indicate either a large loss of habitat or a species that is an extreme ecological specialist. Low scores indicate a stable or increasing habitat or a species that is an ecological generalist. Used for both breeding and wintering birds.

5. Threats on Non-breeding Grounds (TN) - Range-wide threats on non-breeding, or winter, grounds. This is scored using the same criteria as threats on breeding grounds but reflects non-breeding issues, including migratory habitat. Used for wintering birds only.

6. Population Trend (PT) - The overall population trend of each species assigned independently for each state, province, or physiographic area. This criterion must meet two thresholds, reliability and magnitude, to warrant either a very high or very low score. When possible, a score was assigned using BBS data, which incorporated a population trend uncertainty score based on the statistical validity of the BBS data (i.e. a species must be detected on a minimum of 14 BBS routes per state for population trends to have statistical significance). This criterion was chosen to alert managers to species with modest, but certain, population declines.

7. Area Importance (AI) - The abundance of a species within a state, province, or physiographic area relative to its abundance throughout its range. This criterion helps direct conservation efforts toward areas that are most important to a species' survival. Area Importance is scored locally; therefore, high scores indicate that a large proportion of the species' breeding or winter range occurs in Wyoming, or a species is using a habitat that is only available in Wyoming. Low scores indicate that a small proportion of the species' range occurs in Wyoming, or the preferred habitat is widespread across its range. Used for both breeding and wintering birds.

Priority Species

Priority bird species in Wyoming were identified from the PIF Priority Database (Carter et al. 1997) and by qualitative, informed decisions. Those species with a total score of 18 or above, Area Importance (AI) of 3 or above, and/or Population Trend (PT) of 3 or above from the database, or with a total score less than 18 but of significant local interest were identified as the highest priority species. However, as more information becomes available, the highest priority species for Wyoming may change, as this is a dynamic database that allows for updated information to be periodically inserted and reviewed. The primary habitat type or types required for breeding were identified for each species to determine the highest priority habitat types for the state.

Literature Cited

Carter, M. F., W. C. Hunter, D. N. Pashley, J. S. Bradley, C. S. Aid, J. Price, and G. S. Butcher. 1997. Setting landbird conservation priorities for states, provinces, and physiographic areas of North America. Partners In Flight Priority Database Final Report, Colorado Bird Observatory, Brighton.

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Nicholoff, S. 2002. Wyoming Bird Conservation Plan, Version 1.1. Wyoming Partners In Flight and Wyoming Game and Fish Department, Lander. In press.

U.S. Fish and Wildlife Service, Wyoming Ecological Services Field Office

Protections for Raptors

Raptors, or birds of prey, and the majority of other birds in the United States are protected by the Migratory Bird Treaty Act, 16 U.S.C. 703 (MBTA). A complete list of migratory bird species can be found in the Code of Federal Regulations at 50 CFR 10.13. Eagles are also protected by the Bald and Golden Eagle Protection Act, 16 U.S.C. 668 (Eagle Act).

The MBTA protects migratory birds, eggs and nests from possession, sale, purchase, barter, transport, import, export, and take. The regulatory definition of take, defined in 50 CFR 10.12, means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to hunt, shoot, wound, kill, trap, capture, or collect a migratory bird. Activities that result in the unpermitted take (e.g., result in death, possession, collection, or wounding) of migratory birds or their eggs are illegal and fully prosecutable under the MBTA. Removal or destruction of active nests (i.e., nests that contain eggs or young), or causing abandonment of an active nest, could constitute a violation of the MBTA, the Eagle Act, or both statutes. Removal of any active migratory bird nest or any structure that contains an active nest (e.g., tree) where such removal results in take is prohibited. Therefore, if nesting migratory birds are present on or near a project area, project timing is an important consideration during project planning. As discussed below, the Eagle Act provides additional protections for bald and golden eagles and their nests. For additional information concerning nests and protections under the MBTA, please see the U.S. Fish and Wildlife Service's (Service) Migratory Bird Permit Memorandum, MBMP-2.

The Service's Wyoming Ecological Services Field Office works to raise public awareness about the possible occurrence of birds in proposed project areas and the risk of violating the MBTA, while also providing guidance to minimize the likelihood that take will occur. We encourage you to coordinate with our office before conducting actions that could lead to the take of a migratory bird, their young, eggs, or active nests (e.g., construction or other activity in the vicinity of a nest that could result in a take). If nest manipulation is proposed for a project in Wyoming, the project proponent should also contact the Service's Migratory Bird Office in Denver at 303-236-8171 to see if a permit can be issued. Permits generally are not issued for an active nest of any migratory bird species, unless removal of the nest is necessary for human health and safety. If a permit cannot be issued, the project may need to be modified to ensure take of migratory birds, their young or eggs will not occur.

For infrastructure (or facilities) that have potential to cause direct avian mortality (e.g., wind turbines, guyed towers, airports, wastewater disposal facilities, transmission lines), we recommend locating structures away from high avian-use areas such as those used for nesting, foraging, roosting or migrating, and the travel zones between high-use areas. If the wildlife survey data available for the proposed project area and vicinity do not provide the detail needed to identify normal bird habitat use and movements, we recommend collecting that information prior to determining locations for any infrastructure that may create an increased potential for avian mortalities. We also recommend contacting the Service's Wyoming Ecological Services office for project-specific recommendations.

Additional Protections for Eagles

The Eagle Act protections include provisions not included in the MBTA, such as the protection of unoccupied nests and a prohibition on disturbing eagles. Specifically, the Eagle Act prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagle or their body parts, nests, chicks or eggs, which includes collection, possession, molestation, disturbance, or killing. The term "disturb" is defined as "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" (50 CFR 22.3 and see also 72 FR 31132).

The Eagle Act includes limited exceptions to its prohibitions through a permitting process. The Service has issued regulations concerning the permit procedures for exceptions to the Eagle Act's prohibitions (74 FR 46836), including permits to take golden eagle nests which interfere with resource development or recovery operations (50 CFR 22.25). The regulations identify the conditions under which a permit may be issued (i.e., status of eagles, need for action), application requirements, and other issues (e.g., mitigation, monitoring) necessary in order for a permit to be issued.

For additional recommendations specific to Bald Eagles please see our Bald Eagle information web page (http://www.fws.gov/wyominges/Pages/Species/Species_SpeciesConcern/BaldEagle.html).

Recommended Steps for Addressing Raptors in Project Planning

Using the following steps in early project planning, agencies and proponents can more easily minimize impacts to raptors, streamline planning and permitting processes, and incorporate measures into an adaptive management program:

1. Coordinate with appropriate Service offices, Wyoming Game and Fish Department, Tribal governments, and land-management agencies at the earliest stage of project planning.
2. Identify species and distribution of raptors occurring within the project area by searching existing data sources (e.g., Wyoming Game and Fish Department, Federal land-management agencies) and by conducting on-site surveys.
3. Plan and schedule short-term and long-term project disturbances and human-related activities to avoid raptor nesting and roosting areas, particularly during crucial breeding and wintering periods
4. Determine location and distribution of important raptor habitat, nests, roost sites, migration zones and, if feasible, available prey base in the project impact area.
5. Document the type, extent, timing, and duration of raptor activity in important use areas to establish a baseline of raptor activity.
6. Ascertain the type, extent, timing, and duration of development or human activities proposed to occur, and the extent to which this differs from baseline conditions.
7. Consider cumulative effects to raptors from proposed projects when added to past, present, and reasonably foreseeable actions. Ensure that project mitigation adequately addresses cumulative effects to raptors.
8. Minimize loss of raptor habitats and avoid long-term habitat degradation. Mitigate for unavoidable losses of high-valued raptor habitats, including (but not limited to) nesting, roosting, migration, and foraging areas.
9. Monitor and document the status of raptor populations and, if feasible, their prey base post project completion, and evaluate the success of mitigation efforts.
10. Document meaningful data and evaluations in a format that can be readily shared and incorporated into wildlife databases (contact the Service's Wyoming Ecological Services office for details).

Protection of nesting, wintering (including communal roost sites), and foraging activities is considered essential to conserving raptors. In order to promote the conservation of migratory bird populations and their habitats, Federal agencies should implement those strategies directed by Executive Order 13186, "Responsibilities of Federal Agencies To Protect Migratory Birds" (66 FR 3853).

Recommended Seasonal and Spatial Buffers to Protect Nesting Raptors

Because many raptors are particularly sensitive to disturbance (that may result in take) during the breeding season, we recommend implementing spatial and seasonal buffer zones to protect individual nest sites/territories (Table 1). The buffers serve to minimize visual and auditory impacts associated with human activities near nest sites. Ideally, buffers would be large enough to protect existing nest trees and provide for alternative or

replacement nest trees. The size and shape of effective buffers vary depending on the topography and other ecological characteristics surrounding the nest site. In open areas where there is little or no forested or topographical separation, distance alone must serve as the buffer. Adequate nesting buffers will help ensure activities do not take breeding birds, their young or eggs. For optimal conservation benefit, we recommend that no temporary or permanent surface occupancy occur within species-specific spatial buffer zones. For some activities with very substantial auditory impacts (e.g., seismic exploration and blasting) or visual impacts (e.g., tall drilling rig), a larger buffer than listed in Table 1 may be necessary, please contact the Service's Wyoming Ecological Services office for project specific recommendations on adequate buffers.

As discussed above, for infrastructure that may create an increased potential for raptor mortalities, the spatial buffers listed in Table 1 may not be sufficient to reduce the incidence of raptor mortalities (for example, if a wind turbine is placed outside a nest disturbance buffer, but inadvertently still within areas of normal daily or migratory bird movements); therefore, please contact the Service's Wyoming Ecological Services office for project specific recommendations on adequate buffers.

Buffer recommendations may be modified on a site-specific or project-specific basis based on field observations and local conditions. The sensitivity of raptors to disturbance may be dependent on local topography, density of vegetation, and intensity of activities. Additionally, individual birds may be habituated to varying levels of disturbance and human-induced impacts. Modification of protective buffer recommendations may be considered where biologically supported and developed in coordination with the Service's Wyoming Ecological Services Field Office.

Because raptor nests are often initially not identified to species (e.g., preliminary aerial surveys in winter), we first recommend a generic raptor nest seasonal buffer guideline of January 15th – August 15th. Similarly, for spatial nesting buffers, until the nesting species has been confirmed, we recommend applying a 1-mile spatial buffer around the nest. Once the raptor species is confirmed, we then make species-specific and site-specific recommendations on seasonal and spatial buffers (Table 1).

Activities should not occur within the spatial/seasonal buffer of any nest (occupied or unoccupied) when raptors are in the process of courtship and nest site selection. Long-term land-use activities and human-use activities should not occur within the species-specific spatial buffer of occupied nests. Short-term land use and human-use activities proposed to occur within the spatial buffer of an occupied nest should only proceed during the seasonal buffer after coordination with the Service, State, and Tribal wildlife resources management agencies, and/or land-management agency biologists. If, after coordination, it is determined that due to human or environmental safety or otherwise unavoidable factors, activities require temporary incursions within the spatial and seasonal buffers, those activities should be planned to minimize impacts and monitored to determine whether impacts to birds occurred. Mitigation for habitat loss or degradation should be identified and planned in coordination with applicable agencies.

Please contact the Service's Wyoming Ecological Services Field Office if you have any questions regarding the status of the bald eagle, permit requirements, or if you require technical assistance regarding the MBTA, Eagle Act, or the above recommendations. The recommended spatial and seasonal buffers are voluntary (unless made a condition of permit or license) and are not regulatory, and they do not supersede provisions of the MBTA, Eagle Act, Migratory Bird Permit Memorandum (MBMP-2), and Endangered Species Act. Assessing legal compliance with the MBTA or the Eagle Act and the implementing regulations is ultimately the authority and responsibility of the Service's law enforcement personnel. Our recommendations also do not supersede Federal, State, local, or Tribal regulations or permit conditions that may be more restrictive.

Table 1. Service's Wyoming Ecological Services Field Office's Recommended Spatial and Seasonal Buffers for Breeding Raptors

Raptors of Conservation Concern (see below for more information)

Common Name	Spatial buffer (miles)	Seasonal buffer
Golden Eagle	0.50	January 15 - July 31
Ferruginous Hawk	1.00	March 15 - July 31
Swainson's Hawk	0.25	April 1 - August 31
Bald Eagle	see Bald Eagle information web page[1]	
Prairie Falcon	0.50	March 1 - August 15
Peregrine Falcon	0.50	March 1 - August 15
Short-eared Owl	0.25	March15- August 1
Burrowing Owl	0.25	April 1 – September 15
Northern Goshawk	0.50	April 1 - August 15

Additional Wyoming Raptors

Common Name	Spatial buffer (miles)	Seasonal buffer
Osprey	0.25	April 1 - August 31
Cooper's Hawk	0.25	March 15 – August 31
Sharp-shinned Hawk	0.25	March 15 – August 31
Red-tailed Hawk	0.25	February 1 – August 15
Rough-legged Hawk (winter resident only)	----	----
Northern Harrier	0.25	April 1 - August 15
Merlin	0.50	April 1 - August 15
American Kestrel	0.125	April 1 – August 15
Common Barn Owl	0.125	February 1 – September 15
Northern Saw-whet Owl	0.25	March 1 - August 31
Boreal Owl	0.25	February 1 – July 31
Long-eared Owl	0.25	February 1 – August 15
Great Horned Owl	0.125	December 1 – September 30
Northern Pygmy-Owl	0.25	April 1 – August 1
Eastern Screech -owl	0.125	March 1 – August 15
Western Screech-owl	0.125	March 1 – August 15
Great Gray Owl	0.25	March 15 – August 31

[1] http://www.fws.gov/wyominges/Pages/Species/Species_SpeciesConcern/BaldEagle.html

Raptors of Conservation Concern

The Service's Birds of Conservation Concern (2008) report identifies "species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing" under the Endangered Species Act (16 U.S.C 1531 et seq.). This report is intended to stimulate coordinated and proactive conservation actions among Federal, State, and private partners. The Wyoming Partners in Flight Wyoming Bird Conservation Plan identifies priority bird species and habitats, and establishes objectives for bird populations and habitats in Wyoming. This plan also recommends conservation actions to accomplish the population and habitat objectives.

We encourage project planners to develop and implement protective measures for the Birds of Conservation Concern as well as other high-priority species identified in the Wyoming Bird Conservation Plan. For

additional information on the Birds of Conservation Concern that occur in Wyoming, please see our Birds of Conservation Concern web page.

Additional Planning Resources

Avian Power Line Interaction Committee (APLIC). 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, CA.

Edison Electric Institute and the Raptor Research Foundation. 1996. Suggested Practices for Raptor Protection on Power Lines - The State of the Art in 1996. Washington, D.C.

Edison Electric Institute's Avian Power Line Interaction Committee and U.S. Fish and Wildlife Service. 2005. Avian Protection Plan Guidelines.

Edison Electric Institute and the Raptor Research Foundation. 1994. Mitigating Bird Collisions with Power Lines - The State of the Art in 1994. Washington, D.C.

U.S. Fish and Wildlife Service. 2000. Siting, Construction, Operation and Decommissioning of Communications Towers and Tower Site Evaluation Form (Directors Memorandum September 14, 2000), Arlington, Virginia.

U.S. Fish and Wildlife Service. 2007. National Bald Eagle Management Guidelines. United States Department of Interior, Fish and Wildlife Service, Arlington, Virginia. 23 pp.

Wyoming Game and Fish Department Internet Link to Raptor Information

References

50 CFR 10.12 – Code of Federal Regulations. Title 50--Wildlife and Fisheries, Chapter I--United States Fish and Wildlife Service, Department of the Interior, Part 10--General Provisions.

50 CFR 10.13– Code of Federal Regulations. Title 50--Wildlife and Fisheries, Chapter I--United States Fish and Wildlife Service, Department of the Interior, Part 10--General Provisions.

50 CFR 22.3 – Code of Federal Regulations. Title 50--Wildlife and Fisheries, Chapter I--United States Fish and Wildlife Service, Department of the Interior, Part 22—Eagle Permits.

50 CFR 22.25– Code of Federal Regulations. Title 50--Wildlife and Fisheries, Chapter I--United States Fish and Wildlife Service, Department of the Interior, Part 22—Eagle Permits.

66 FR 3853 - Presidential Documents. Executive Order 13186 of January 10, 2001. Responsibilities of Federal Agencies To Protect Migratory Birds. Federal Register, January 17, 2001.

72 FR 31132 - Protection of Eagles; Definition of "Disturb". Final Rule. Federal Register, June 5, 2007.

74 FR 46836 - Eagle Permits; Take Necessary To Protect Interests in Particular Localities. Final Rule. Federal Register, September 11, 2009.

U.S. Fish and Wildlife Service. 2003. Migratory Bird Permit Memorandum, MBMP-2, Nest Destruction (Directors Memorandum April 15, 2003), Washington, D.C.

U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp.

APPENDIX JD-D9:

WILDLIFE

April 2014

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LIST OF ABBREVIATIONS AND ACRONYMS

BLM	Bureau of Land Management
CBM	Coalbed methane
CPA	Core population areas
ISR	In Situ Recovery
MBHFI	Migratory Birds of High Federal Interest
NRCS	Natural Resources Conservation Service
SC	Species of concern
TEPC	Threatened, endangered, proposed, and candidate
TRC	TRC Environmental Corporation
USFWS	U.S. Fish and Wildlife Service
WDEQ/LQD	Wyoming Department of Environmental Quality/Land Quality Division
WGFD	Wyoming Game and Fish Department
WNDD	Wyoming Natural Diversity Database
WSGIT	Wyoming Sage Grouse Implementation Team

JD-D9.1.0 INTRODUCTION

JD-D9.1.1 HABITAT DESCRIPTION AND BACKGROUND INFORMATION

The Jane Dough Unit is within the 10- to 14-inch Northern Plains (10-14NP) zone of northeastern Wyoming (Natural Resource Conservation Service [NRCS] 1988). The study area has the potential to provide habitat for mule deer, elk, pronghorn antelope, jackrabbit, cottontail rabbit, coyote, bobcat, mountain lion, red fox, badger, raccoon, skunk, chipmunk, rodents, songbirds, waterfowl, eagles, hawks, owls, greater sage-grouse, chukar, wild turkey, gray partridge, mourning dove, magpie, and crow. Most species are yearlong residents; however, some species such as elk, eagles, songbirds, and waterfowl are more abundant during migration periods (Cerovski et al. 2004).

Two federally-listed species have been identified by the U.S. Fish and Wildlife Service (USFWS) to have the potential to occur within or in the vicinity of the Jane Dough Unit: Ute ladies'-tresses orchid (threatened) and greater sage-grouse (candidate). The Ute ladies'-tresses orchid is discussed in Appendix JD-D8. In addition, the USFWS has two wildlife species of concern, the black-tailed prairie dog and mountain plover (Addendum JD-D9-A).

To comply with Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD) *Noncoal Rules and Regulations* (2000) and *Guideline No. 5* (1987), Wildlife Resources LLC of Bighorn, Wyoming, completed a raptor nest and greater sage-grouse lek surveys associated with the Jane Dough Unit in 2012. Data collection needs and procedures used in the preparation of this section of the permit were based on recommendations set forth in WDEQ/LQD *Guideline No. 5* (1987). The level of baseline wildlife inventories was modified from WDEQ/LQD *Guideline No. 5* (1987) to better reflect the project and site-specific circumstances of the proposed mine.

The 2012 inventories included greater sage-grouse lek monitoring, raptor nest activity and productivity surveys, and federally-listed species and species of concern. Uranerz's Nichols Ranch Unit is located north of and immediately adjacent to the Jane Dough Unit and extensive

baseline wildlife surveys were conducted in 2006-2007. Wildlife Resources LLC of Bighorn, Wyoming, has conducted annual wildlife surveys (raptor nest surveys and lek activity monitoring) of the Jane Dough Unit as well as on Uranerz's adjacent Nichols Ranch and Hank Unit ISR project areas from 2006-2012 (Wildlife Resources LLC 2012).

JD-D9.1.2 DESCRIPTION OF PROJECT AREA

JD-D9.1.2.1 Location and Size

The Jane Dough Unit is located in Campbell and Johnson counties, Wyoming, and encompasses the Jane Dough production unit. Uranerz's Nichols Ranch Unit is located north of and immediately adjacent to the Jane Dough Unit (Figure JD-D9-1). Production from the Jane Dough Unit will be piped to the production plant facility located in the Nichols Ranch Unit via a system of pipelines. The Jane Dough Unit encompasses approximately 3,680 acres in portions of Sections 20, 21, 27, 28, 29, 30, 31, 32, 33, and 34, T43N, R76W (Figure JD-D1-1). Access to the Jane Dough Unit is by way of the Iberlin Road north from Wyoming Highway 387. The wildlife study area includes the project area and a 1.0-mile buffer for raptor nests and a 2.0-mile buffer for greater sage-grouse leks. The entire wildlife survey area (permit area plus a 2.0-mile survey area) encompasses approximately 39.2 miles^2 (25,144 acres).

JD-D9.1.2.2 Topography

Topographic relief ranges from 4,670 to 4,960 feet above mean sea level in the Jane Dough Unit. Annual precipitation varies from 10 to 14 inches, with approximately 35 - 41% falling during the normal growing season (NRCS 1988). Growth of native cool-season plants begins about April 1 and continues to about July 1. Growth of native warm-season plants begins about May 15 and continues to about August 15. Appendix JD-D8 provides a detailed description of vegetation communities occurring in the Jane Dough Unit.

JD-D9.1.2.3 Habitat and Vegetative Composition

There are no perennial streams in the project area; however, the Jane Dough Unit is located in an active coalbed methane (CBM) field; therefore, ponds associated with CBM development are scattered throughout the project area. At the time of the July 2010 and August 2012 site visits, all of the CBM ponds contained water. Cottonwood Creek and Seventeenmile, both ephemeral streams, are the main drainages in the Jane Dough Unit. Cottonwood Creek occurs in the north portion of the Jane Dough Unit area and the Seventeenmile drainage occurs in the southwestern corner of the Jane Dough Unit area (Figure JD-D9-1). Cottonwood Creek, Seventeenmile drainage, and all other unnamed tributaries were dry at the time of the July site visits. No springs occur in the project area. One developed groundwater well provides water to a constructed pond that overflows to an otherwise ephemeral drainage creating the only flowing stream in the Jane Dough Unit. Within the project area, both Cottonwood Creek and Seventeenmile drainage have been physically altered by local ranches, and a system of irrigation ditches has been constructed to supply water to the area for hay production; therefore, there is no defined bed/bank with a typical pool-riffle riverine system in the project area. Current land use (Appendix JD-D1) in the project area is primarily livestock grazing, wildlife habitat, and CBM and natural gas development.

Descriptions of vegetation communities (i.e., wildlife habitat types) that occur in the project area are presented in detail in Appendix JD-D8 (Vegetation) and are illustrated on Exhibit JD-D8-1. A description of the wetland community is presented in Appendix JD-D10.

Vegetation communities present within the project and wildlife survey area and their equivalent Wyoming Game and Fish Department (WGFD) classifications (Cerovski et al. 2004) are:

- sagebrush shrubland (4.12),
- mixed grassland (4.10),
- bottomland (2.30),
- disturbed land (99.8),
- wetlands (8.20), and
- rock outcrop (12.40).

JD-D9.2.0 FIELD STUDIES, RESULTS, AND DISCUSSION

JD-D9.2.1 INTRODUCTION

Field surveys were conducted within the Jane Dough Unit during April and May 2012 for raptor nests and monitoring of greater sage-grouse lek activity. No formal surveys were conducted for other wildlife species; however, wildlife species that have the potential to occur in the survey area were determined from published literature, the Wyoming Natural Diversity Database (WNDD) (2012), and the *Atlas of Birds, Mammals, Reptiles and Amphibians in Wyoming* (Cerovski et al. 2004). In addition, a list of actual wildlife species observed in the Nichols Ranch and Hank Units is presented in Addendum JD-D9-B.

JD-D9.2.2 BIG GAME

JD-D9.2.2.1 Survey Methods and Results

Two species of big game are known to occur in the Jane Dough Unit, the pronghorn antelope and mule deer. No formal surveys for big game were conducted; however, opportunistic observations were made of big game during other wildlife and vegetation surveys that were conducted by TRC. Two species of big game--pronghorn antelope and mule deer--were observed in the wildlife survey area throughout the 2010-2011 field season. Pronghorn were mainly associated with the mixed grassland and sagebrush shrubland vegetation types. Mule deer were generally observed in mixed sagebrush grassland vegetation type.

JD-D9.2.2.2 Discussion

JD-D9.2.2.2.1 Pronghorn

The Jane Dough Unit wildlife survey area is within the Pumpkin Buttes Antelope Herd Unit and Hunt Area 23 (WGFD 2011a). The Pumpkin Buttes Antelope Herd Unit occupies 1,544 mile^2, of which 1,475 mile^2 are considered occupied antelope habitat. The Pumpkin Buttes Antelope

Herd Unit has been above objective population size since 1999. The current population objective is 18,000 animals. The 2006 to 2010 population estimates of the herd unit averaged 22,537 animals. The 2011 population estimate was 26,304 animals. Based on the current population trends, harvest numbers, and hunter success numbers, the projected 2012 post-season population estimate for the Pumpkin Buttes Antelope herd contains about 28,192 animals (WGFD 2011a). With most of the herd unit under private ownership, hunter access and harvest rates is governed by private land owners, making achieving adequate harvest the largest issue affecting the management of this herd unit (WGFD 2011a).

The Jane Dough Unit and surrounding area lies within habitat designated by the WGFD as winter/yearlong and yearlong range for pronghorn (Figure JD-D9-1). There are no crucial pronghorn ranges within the Jane Dough Unit or vicinity. The nearest crucial range for pronghorn occurs approximately 36 miles south of the project area (WGFD 2010 and WGFD 2011a).

JD-D9.2.2.2.2 Mule Deer

The Jane Dough Unit wildlife survey area is within portions of the Pumpkin Buttes Mule Deer Herd Unit. The Pumpkin Buttes Mule Deer Herd is comprised of Hunt Areas 19, 20, 29, and 31. The Jane Dough Unit is in Hunt Area 19. The herd unit contains 2,706 mile^2 of occupied habitat. The current population objective is 11,000 animals. The 2006-2010 population estimates of the herd unit averaged 12,246 animals. The 2011 population estimate was 9,604 animals. Based on the current population trends, harvest numbers, and hunter success number, the projected 2012 post-season population estimate for the Pumpkin Buttes Mule Deer herd is 11,178 animals (WGFD 2011b).

The project area and wildlife study area lie within habitat designated as winter/yearlong and yearlong range (Figure JD-D9-2). There are no crucial mule deer ranges within the wildlife survey area. The nearest mule deer crucial winter range occurs approximately 39 miles west of the project area (WGFD 2010 and WGFD 2011b).

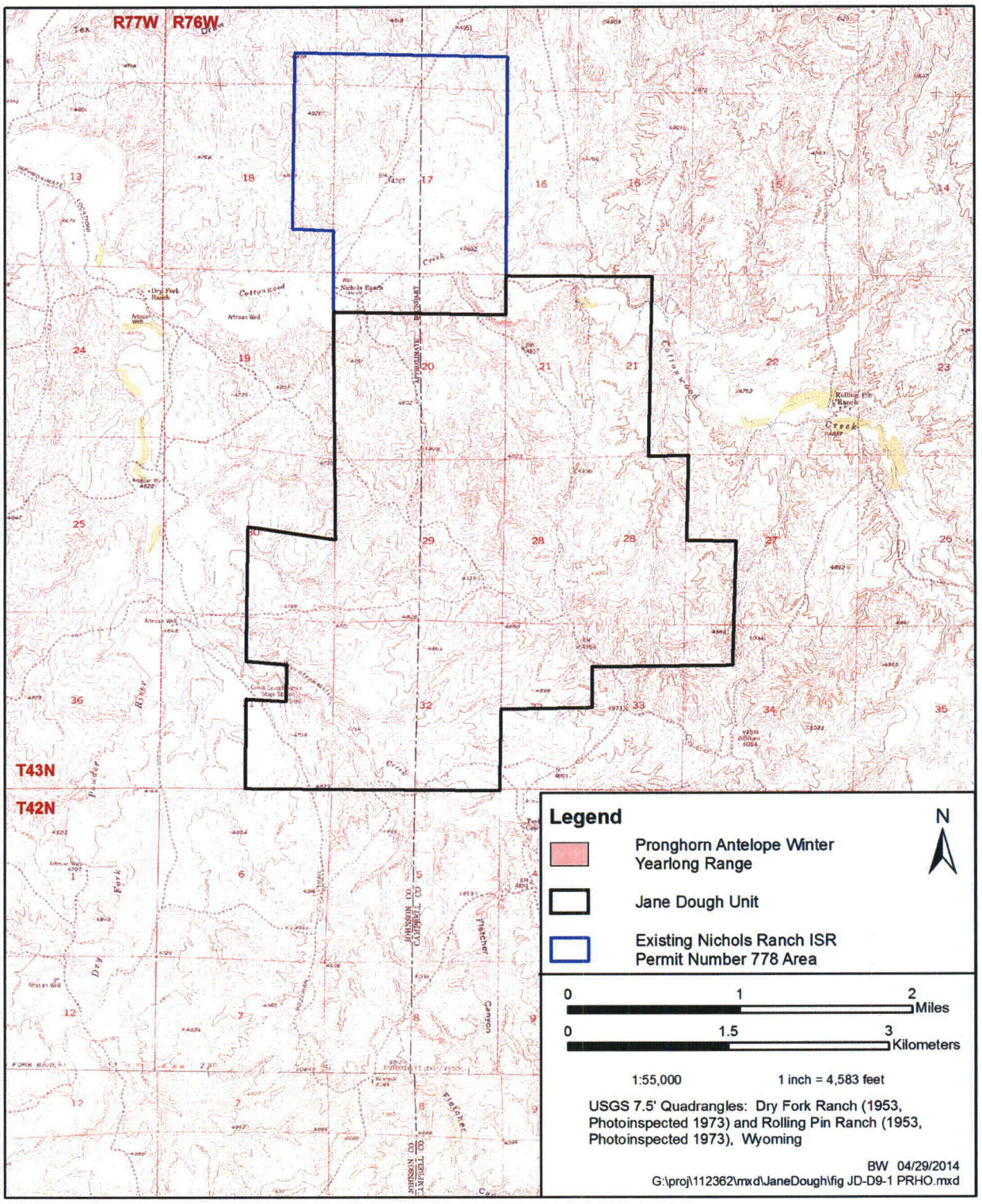

Figure JD-D9-1 WGFD Pronghorn Antelope Habitat Range, Jane Dough Unit, 2012.

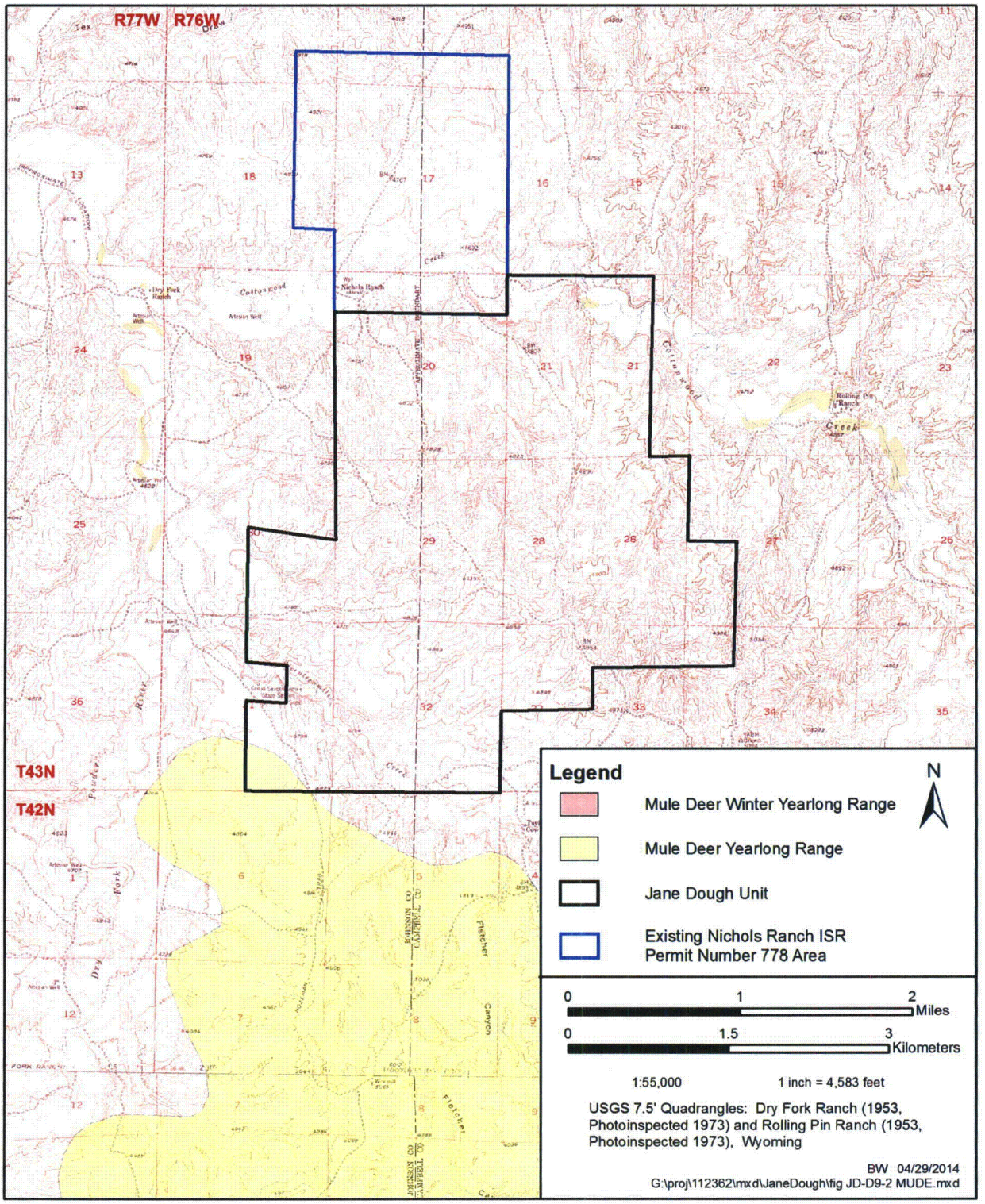

Figure JD-D9-2 WGFD Mule Deer Habitat Range, Jane Dough Unit, 2012.

JD-D9.2.3 UPLAND GAME BIRDS, SHOREBIRDS, AND WATERFOWL

No other formal surveys were conducted for upland bird species. Greater sage-grouse are discussed in Section JD-D9.2.7. The gray partridge is the only other upland game bird with the potential to occur in the Jane Dough Unit; however, there are no known sightings of any gray partridge in the project area.

Limited habitat for waterfowl and shorebirds occurs in the project area; therefore, formal surveys for waterfowl and shorebirds were not conducted. The only perennial water bodies to provide potential waterfowl and shorebird habitat in the Jane Dough Unit are CBM ponds. Limited habitat for waterfowl and shorebirds occurs in the project area; therefore, formal surveys for waterfowl and shorebirds were not conducted. The only perennial water bodies to provide potential waterfowl and shorebird habitat in the Jane Dough Unit are CBM ponds. The margins of all or most of the CBM ponds in the Jane Dough Unit lack vegetation; therefore, there is limited potential waterfowl habitat (cover, nesting and foraging) associated with the CBM ponds. Other seasonal water sources that provide suitable waterfowl and shorebird habitat include constructed stock ponds scattered throughout the wildlife study area. Waterfowl and shorebird species expected to occur within the general region of the survey area are listed in Addendum JD-D9-B.

JD-D9.2.4 MAMMALIAN PREDATORS, LAGOMORPHS, SMALL MAMMALS

No formal surveys for mammalian predators, lagomorphs, or small mammals were conducted. Three species of mammalian predators were observed during field survey work on the Nichols Ranch Unit: bobcat, badger, and coyote. In addition, a swift fox was observed approximately 5.0 miles east of the project area crossing the Van Buggenum Road. Numerous sightings of desert cottontail rabbits and white-tailed jackrabbits were documented within the project area in 2010 and 2012. These sightings occurred in all of the available habitats; however, the highest concentration of rabbits was observed around disturbed areas such as the existing well pads, a compression station, and along existing roads. Thirteen-lined ground squirrels and black-tailed prairie dogs were the only species of small mammals observed within the

Jane Dough Unit. Approximately 507 acres of black-tailed prairie dog colonies occur within 2.0 miles of the Jane Dough Unit. No black-tailed prairie dog colonies occur in the Jane Dough Unit (see map pocket Figure JD-D9-3). Mammalian predators species and small mammals expected to occur within the general region of the survey area are listed in Addendum JD-D9-B.

JD-D9.2.5 RAPTORS AND NONGAME/MIGRATORY BIRDS

JD-D9.2.5.1 Raptors

Raptor nest locations and productivity were monitored in April-June 2012 by Wildlife Resources LLC of Bighorn, Wyoming.

A raptor nest was determined to be active if adult birds displayed defensive behavior within the vicinity of known or potential nest sites; eggs or young were present, or an adult was observed in incubating posture on the nest (Postupalsky 1974).

An inventory of raptor nests located in the project area was conducted in April and May prior to the appearance of foliage on the trees. Follow-up productivity surveys on occupied nests were conducted in June. The activity status of all nests was documented. Nests were observed from a distance to avoid disturbing nesting birds. Binoculars and a spotting scope were used to determine the presence and, if possible, the number of young in the nest. Nests that could not be properly observed were classified as active if at least one adult was observed defending the nest. If no sign of occupancy was evident, the area below and around the nest was checked for signs of recent activity (mutes, pellets, feathers, prey remains, or young) in an attempt to verify, or determine the cause of nest failure.

During the 2012 field season, 79 raptor nests were found within the project area and a 1.0-mile buffer (map pocket Exhibit JD-D9-1 and Table JD-D9-1), of which seven (Nests 1 through 6 and 63) were determined to be active (Wildlife Resources LLC 2012). Of the seven active nests, three were great horned owl nests, two were red-tailed hawk nests, and two were golden eagle nests.

Table JD-D9-1 Raptor Nests Within 1.0 Mile of the Jane Dough Unit, 2012.

Nest Number [1]	Species	Date Checked	BLM Nest ID	TWN	RNG	Easting	Northing	2012 Status[2]	2012 Production	Nest Condition	Nest Substrate /Height (ft)	Nest/Height (ft)
1*	Great-horned owl	5/17/2012	4503	43	76	418480	4836380	Active	2 Class II young	GOOD	CTL	Sticks
2*	Red-tailed hawk	5/17/2012	5493	43	76	419830	4836409	Active	0	GOOD	CTL	Sticks/20'
3*	Golden eagle	4/25/2012	5496	43	76	417076	4833816	Active	0	GOOD	CTL/50'	Sticks/35'
4	Great-horned owl	4/26/2012	10647	43	76	415550	4835244	Active	2 Class II young	FAIR	CTL	Sticks/25'
5	Red-tailed hawk	5/9/2012	12762	43	76	420880	4836933	Active	0	GOOD	CTL/50'	Sticks/40'
6	Great-horned owl	4/25/2012	A3-12	42	76	417608	4832678	Active	2 Class II young	GOOD	CTL/50'	Sticks/40'
7	Red-tailed hawk	5/9/2012	4219	43	76	420995	4836835	Inactive	NA	GONE	CTL/50'	Sticks/40'
8	Great-horned owl	5/9/2012	4222	43	76	420333	4838802	Inactive	NA	GONE	Tree fell	Sticks/18'
9*	Great-horned owl	5/17/2012	4225	43	76	420301	4836415	Inactive	NA	FAIR	CTL	Sticks/17'
10	Red-tailed hawk	5/17/2012	4484	43	76	420012	4833886	Inactive	NA	FAIR	CTL/35'	Sticks/30'
11	Red-tailed hawk	5/18/2012	4486	42	76	419423	4833358	Inactive	NA	POOR	CTL/45'	Sticks/20'
12	Unknown raptor	4/25/2012	4502	43	76	416604	4837147	Inactive	NA	GONE	CTL	Sticks
13	Great-horned owl	4/25/2012	4715	43	76	416617	4834457	Inactive	NA	POOR	CTL/50'	Sticks/40'
14	Red-tailed hawk	4/25/2012	4890	42	76	417558	4832642	Inactive	NA	FAIR	CTL/50'	Sticks/45'
15*	Unknown raptor	4/25/2012	4898	43	76	417849	4833435	Inactive	NA	GONE	CTL/45'	Sticks/30'
16	Unknown raptor	5/18/2012	5328	42	76	419083	4833001	Inactive	NA	GONE	CTL/35'	Sticks/25'
17	Unknown raptor	5/18/2012	5329	42	76	419100	4833006	Inactive	NA	GONE	CTL/25'	Sticks/20'
18*	Unknown raptor	4/25/2012	5423	43	76	417344	4833817	Inactive	NA	FAIR	CTL/20'	Sticks/15'
19	Unknown raptor	5/18/2012	5424	43	76	419520	4833402	Inactive	NA	GONE	CTL/45'	Sticks/25'
20	Red-tailed hawk	5/18/2012	5425	42	76	419403	4833361	Inactive	NA	FAIR	CTL/50'	Sticks/40'
21	Red-tailed hawk	5/9/2012	5464	43	76	420304	4838724	Inactive	NA	FAIR	CTL/25'	Sticks/20'
22	Great-horned owl	4/25/2012	5471	42	76	417203	4833122	Inactive	NA	GONE	CTL/40'	Sticks/30'
23	Unknown raptor	4/25/2012	5472	42	76	417187	4833080	Inactive	NA	GONE	CTL/35'	Sticks/20'
24	Great-horned owl	4/26/2012	5477	43	76	415680	4836155	Inactive	NA	GONE	CTL/35'	Sticks/30'
25*	Red-tailed hawk	5/17/2012	5480	43	76	418583	4836300	Inactive	NA	FAIR	CTL/30'	Sticks/15'
26	Great-horned owl	4/26/2012	5504	43	76	415674	4836131	Inactive	NA	GONE	CTL/35'	Sticks/30'
27	Great-horned owl	4/26/2012	5513	43	76	415651	4835483	Inactive	NA	Poor	CTL/35'	Sticks/30'
28	Great-horned owl	5/17/2012	5514	43	76	419975	4834468	Inactive	NA	GONE	CTL/35'	Sticks/12'
29*	Unknown raptor	4/25/2012	5515	43	76	416667	4834446	Inactive	NA	FAIR	CTL/45'	Sticks/35'
30*	Unknown raptor	5/17/2012	5516	43	76	419553	4835038	Inactive	NA	POOR	CTL	Sticks/15'
31	Unknown raptor	4/25/2012	5522	43	76	416106	4834823	Inactive	NA	FAIR	CTL/35'	Sticks/25'
32	Unknown raptor	4/25/2012	5523	43	76	416352	4834467	Inactive	NA	GONE	CTL/45'	Sticks/35'
33	Unknown raptor	4/25/2012	5524	43	76	416596	4834451	Inactive	NA	POOR	CTL/50'	Sticks/40'
34*	Unknown raptor	5/17/2012	5536	43	76	420374	4836093	Inactive	NA	POOR	CTL	
35	Ferruginous hawk	4/26/2012	5743	43	76	416876	4836232	Inactive	NA	POOR	GHS	Sagebrush
36	Unknown raptor	5/18/2012	10410	42	76	418939	4832879	Inactive	NA	POOR	CTL/45'	Sticks/40'
37	Burrowing owl	4/25/2012	10633	43	76	416069	4833732	Inactive	NA	Unkn	P dog hole	GRND
38	Unknown raptor	4/25/2012	12235	42	76	417728	4832910	Inactive	NA	POOR	CTL	
39	Unknown raptor	4/25/2012	12236	42	76	417727	4832914	Inactive	NA	POOR	CTL	
40	Red-tailed hawk	4/26/2012	12759	43	76	415648	4835481	Inactive	NA	GONE	CTL/40'	Sticks/35'
41*	Unknown raptor	4/25/2012	12772	43	76	417000	4834074	Inactive	NA	FAIR	CTL/45'	Sticks/30'

Table JD-D9-1 Raptor Nests Within 1.0 Mile of the Jane Dough Unit, 2012.

Nest Number [1]	Species	Date Checked	BLM Nest ID	TWN	RNG	Easting	Northing	2012 Status[2]	2012 Production	Nest Condition	Nest Substrate /Height (ft)	Nest/Height (ft)
42*	Unknown raptor	4/25/2012	12777	43	76	416979	4834277	Inactive	NA	FAIR	CTL/20'	Sticks/15'
43	Unknown raptor	4/25/2012	12778	43	76	415680	4834360	Inactive	NA	FAIR	CTL/40'	Sticks/25'
44*	Unknown raptor	4/26/2012	12783	43	76	416949	4835362	Inactive	NA	POOR	CTL/45'	Sticks/25'
45	Unknown raptor	4/26/2012	12786	43	76	415944	4836022	Inactive	NA	FAIR	CTL/30'	Sticks/15'
46	Unknown raptor	4/26/2012	12787	43	76	415693	4836069	Inactive	NA	GONE	CTL/40'	Sticks/30'
47	Unknown raptor	5/9/2012	12794	43	76	420599	4837622	Inactive	NA	FAIR	CTL/50'	Sticks/40'
48*	Unknown raptor	5/9/2012	12795	43	76	419713	4837803	Inactive	NA	POOR	CTL/55'	Sticks/45'
49*	Unknown raptor	5/9/2012	12853	43	76	419789	4837517	Inactive	NA	GONE	CTD/25'	Sticks/20'
50	Unknown raptor	5/18/2012	12861	42	76	419314	4833099	Inactive	NA	GONE	CTL/40'	Sticks/30'
51	Unknown raptor	5/18/2012	12931	42	76	419362	4833266	Inactive	NA	POOR	CTL/35'	Sticks/30'
52	Unknown raptor	5/18/2012	12932	42	76	419522	4833380	Inactive	NA	POOR	CTL/40'	Sticks/30'
53	Unknown raptor	5/18/2012	12933	42	76	419515	4833390	Inactive	NA	POOR	CTL/35'	Sticks/20'
54	Unknown raptor	5/18/2012	12940	43	76	421342	4834309	Inactive	NA	POOR	CTL/35'	Sticks/15'
55	Unknown raptor	5/18/2012	12941	43	76	421306	4834327	Inactive	NA	GONE	CTL/20'	Sticks/12'
56*	Unknown raptor	4/25/2012	12942	43	76	416903	4834332	Inactive	NA	POOR	CTL/30'	Sticks/25'
57	Unknown raptor	5/17/2012	12944	43	76	419992	4834480	Inactive	NA	POOR	CTL/30'	Sticks/15'
58*	Unknown raptor	5/17/2012	12948	43	76	419746	4835009	Inactive	NA	POOR	CTL/30'	Sticks/12'
59*	Unknown raptor	4/26/2012	12954	43	76	418098	4835406	Inactive	NA	FAIR	CTL/30'	Sticks/15'
60*	Unknown raptor	5/17/2012	12961	43	76	420211	4836172	Inactive	NA	POOR	CTL/25'	Sticks/15'
61	Unknown raptor	5/9/2012	13007	43	76	420585	4836882	Inactive	NA	POOR	JUL/20'	Sticks/10'
62	Unknown raptor	4/25/2012	I2-12	43	76	416600	4834497	Inactive	NA	FAIR	WIL/25'	Sticks/15'
63*	Golden eagle	5/9/2012	5495	43	76	419454	4837968	Active	0	GOOD	CTL/50'	Sticks/45'
64	Unknown raptor	4/18/2012	4497	43	76	418438	4838503	Inactive	NA	GONE	CTL/55'	Sticks/25'
65	Unknown raptor	5/9/2012	4498	43	76	419268	4838365	Inactive	NA	GONE	CTL/50'	Sticks/30'
66	Unknown raptor	4/18/2012	4499	43	76	416802	4838238	Inactive	NA	POOR	CTL/45'	Sticks/30'
67*	Golden eagle	4/18/2012	4500	43	76	418591	4837803	Inactive	NA	FAIR	CTL/50'	Sticks/40'
68	Red-tailed hawk	4/18/2012	5487	43	76	416557	4837912	Inactive	NA	FAIR	CTL/60'	Sticks/50'
69*	Golden eagle	4/18/2012	5494	43	76	418662	4837768	Inactive	NA	GONE	CLF	Sticks
70*	Great-horned owl	5/17/2012	5511	43	76	418271	4837232	Inactive	NA	GONE	CTL/45'	Sticks/35'
71	Golden eagle	4/18/2012	12757	43	76	417064	4837702	Inactive	NA	FAIR	CTL/50'	Sticks/40'
72*	Unknown raptor	5/17/2012	12963	43	76	418630	4837317	Inactive	NA	POOR	CTL/50'	Sticks/20'
73	Unknown raptor	4/18/2012	12965	43	76	417032	4837780	Inactive	NA	POOR	CTL/40'	Sticks/30'
74	Unknown raptor	4/18/2012	12967	43	76	419028	4838833	Inactive	NA	POOR	CTL/50'	Sticks/35'
75	Red-tailed hawk	4/18/2012	5486	43	76	419491	4839078	Inactive	NA	GOOD	CTL/55'	Sticks/40'
76	Long-earred owl	4/18/2012	5491	43	76	418730	4839255	Inactive	NA	POOR	CTL/40'	Sticks/30'
77	Unknown raptor	4/18/2012	5534	43	76	418790	4839206	Inactive	NA	GONE	CTL/25'	Sticks/20'
78	Unknown raptor	4/18/2012	5535	43	76	418720	4839265	Inactive	NA	POOR	CTL/25'	Sticks/20'
79	Golden eagle	4/18/2012	5537	43	76	418170	4838235	Inactive	NA	GONE		

[1] Refer to Exhibit JD-D9-1 for Nest Number and Location; [2] NA - not applicable; * Nest Located Within Jane Dough Unit Permit Boundary.

Nests 1, 2, 3, and 63 are located in the Jane Dough Unit and the remaining three active nests, 4, 5, and 6, are located in trees outside the Jane Dough Unit. All of the active nests were located in isolated cottonwood trees in drainages. The active golden eagle nest 3 was observed in a cottonwood tree in Seventeenmile Creek inside the Jane Dough Unit. The active golden eagle nest 63 was also observed in a cottonwood tree inside the Jane Dough Unit. Of the seven nests determined to be active, it could be confirmed that there were six young great horned owls, two young per nest, produced in 2012. The remaining 72 nests were inactive or status unknown and ranged from poor to good in general condition. The species that either built or previously occupied these nests are unknown.

There are no winter bald eagle roosts within 1.0 miles of the Jane Dough Unit. The closest known winter bald eagle roost is approximately 4.0 miles northeast of the Jane Dough Unit.

JD-D9.2.5.2 Nongame/Migratory Birds

No formal surveys for nongame/migratory birds were conducted. A list of Migratory Bird Species of Management Concern (i.e., Migratory Birds of High Federal Interest [MBHFI]) in Wyoming is provided in Addendum JD-D9-A.

JD-D9.2.6 REPTILES AND AMPHIBIANS

No formal surveys for reptiles and amphibians were conducted. Two species of reptiles were observed in the adjacent Nichols Ranch Unit--the prairie rattlesnake and bullsnake. Other amphibians and reptiles likely to occur within the survey area are presented in Addendum JD-D9-B.

JD-D9.2.7 THREATENED, ENDANGERED, PROPOSED, AND CANDIDATE SPECIES AND SPECIES OF CONCERN

JD-D9.2.7.1 Introduction

A list of TEPC species and Species of Concern (SC), status, and expected occurrence (i.e., habitat) was obtained from the USFWS (USFWS 2012, Addendum JD-D9-A).

Additionally, a database search was conducted by the Wyoming Natural Diversity Database (WNDD) for any records of TEPC and SC species that may occur in the area based on habitat type and geographic location (Addendum D9-A). Four occupied greater sage-grouse leks occur within 2.0 miles of the Jane Dough Unit (map pocket Figure JD-D9-3 and Table JD-D9-2).

The USFWS identified one TEPC animal species, the greater sage-grouse, and two SC, the black-tailed prairie dog and mountain plover, with the potential to occur and/or be affected by the proposed project (refer to Addendum JD-D9-A).

JD-D9.2.7.2 Greater Sage-grouse

The greater sage-grouse is a federal candidate species that is known to occur within the proposed project area. The species was first petitioned for federal listing as threatened or endangered in July 2002. After several additional petitions and court challenges, the USFWS issued a final determination of "warranted for listing but precluded by higher priorities" (i.e., a candidate species) in March 2010 (USFWS 2010). As a result, the greater sage-grouse was placed on the list of federal candidate species (50 C.F.R. Part 17 [FWS-R6-ES-2010-0018] [MO 92210-0-0008-B2]).

As a preemptive measure, the Governor of Wyoming initiated a Wyoming Sage Grouse Implementation Team (WSGIT) in July 2007 to make recommendations on management of greater sage-grouse populations relative to development in Wyoming with the goal of maintaining healthy greater sage-grouse populations and avoiding federal listing of the species. The WSGIT and eight local working groups identified and defined core population areas (CPAs) in Wyoming, addressed the need for connectivity among geographically important populations, recommended guidelines for development activities both within and outside of the CPAs, and assessed needs for further research regarding habitat protection and population monitoring (WSGIT 2010a). CPAs encompass habitats and existing populations for at least two-thirds of the greater sage-grouse in Wyoming (WSGIT 2008). WSGIT (2008) predicted that, based on peak male attendance, approximately 83% of the males attending leks in Wyoming were within

Table JD-D9-2 2005-2012 Greater Sage-grouse Lek Activity, Jane Dough Unit, 2012.

Lek ID	Year	Maximum Number[1]	
		Males	Females
38-Cottonwood Creek 1	2005	15	4
	2006	29	1
	2007	40	3
	2008	6	4
	2009	1	1
	2010	0	0
	2011	0	0
	2012	0	0
	2013	0	0
38-Cottonwood Creek 1 Satellite	2005	NC	NC
	2006	9	0
	2007	7	2
	2008	NC	NC
	2009	NC	NC
	2010	NC	NC
	2011	0	0
	2012	NC	NC
	2013	0	0
38-Cottonwood Creek 2	2005	12	1
	2006	25	1
	2007	21	1
	2008	11	4
	2009	1	0
	2010	1	1
	2011	0	0
	2012	0	0
	2013	0	0
38-Cottonwood Creek 3	2005	7	0
	2006	6	0
	2007	2	0
	2008	0	0
	2009	0	0
	2010	0	0
	2011	0	0
	2012	0	1
	2013	0	0

[1] Maximum number of males and females may not have been observed during the same lek visit; NC = not checked.

initially identified CPAs, as were approximately 61% of the occupied leks in the state. After further review, the CPAs were refined in June 2010--and Version 3.0 of the core area map was released to the public--to exclude some areas of the state where greater sage-grouse habitat was marginal or the level of human development in the area warranted exclusion and to include areas required to maintain connectivity between and among important populations (WSGIT 2010b).

Then on June 2, 2011, the Governor of Wyoming signed Executive Order 2011-5, updating the previous Executive Order (2010-4) regarding the protection of greater sage-grouse (State of Wyoming 2011). The most restrictive conservation measures and recommendations are for the greater sage-grouse CPAs, which are areas identified by the State of Wyoming as high-quality habitat for greater sage-grouse nesting and brood-rearing and necessary to maintain sage-grouse populations. This Executive Order applies to all actions (including issuance of state authorized permits) undertaken by all Wyoming state agencies including permits issued by WDEQ/LQD (State of Wyoming 2010).

The locations of known occupied greater sage-grouse leks within 2.0 miles of the Jane Dough Unit and the location of greater sage-grouse CPAs were gathered from the WGFD databases (WGFD 2012). The WGFD identified four leks within 2.0 miles of the Jane Dough Unit: 38-Cottonwood Creek 1, 38-Cottonwood Creek 1 Satellite, 38-Cottonwood 2, and 38-Cottonwood 3 (map pocket Figure JD-D9-3). All of these leks have been surveyed annually since 2005. Each lek was visited three times at sunrise and the maximum number of males and female birds were recorded. The period-of-record activity status and number of birds observed are presented on Table JD-D9-2 for each of the four lek locations. 38-Cottonwood Creek 1 was active from 2005-2009; 38-Cottonwood Creek 1 Satellite was active in 2006 and 2007; 38-Cottonwood Creek 2 was active in 2005-2010; and 38-Cottonwood Creek 3 was active in 2005-2007. No activity was noted on any of the four leks in 2011 or 2012.

There are several potential explanations for these decreases, including natural population responses to recent drought conditions in the general area and natural degradation of sagebrush habitat (Knick et al. 2003). However, recent studies have also documented that intensive gas development can have adverse impacts on greater sage-grouse populations (Holloran and

Anderson 2005; Lyon 2000; Lyon and Anderson 2003; and Walker, Naugle, and Doherty 2007). A large number of gas (CBM) wells (between 4 and 12 wells per section) have been drilled throughout the project area over the past 3 years. In addition, there also appears to be an indirect impact associated with an increased number of avian predators (e.g., corvids) and mammalian predators (e.g., foxes, coyotes) associated with increased gas development that have also been documented as having adverse impacts on nesting greater sage-grouse (Hollaran and Anderson 2005; Lyon and Anderson 2003). Therefore, any decrease in the attendance of male greater sage-grouse and related population declines within the general project area are likely the result of a combination of natural and manmade factors not associated with the Jane Dough Unit. The Jane Dough Unit is located outside of a greater sage-grouse CPA (WSGIT 2010b).

JD-D9.2.7.3 Black-tailed Prairie Dog

The black-tailed prairie dogs occur within the eastern third of Wyoming on short and mixed grass prairies. The USFWS identifies the black-tailed prairie dog as a SC because they are primary prey for the black-footed ferret and several raptors such as golden eagle and ferruginous hawk (USFWS 2012; Addendum JD-D9-A). In addition, prairie dog colonies and burrows also provide nest sites for the mountain plover and burrowing owls. Approximately 507 acres of black-tailed prairie dog colonies occur north of the project area in the Nicholas Ranch Unit (Figure JD-D9-3). However, no black-tailed prairie dogs colonies occur in the Jane Dough Unit.

JD-D9.2.7.4 Mountain Plover

The mountain plover was formally proposed for listing under the *Endangered Species Act* in 1999; however, it was removed from consideration by the USFWS in September 2003. The mountain plover is listed as a MBHFI and as a USFWS SC (Addendum JD-D9-A). Potential mountain plover nesting habitat is present within and adjacent to the Jane Dough Unit. Such habitat includes the mixed grassland vegetation community, disturbed lands, and prairie dog colonies (USFWS 1999). The WNDD has records of mountain plover approximately 4.0 miles from the area (WNDD 2012; Addendum JD-D9-A); however, no mountain plovers were observed within the Jane Dough Unit.

JD-D9.3.0 WILDLIFE IMPACTS AND MITIGATIVE MEASURES

Mining activities within the proposed Jane Dough Unit project area will result in limited short-term loss of approximately 101 acres of wildlife habitat over the life of the operation. Short-term habitat losses will occur in those areas that are temporarily disturbed during drilling operations and during the construction of the ancillary facilities. The losses in wildlife habitat will be limited to small areas (maximum of 60-80 acres at any one time) and will be short-term in nature. The loss of wildlife habitat will be mitigated with the completion of reclamation activities.

All wildlife habitat disturbed during the life of the mine will be revegetated following the completion of mining operations (refer to the Reclamation Plan). Reclamation will be directed toward the restoration of the site primarily for livestock grazing and wildlife habitat.

The wildlife mitigation and monitoring plan for general wildlife and MBHFI (including raptors) is presented in the Mine Plan.

JD-D9.3.1 BIG GAME

The entire project area lies within winter/yearlong pronghorn antelope and mule deer range of the Pumpkin Buttes Herd Units (WGFD 2011a and WGFD 2011b). Direct impacts to big game as a result of project activities will include the disturbance of a portion of winter/yearlong range, loss of forage, increased potential for poaching, vehicular collision accidents, and the displacement of big game into surrounding areas. An estimated 101 acres will be incrementally disturbed during the life of the operation. As a result of these habitat disturbances, the winter/yearlong range carrying capacity for big game will be reduced during the life of the mine and for approximately 1-3 years following mining until vegetative growth on the revegetated areas becomes productive enough to support big game. Since only 60-80 acres will be withdrawn from use as wildlife habitat at any given time, the Jane Dough Unit is not expected to have any adverse impacts on pronghorn antelope or mule deer. Uranerz will also perform interim reclamation operations that will minimize displacement of big game species.

No significant increase in the potential for vehicle collision with big game is expected because of the short distances and low speeds required on the access roads.

The number of employees and the nature and intensity of mining activities will be comparable to those already taking place near this site, and no increase in the potential for poaching and general harassment of big game is anticipated.

JD-D9.3.2 UPLAND GAME BIRDS, SHOREBIRDS, AND WATERFOWL

Limited habitat for shorebirds and waterfowl occur in the project area due to the fact that aquatic habitats on the project area are generally seasonal in nature and higher-quality waterfowl habitat is located outside the project area. Therefore, the Jane Dough Unit is not expected to have any adverse impacts on waterfowl or shorebirds. Greater sage-grouse are discussed in Section JD-D9.3.6.

JD-D9.3.3 MAMMALIAN PREDATORS, LAGAMORPHS, SMALL MAMMALS

The use of the project area by mammalian predators will be temporarily reduced due to mining activities at the Jane Dough Unit. In addition, occasional outbreaks of Tularemia may have an effect on the prey base (i.e., rabbits) for mammalian predators, which may have already resulted in a shift of predators to other areas to seek prey. Therefore, the Jane Dough Unit is not expected to have any adverse long-term impacts on mammalian predators.

Rabbits were abundant within the project area and wildlife study area. Direct impacts to lagomorphs as a result of the project may include vehicular collision accidents, loss of habitat, increased motorized access by the public leading to legal and illegal harvest, and the displacement of lagomorphs into surrounding areas due to human activity and project-related noise. It also appears that natural outbreaks of Tularemia have caused noticeable decrease in the number of rabbits in the area. Since lagomorphs are relatively abundant in the project area, and the fact that they show an affinity to disturbed areas with existing facilities such as culverts and

well pads, the Jane Dough Unit is expected to have a negligible short-term adverse impacts on lagomorph populations and no adverse long-term impacts are likely to occur.

Because suitable habitat exists throughout the project area, some small mammals will be displaced or killed by mining-related activities over the life of the operation. Whenever possible, Uranerz will take steps to minimize disturbance to known small mammal habitat such as black-tailed prairie dog towns; however, some disturbance will be unavoidable. Because of the limited amount of disturbance (101 acres over the life of the operation), the Jane Dough Unit will have negligible short-term and long-term impacts on small mammal populations in the immediate project area.

JD-D9.3.4 RAPTORS AND NONGAME/MIGRATORY BIRDS

In 2012, 79 raptor nests were located within the wildlife study area, of which seven were determined to be active. Of the seven active nests, three were great horned owl nests, two were red-tailed hawk nests, and two were golden eagle. Based on the project area boundary, these trees with nests will not be removed during project activities. The principal impact to these nests from project activities and associated increased human access is potential disturbance during nesting, which could result in nest abandonment and decreased reproductive success. Potential conflicts between active nest sites and project-related activities will be mitigated by annual raptor monitoring and mitigation plans as presented in the Mine Plan.

The temporary disturbance of approximately 101 acres of raptor prey species' habitat is unlikely to result in a reduction in the raptor population in the area because only 60-80 acres will be disturbed at any time. This reduction in raptor foraging habitat will have short-term and negligible impacts on raptor populations in the project area. Therefore, the Jane Dough Unit is not expected to have any adverse long-term impacts on raptor populations.

The short-term disturbance of approximately 101 acres of habitat will likely result in some temporary reduction in the carrying capacity for nongame/migratory birds within the project area. Birds may be displaced by the mining activities and the temporary disturbance of wildlife

habitat; however, the amount of habitat lost will be minimal in relation to the amount of comparable habitats that are available in the general area. Therefore, the Jane Dough Unit is not expected to have any adverse long-term impact on any passerine bird populations.

JD-D9.3.5 REPTILES AND AMPHIBIANS

The mining activities and temporary disturbance may result in some reduction in the population levels of reptile and amphibian species in the area; however, these impacts are expected to be short-term and negligible. Therefore, the Jane Dough Unit is not expected to have any adverse long-term impacts on any reptiles or amphibian populations.

JD-D9.3.6 THREATENED, ENDANGERED, PROPOSED, AND CANDIDATE SPECIES AND SPECIES OF CONCERN

One federally-listed animal species, the greater sage-grouse, a candidate species has the potential to occur in the Jane Dough Unit (Addendum JD-D9-A). Four occupied greater sage-grouse leks occur within 2.0 mile of the Jane Dough Unit (Figure JD-D9-3 see map pocket). All of the leks were inactive in 2012 (Table JD-D9-2). Direct impacts to greater sage-grouse from project activities would include habitat loss and fragmentation from mine, road, pipeline, and power line construction; alteration of plant and animal communities; increased human activity that could cause the birds to avoid an area; increased noise that could cause the birds to avoid an area or reduce breeding efficiency; increased motorized access by the public leading to legal and illegal harvest; direct mortality from increased vehicular traffic; and an increase in mortality from raptors if power poles are placed in occupied greater sage-grouse habitat.

The Proposed Action is not located in a CPA, and therefore would not impact any greater sage-grouse CPAs. The closest CPA is located approximately 16.0 miles west-northwest of the Jane Dough Unit (WSGIT 2010b). There are also no winter concentration areas within or near the proposed project area and there would be no impacts to winter concentration areas for greater sage-grouse. As indicated in Section JD-D9.2.7, there is one lek within the Jane Dough Unit; and there are a total of four "occupied" greater sage-grouse leks within a 2.0-mile radius of the

Hank Unit (Figure JD-D9-3 see map pocket). As a result, the Proposed Action would have no physical impacts to greater sage-grouse leks as the Jane Dough wellfield is approximately 0.5 miles away from the closest occupied lek.

However, it is also possible that noise from construction activities could impact nesting and brood rearing activities of greater sage-grouse and they might avoid using nesting and brood rearing habitat near any occupied lek (Knick and Connelly 2011). Due to the limited amount of greater sage-grouse nesting occurring in the Jane Dough Unit and the appropriate mitigation measures presented in Mine Plan, Uranerz expect impacts to nesting and brood rearing activities to be minimal.

Some greater sage-grouse could be lost due to vehicle collisions (Connelly et. al., 2004). However, due to the low level of traffic within the Jane Dough and the appropriate mitigation measures presented in the Mine Plan, Uranerz does not expect there will be many greater sage-grouse/vehicle collisions.

D9.4.0 REFERENCES

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ADDENDUM JD-D9-A:

DOCUMENTATION OF CONTACT WITH
THE USFWS AND WNDD

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
5353 Yellowstone Road, Suite 308A
Cheyenne, WY 82009

COPY

AUG 0 9 2012

In Reply Refer To:
06E13000/WY12SL0319

8/13/12
JKH ✓
SWK
File # 112362-02.

Jan K. Hart, Senior Project Manager/Biologist
TRC Environmental Corporation
605 Skyline Drive
Laramie, Wyoming 82070

Dear Ms. Hart:

Thank you for your letter of July 24, 2012, received in our office on July 25, regarding the Jane Dough In-Situ Uranium Recovery Project (Project) for Uranerz Energy Corporation. This Project will be located in portions of Sections 19, 20, 21, 27, 28, 29, 30, 31, 32, and 33, Township 43 North, Range 76 West in Campbell and Johnson Counties, Wyoming. The Project includes land administered by the U.S. Bureau of Land Management (BLM).

Pursuant to Wyoming regulations, mining applicants are required to consult with the U.S. Fish and Wildlife Service (Service) prior to submission of the permit application to the Wyoming Department of Environmental Quality (Chapter 2, Regular Noncoal Mine Permit Applications, Section 1(f)). Therefore, we are providing general information that may assist the applicant in preparing their application. Please also note that because the project requires an action (e.g., an approval) from another Federal agency, the Service is required to consult directly with the other Federal agency related to endangered and threatened species, unless that agency formally designates a non-Federal representative (50 CFR 402.08). The BLM will evaluate and consult with the Service as may be appropriate concerning the effects of this project to listed species and other areas of Service responsibility.

You have requested information regarding species listed under the Endangered Species Act of 1973, as amended (Act), 16 U.S.C. 1531 *et seq.* In response to your request, the Service is providing recommendations for protective measures for threatened and endangered species in accordance with the Act. We are also providing recommendations concerning migratory birds in accordance with the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703, and the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668. Wetlands are afforded protection under Executive Orders 11990 (wetland protection) and 11988 (floodplain management), as well as section 404 of the Clean Water Act. Other fish and wildlife resources are considered under the Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 *et seq.*, and the Fish and Wildlife Act of 1956, as amended, 16 U.S.C. 742a-742j.

In your letter, you also request that we address the potential for Migratory Birds of High Federal Interest (MBHFI) to nest within or adjacent to the proposed permit area. The Service does not maintain site-specific information on the nesting locations of the birds on the MBHFI list (copy enclosed). Site-specific nest location information may be available from the Wyoming Game and Fish Department (WGFD), applicable land management agencies, or through species-specific surveys conducted on site. If site-specific information indicates that MBHFI do occur at or in the vicinity (e.g., 1 mile) of the proposed project area, we can provide additional site and species-specific recommendations.

The Service has transitioned to a new online system to deliver species lists: the Information, Planning, and Consultation (IPaC) system. To obtain a current list of endangered, threatened, proposed, and candidate species and their designated and proposed critical habitat that occur within the boundaries of or may be affected by actions associated with your proposed project, please visit our website at http://ecos.fws.gov/ipac/. The system will provide you with an immediate response to your species list request. The response will also include information regarding other Service trust authorities.

In accordance with section 7(c) of the Act, we have determined that the following species or their designated habitat may be present in the proposed project area. We would appreciate receiving information as to the current status of each of these species within the proposed project area.

Endangered, Threatened, Proposed, and Candidate Species
And Their Designated and Proposed Critical Habitat That Occur
In or May Be Affected by Actions in the Proposed Project Area

August 2012

Species	Scientific Name	Status	Habitat
Ute Ladies'-tresses	*Spiranthes diluvialis*	Threatened	Seasonally moist soils and wet meadows of drainages below 7,000 ft. elevation
Greater Sage-grouse	*Centrocercus urophasianus*	Candidate	Sagebrush communities

Ute Ladies'-tresses: Ute ladies'-tresses (*Spiranthes diluvialis*) is a perennial orchid, 8 to 20 inches tall, with white or ivory flowers clustered into a spike arrangement at the top of the stem. Ute ladies'-tresses typically blooms from late July through August. However, it may bloom in early July or still be in flower as late as early October, depending on location and climatic conditions. Ute ladies'-tresses is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges. The elevation range of known occurrences is 4,200 to 7,000 feet (although no known populations in Wyoming occur above 5,500 feet). Soils where Ute ladies'-tresses have been found typically range from fine silt/sand, to gravels and cobbles, as well as to highly organic and peaty soil types. Ute ladies'-tresses is not found in heavy or tight clay soils or in extremely saline or alkaline soils. Ute ladies'-tresses typically occurs in small, scattered groups found primarily in areas where vegetation is relatively open.

Many orchid species take 5 to 10 years to reach reproductive maturity; this appears to be true for Ute ladies'-tresses (FR 57 2048). Furthermore, reproductively mature plants do not flower every year. For these reasons, 2 to 3 years of surveys are necessary to determine presence or absence of Ute ladies'-tresses. Surveys should be conducted by knowledgeable botanists trained in conducting rare plant surveys.

Greater Sage-grouse: The Service has determined that the greater sage-grouse (*Centrocercus urophasianus*) warrants listing under the Act, but the development of a proposed listing rule is precluded by other higher priority listing actions. As a result, the greater sage-grouse has been placed on the list of candidate species. Candidates are reviewed annually to determine if they continue to warrant listing or to reassess their listing priority. Ideally, sufficient threats can be removed to eliminate the need for listing, in which case sage-grouse would no longer be a candidate. If threats are not addressed or the status of the species declines, a candidate species can move up in priority for a listing proposal.

Please see our recent *Federal Register* notice (75 FR 13910; March 23, 2010: available at http://www.fws.gov/wyominges/Pages/Species/Findings/GrtSageGrouse_CandidateBulletin.html) on greater sage-grouse for detailed information concerning the status of the species. Greater sage-grouse are dependent on sagebrush habitats year-round. Habitat loss and degradation, as well as loss of population connectivity have been identified as important factors contributing to the decline of greater sage-grouse populations rangewide. Therefore, any activities that result in loss or degradation of sagebrush habitats that are important to this species should be closely evaluated for their impacts to sage-grouse.

We recommend you contact the Wyoming Game and Fish Department to identify important greater sage-grouse habitats, recommended seasonal restrictions within the project area, and appropriate measures to minimize potential impacts from the proposed project. The Service recommends surveys and mapping of important greater sage-grouse habitats where local information is not available. The results of these surveys should be used in project planning to minimize potential impacts to this species. No project activities that may exacerbate habitat loss or degradation should be permitted in important habitats.

Species of Concern

Black-tailed Prairie Dog: The range of the black-tailed prairie dog (*Cynomys ludovicianus*) once spanned the short and mixed grass prairies of North America east of the Rockies from southern Canada to northern Mexico. This species still occurs over much of its historic range; although, in more widely scattered large colonies. Black-tailed prairie dogs occur within the eastern third of Wyoming. A population thought to have been intentionally introduced outside of this range also occurs in the Bighorn Basin. We encourage the conservation of prairie dog colonies for their value to the prairie ecosystem and the many species that rely on them. Threats that may be significant to conserving black-tailed prairie dog populations include disease (sylvatic plague) and some control programs (poisoning). Prairie dogs serve as the primary prey species for the black-footed ferret (*Mustela nigripes*) and several raptors, including the golden eagle (*Aguila chrysaetos*) and ferruginous hawk (*Buteo regalis*). Prairie dog colonies and burrows also provide shelter or nest sites for species like the mountain plover (*Charadrius montanus*) and burrowing owl (*Athene cunicularia*). Because black-tailed prairie dog colonies in Wyoming do not currently support any ferret populations, black-footed ferret surveys are not

necessary within Wyoming. However, we do encourage evaluating black-tailed prairie dog colonies for the potential reintroduction of black-footed ferrets.

Mountain Plover: On May 12, 2011, the Service announced the decision to withdraw the proposed listing of the mountain plover (*Charadrius montanus*) as a threatened species under the Act (76 FR 27756). The mountain plover is a migratory, terrestrial shorebird averaging 8 inches (21 centimeters) in body length. Mountain plovers are light brown above and white below, but lack the contrasting band characteristic of other plovers. They feed on invertebrates, primarily beetles, crickets, and ants. Mountain plovers arrive at their breeding grounds in the western Great Plains and Rocky Mountain states in the spring. Southbound migration is prolonged, starting in late June and continuing through October.

We encourage project planners to develop and implement protective measures if mountain plovers, or suitable mountain plover habitat, occur within project areas. Measures to protect the mountain plover from further decline may include: (1) avoidance of suitable habitat during the plover nesting season (April 10 through July 10), (2) prohibition of ground disturbing activities in prairie dog towns, and (3) prohibition of any permanent above ground structures that may provide perches for avian predators or deter plovers from using preferred habitat. Suitable habitat for nesting mountain plovers includes grasslands, mixed grassland areas and short-grass prairie, shrub-steppe, plains, alkali flats, agricultural lands, cultivated lands, sod farms, and prairie dog towns.

Migratory Birds: The MBTA, enacted in 1918, prohibits the taking of any migratory birds, their parts, nests, or eggs, except as permitted by regulations, and does not require intent to be proven. Section 703 of the MBTA states, "Unless and except as permitted by regulations ... it shall be unlawful at any time, by any means or in any manner, to ... take, capture, kill, attempt to take, capture, or kill, or possess ... any migratory bird, any part, nest, or eggs of any such bird..." The BGEPA prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing. Work that could lead to the take of a migratory bird or eagle, their young, eggs, or nests (for example, if you are going to erect new roads, or power lines in the vicinity of a nest), should be coordinated with our office before any actions are taken.

Removal or destruction of such nests, or causing abandonment of a nest could constitute violation of one or both of the above statutes. Removal of any active migratory bird nest or nest tree is prohibited. For golden eagles, inactive nest permits are limited to activities involving resource extraction or human health and safety. Mitigation, as determined by the local Service field office, may be required for loss of these nests. No permits will be issued for an active nest of any migratory bird species, unless removal of an active nest is necessary for reasons of human health and safety. Therefore, if nesting migratory birds are present on, or near the project area, timing is a significant consideration and needs to be addressed in project planning.

If nest manipulation is proposed for this project, the project proponent should contact the Service's Migratory Bird Office in Denver at 303-236-8171 to see if a permit can be issued for this project. No nest manipulation is allowed without a permit. If a permit cannot be issued, the project may need to be modified to ensure take of a migratory bird or eagle, their young, eggs or nest will not occur.

The Service's Wyoming Field Office has compiled a list of Migratory Bird Species of High Federal Interest (Enclosure) from the ongoing work among State and Federal agencies, non-governmental organizations, and the interested public that produced the Wyoming Bird Conservation Plan. This list will now serve as our list of Migratory Bird Species of Management Concern in Wyoming, in place of the previous list based on the Migratory Nongame Birds of Management Concern in the United States: the 1995 List.

Eagle/Raptor: Enclosed please find our general recommendations for the protection of eagles and other raptor species. We strongly encourage project proponents to fully implement the protective measures described in the enclosures in order to help ensure compliance with the MBTA and the BGEPA. We are also available to assist you in developing a project specific plan to address the MBTA and BGEPA concerns.

Wetlands/Riparian Areas: Wetlands or riparian areas may be impacted by the proposed project. Wetlands perform significant ecological functions which include: (1) providing habitat for numerous aquatic and terrestrial wildlife species, (2) aiding in the dispersal of floods, (3) improving water quality through retention and assimilation of pollutants from storm water runoff, and (4) recharging the aquifer. Wetlands also possess aesthetic and recreational values. If wetlands may be destroyed or degraded by the proposed action, those wetlands in the project area should be inventoried and fully described in terms of their functions and values. Acreage of wetlands, by type, should be disclosed and specific actions should be outlined to avoid, minimize, and compensate for all unavoidable wetland impacts.

Riparian or streamside areas are a valuable natural resource and impacts to these areas should be avoided whenever possible. Riparian areas are the single most productive wildlife habitat type in North America. They support a greater variety of wildlife than any other habitat. Riparian vegetation plays an important role in protecting streams, reducing erosion and sedimentation as well as improving water quality, maintaining the water table, controlling flooding, and providing shade and cover. In view of their importance and relative scarcity, impacts to riparian areas should be avoided. Any potential, unavoidable encroachment into these areas should be further avoided and minimized. Unavoidable impacts to streams should be assessed in terms of their functions and values, linear feet and vegetation type lost, potential effects on wildlife, and potential effects on bank stability and water quality. Measures to compensate for unavoidable losses of riparian areas should be developed and implemented as part of the project.

Plans for mitigating unavoidable impacts to wetland and riparian areas should include mitigation goals and objectives, methodologies, time frames for implementation, success criteria, and monitoring to determine if the mitigation is successful. The mitigation plan should also include a contingency plan to be implemented should the mitigation not be successful. In addition, wetland restoration, creation, enhancement, and/or preservation does not compensate for loss of stream habitat; streams and wetlands have different functions and provide different habitat values for fish and wildlife resources.

Best Management Practices (BMPs) should be implemented within the project area wherever possible. BMPs include, but are not limited to, the following: installation of sediment and erosion control devices (*e.g.*, silt fences, hay bales, temporary sediment control basins, erosion control matting); adequate and continued maintenance of sediment and erosion control devices to insure their effectiveness; minimization of the construction disturbance area to further avoid streams, wetlands, and riparian areas; location of equipment staging, fueling, and maintenance

areas outside of wetlands, streams, riparian areas, and floodplains; and re-seeding and re-planting of riparian vegetation native to Wyoming in order to stabilize shorelines and streambanks.

In-Situ Uranium Mining: High selenium concentrations can occur in wastewater from in-situ mining of uranium ore as uranium-bearing formations are usually associated with seleniferous strata (Boon 1989). Boon (1989) reported that uranium deposits in Converse County, Wyoming can contain up to 4,500 µg/g (ppm) of selenium. In-situ mining of uranium is done by injecting a leaching solution of native ground water containing dissolved oxygen and carbon dioxide into the uranium-bearing formation through injection wells. The leaching solution dissolves selenium present in the formation. The disposal of this wastewater can expose migratory birds to selenium, which is known to cause impaired reproduction and mortality in sensitive species of birds such as waterfowl.

The in-situ mining wastewater is typically disposed of through deep-well injection or discharge into large evaporation ponds. One mining operation in Converse County disposes of the wastewater through land application using center-pivot irrigation after treatment for removal of uranium and radium. In 1998 the Service conducted a study of grassland irrigated with wastewater from an in-situ uranium mine and found that selenium was mobilized into the food chain and bioaccumulated by grasshoppers and songbirds (Ramirez and Rogers 2002). Disposal of the in-situ wastewater through irrigation is not recommended by the Service due to the potential for selenium bioaccumulation in the food chain and adverse effects to migratory birds. Additionally, land application may result in the contamination of groundwater and eventually seep out and reach surface waters. Furthermore, the selenium-contaminated groundwater could seep into low areas or basins in upland sites and create wetlands, which would attract migratory birds and other wildlife.

The Service is also concerned with the potential for elevated selenium in evaporation ponds receiving in-situ wastewater. Waterborne selenium concentrations ≥ 2 µg/L are considered hazardous to the health and long-term survival of fish and wildlife (Lemly 1996). Additionally, water with more than 20 µg/L (ppm) is considered hazardous to aquatic birds (Skorupa and Ohlendorf 1991). Chronic effects of selenium manifest themselves in immune suppression to birds (Fairbrother et al. 1994), which can make affected birds more susceptible to disease and predation. Selenium toxicity will also cause embryonic deformities and mortality (See et al. 1992; Skorupa and Ohlendorf 1991; Ohlendorf 2002)

If submerged aquatic vegetation and/or aquatic invertebrates are present in evaporation ponds with high waterborne selenium concentrations, extremely high dietary levels of this contaminant can be available to aquatic migratory birds. Ramirez and Rogers (2000) documented selenium concentrations ranging from 434 to 508 µg/g in pondweed (*Potamogeton vaginatus*) collected from a uranium mine wastewater storage reservoir that had waterborne selenium concentrations ranging from 260 to 350 µg/L.

The potential for selenium and other contaminants to impact migratory birds should be assessed if the proposed facility will use ponds to store or dispose of the wastewater or if the wastewater will be disposed of in such a manner as to potentially expose migratory birds or other wildlife to contaminants. Accidental releases/spills of uranium in-situ production water can result in the ponding or pooling of this production water, which could be ingested by wildlife, including

migratory birds thus exposing them to uranium, radionuclides, and selenium. Spills or releases of production water could also reach surface waters, which could impact aquatic organisms inhabiting the affected waters.

The following safeguards or management actions should be incorporated into the permit to prevent or minimize the adverse impacts from contaminants to our trust resources:

- Leak detection systems should be installed in all injection wells and production wells to enable operators to immediately respond to releases of injection or production water onto the environment.
- A spill contingency plan should be prepared for the project area.
- Land application of in-situ wastewater through irrigation or other disposal methods should not be allowed if this disposal option presents a risk for selenium bioaccumulation in the food chain and adverse effects to migratory birds, and a risk for soil, surface water and ground water contamination.
- Annual monitoring of wastewater evaporation ponds should be conducted to determine waterborne selenium concentrations and to determine if submerged aquatic vegetation and/or aquatic invertebrates are present and provide a pathway for selenium bioaccumulation by birds using the evaporation ponds. If submerged aquatic vegetation and/or aquatic invertebrates are present and waterborne selenium is > 2 µg/L, please contact our office for further guidance.

For our internal tracking purposes, the Service would appreciate notification of any decision made on this project (such as issuance of a permit or signing of a Record of Decision or Decision Memo). Notification can be sent in writing to the letterhead address or by electronic mail to FW6_Federal_Activities_Cheyenne@fws.gov.

We appreciate your efforts to ensure the conservation of endangered, threatened, and candidate species and migratory birds. If you have questions regarding this letter or your responsibilities under the Act and/or other authorities or resources described above, please contact Genevieve Skora of my office at the letterhead address or phone (307) 772-2374, extension 225.

Sincerely,

for R. Mark Sattelberg
Field Supervisor
Wyoming Field Office

Enclosures (2)

cc: BLM, Endangered Species Program Lead, Cheyenne, WY (C. Keefe) (e-mail)
WDEQ-LQD, District 3 Supervisor, Sheridan, WY (M. Rogaczewski)
WGFD, Non-game Coordinator, Lander, WY (B. Oakleaf)
WGFD, Statewide Habitat Protection Coordinator, Cheyenne, WY (M. Flanderka)

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Migratory Bird Species of Management Concern in Wyoming
(Migratory Birds of High Federal Interest)
Based on the *Wyoming Bird Conservation Plan* (Cerovski et al. 2000)

May 2, 2002

U.S. Fish and Wildlife Service, Wyoming Field Office,
5353 Yellowstone Road - Suite 308A, Cheyenne, Wyoming 82009

The Wyoming Field Office of the U.S. Fish and Wildlife Service (Service) has compiled the following list from the ongoing work among State and Federal agencies, non-governmental organizations, and the interested public that produced the Wyoming Bird Conservation Plan. This list will now serve as our list of Migratory Bird Species of Management Concern in Wyoming, in place of the previous list based on the Migratory Nongame Birds of Management Concern in the United States: the 1995 List. The Wyoming Bird Conservation Plan identified priority species based on a number of criteria (see below) using the best information available for these generally un-studied species. In many cases, this list reflects identified threats to habitat because no information is available on the species population trends. In some cases it reflects identified population declines though no causal factors have been identified.

The following tables and explanatory text are taken directly from the Wyoming Bird Conservation Plan (Cerovski et al. 2000). For more information on this listing process, this report is available from our Wyoming Field Office, 5353 Yellowstone Road, Suite 308A, Cheyenne, Wyoming 82009; or Wyoming Game and Fish Department (WGFD), Nongame Branch, 260 Buena Vista, Lander, Wyoming 82520.

Table 1. **Level I Species (Conservation Action).** Species clearly needs conservation action. Includes species of which Wyoming has a high percentage of and responsibility for the breeding population, and the need for additional knowledge through monitoring and research into basic natural history, distribution, etc.

Species	PIF Score[a]	AI[b]	PT[c]	Primary Habitat Type(s)
Mountain Plover[d]	28	4	3	Shortgrass Prairie, Shrub-steppe
Trumpeter Swan	26	3	3	Wetlands
Sage Grouse	26	5	3	Shrub-steppe
McCown's Longspur	26	3	2	Shortgrass Prairie, Shrub-steppe
Baird's Sparrow	26	2	3	Shortgrass Prairie
Ferruginous Hawk	23	4	3	Shrub-steppe, Shortgrass Prairie
Brewer's Sparrow	23	5	5	Shrub-steppe, Mountain-foothills Shrub
Wilson's Phalarope	22	3	5	Wetlands
Franklin's Gull	22	3	3	Wetlands
Sage Sparrow	22	5	2	Shrub-steppe, Mountain-foothills Shrub

Table 1. **Level I Species (Conservation Action)**, continued.

Species	PIF Score[a]	AI[b]	PT[c]	Primary Habitat Type(s)
Swainson's Hawk	21	3	3	Plains/Basin Riparian
Long-billed Curlew	21	2	3	Shortgrass Prairie
Short-eared Owl	20	3	3	Shortgrass Prairie
Northern Goshawk	19	4	3	High Elevation Conifer, Mid Elevation Conifer, Aspen
Peregrine Falcon	19	3	3	Specialized (cliffs)
Burrowing Owl	19	3	4	Shortgrass Prairie
Forster's Tern	19	2	3	Wetlands
Bald Eagle	18	3	3	Montane Riparian, Plains/Basin Riparian
Upland Sandpiper	18	2	2	Shortgrass Prairie
Black Tern	18	3	3	Wetlands
Whooping Crane	n/a	n/a	n/a	Wetlands
Piping Plover	n/a	n/a	n/a	Wetlands, Aquatic

[a] From the PIF Priority Database (Carter et al. 1997).
[b] AI ' Area Importance (from the PIF Priority Database, Carter et al. 1997).
[c] PT ' Population Trend (from the PIF Priority Database, Carter et al. 1997).
[d] Species in all capital letters previously appeared on the Service's 1995 list.

Table 2. **Level II Species (Monitoring).** The action and focus for the species is monitoring. Includes species of which Wyoming has a high percentage of and responsibility for the breeding population, species whose population trend is unknown, species that are peripheral for breeding in the habitat or state, or species for which additional knowledge is needed.

Species	PIF Score[a]	AI[b]	PT[c]	Primary Habitat Type(s)
Calliope Hummingbird	23	5	3	Mid Elevation Conifer, Montane Riparian
Lewis' Woodpecker	23	3	3	Low Elevation Conifer, Plains/Basin Riparian
Cassin's Kingbird	22	3	3	Juniper Woodland, Plains/Basin Riparian
Lark Bunting	22	4	4	Shortgrass Prairie, Shrub-steppe
American White Pelican	21	3	3	Aquatic
Williamson's Sapsucker	21	3	3	Mid Elevation Conifer
Black-backed Woodpecker	21	3	3	Mid Elevation Conifer, High Elevation Conifer
Gray Flycatcher	21	3	3	Juniper Woodland, Mountain-foothills Shrub
Juniper Titmouse [d]	21	3	3	Juniper Woodland
Dickcissel	21	3	3	Shortgrass Prairie
Chestnut-collared Longspur	21	2	3	Shortgrass Prairie
Harlequin Duck	20	3	3	Montane Riparian
Snowy Plover	20	3	3	Wetlands
Black-chinned Hummingbird	20	2	3	Plains/Basin Riparian, Shrub-steppe
Rufous Hummingbird	20	2	3	Mid Elevation Conifer
Red-naped Sapsucker	20	3	2	Aspen
Three-toed Woodpecker	20	4	3	Mid Elevation Conifer, High Elevation Conifer
Willow Flycatcher	20	3	4	Montane Riparian, Plains/Basin Riparian
Hammond's Flycatcher	20	2	3	High Elevation Conifer with Aspen, Montane Riparian
Cordilleran Flycatcher	20	3	3	Montane Riparian, Mid Elevation Conifer
Pygmy Nuthatch	20	3	3	Low Elevation Conifer
Marsh Wren	20	3	4	Wetlands
American Dipper	20	3	3	Montane Riparian
Plumbeous Vireo	20	3	3	Mid Elevation Conifer, Low Elevation Conifer
Townsend's Warbler	20	3	3	High Elevation Conifer, Mid Elevation Conifer
Dusky Flycatcher	19	3	2	Low Elevation Conifer, Aspen, Mountain-foothills Shrub

Table 2. **Level II Species (Monitoring)**, continued.

Species	PIF Score[a]	AI[b]	PT[c]	Primary Habitat Type(s)
Western Bluebird	19	3	3	Juniper Woodland, Low Elevation Conifer
Sage Thrasher	19	5	2	Shrub-steppe
Grasshopper Sparrow	19	3	5	Shortgrass Prairie, Shrub-steppe
Bobolink	19	2	3	Shortgrass Prairie, Shrub-steppe
Common Loon	18	3	3	Wetlands
Black-billed Cuckoo	18	2	3	Plains/Basin Riparian
Red-headed Woodpecker	18	2	3	Plains/Basin Riparian, Low Elevation Conifer
Yellow-billed Cuckoo	18	3	3	Plains/Basin Riparian
Eastern Screech-Owl	18	3	3	Plains/Basin Riparian
Western Screech-Owl	18	3	3	Plains/Basin Riparian
Great Gray Owl	18	3	3	Mid Elevation Conifer, High Elevation Conifer
Boreal Owl	18	3	3	High Elevation Conifer
Broad-tailed Hummingbird	18	2	2	Montane Riparian, Plains/Basin Riparian, Mid Elevation Conifer
Western Scrub-Jay[d]	18	3	3	Juniper Woodland
Loggerhead Shrike	18	3	3	Shrub-steppe
Vesper Sparrow	18	5	4	Shrub-steppe
Lark Sparrow	18	3	4	Shrub-steppe
Golden-crowned Kinglet	17	3	3	High Elevation Conifer
MacGillivray's Warbler	17	3	1	Montane Riparian, Plains/Basin Riparian
Ash-throated Flycatcher[d]	16	2	3	Juniper Woodland
Bushtit[d]	16	3	3	Juniper Woodland
Brown Creeper	16	3	3	Mid Elevation Conifer, High Elevation Conifer
Merlin	15	3	3	Low Elevation Conifer
Sprague's Pipit	n/a	n/a	n/a	Grassland, Plains/Basin Riparian, Shortgrass Prairie
Barn Owl	n/a	n/a	n/a	Shortgrass Prairie, Urban
White-faced Ibis	n/a	n/a	n/a	Wetlands, Aquatic
American Bittern	n/a	n/a	n/a	Wetlands, Aquatic
Common Tern	n/a	n/a	n/a	Wetlands, Aquatic
Purple Martin	n/a	n/a	n/a	Wetlands, Aquatic/Basin Riparian, Montane Riparian

[a] From the PIF Priority Database (Carter et al. 1997).
[b] AI ' Area Importance (from the PIF Priority Database).
[c] PT ' Population Trend (from the PIF Priority Database).
[d] Nicholoff, S. 2002. Wyoming Bird Conservation Plan, Version 1.1. Wyoming Partners In Flight and Wyoming Game and Fish Department, Lander. In press.

Wyoming Partners In Flight Process for Prioritizing Species

Wyoming Partners In Flight participants developed the current list of priority species based on a combination of the seven criteria in the national Partners In Flight Priority Database (Carter et al. 1997). This database serves as a defensible method of prioritizing both species and habitats in need of conservation. The criteria include Wyoming-dependent and Wyoming-independent factors. The Wyoming-independent criteria are constant over a species' range and do not vary for each species. The Wyoming-dependent criteria were the key components used to prioritize species and their conservation action needs. In the absence of any more rigorous statewide surveys, Breeding Bird Survey data dating back to 1968 were used to determine population trends in Wyoming.

Criteria

Within each criterion below, a species was given a rank score ranging from 1 to 5, with 1 being the least critical rank and 5 the most critical. Each ranked species could potentially receive a low score of 7 and a high score of 35. However, setting conservation goals based only on total score could be misleading; therefore, each total score was reviewed in conjunction with its component parts. In Wyoming, species were initially ranked using total score, area importance, and population trend.

1. Relative Abundance (RA) - The abundance of a bird, in appropriate habitat within its entire range, relative to other bird species. This criterion gives an indication of a species' vulnerability to withstand cataclysmic environmental changes. A low score would indicate a higher relative abundance, therefore reducing the risk of complete extirpation from losses in one or more regions. Higher scores indicate a lower relative abundance, thus more vulnerability to drastic losses or population changes.

2. Breeding Distribution (BD) - A relative measure of breeding range size as a proportion of North America (defined as the main body of the continent, excluding Greenland, through Panama and the islands of the Caribbean, comprising an area of 22,059,680 km^2 [National Geographic Society 1993]), and as such it provides an index of a species' vulnerability to random environmental events. High scores indicate localized breeding, thus a higher likelihood of serious decline from drastic environmental changes. Low scores indicate wide breeding distribution, therefore less likelihood of extirpation. Used for breeding birds only.

3. Non-breeding Distribution (ND) - A relative measure of non-breeding, or winter, range size as a proportion of North America, and as such it provides an index of a species' vulnerability to random environmental events. High scores indicate localized distribution on the non-breeding grounds. Low scores indicate wide distribution on the non-breeding grounds, therefore less likelihood of extirpation. Used for wintering birds only.

4. Threats on Breeding Grounds (TB) - The ability of a habitat in an area to support populations of a species in that area. Two factors are considered here: 1) each species' demographic and ecological vulnerability (the potential inability of a species to recover from population loss by normal reproductive effort due to low reproductive rate, high juvenile mortality, or both; and the level of ecological specialization of a species and, hence, its potential

inability to withstand environmental change), and 2) habitat loss or disruption (a combination of the amount of habitat or conditions necessary for survival and reproductive success that has been lost since 1945, and the amount that is anticipated to be lost in the future). High scores indicate either a large loss of habitat or a species that is an extreme ecological specialist. Low scores indicate a stable or increasing habitat or a species that is an ecological generalist. Used for both breeding and wintering birds.

5. Threats on Non-breeding Grounds (TN) - Range-wide threats on non-breeding, or winter, grounds. This is scored using the same criteria as threats on breeding grounds but reflects non-breeding issues, including migratory habitat. Used for wintering birds only.

6. Population Trend (PT) - The overall population trend of each species assigned independently for each state, province, or physiographic area. This criterion must meet two thresholds, reliability and magnitude, to warrant either a very high or very low score. When possible, a score was assigned using BBS data, which incorporated a population trend uncertainty score based on the statistical validity of the BBS data (i.e. a species must be detected on a minimum of 14 BBS routes per state for population trends to have statistical significance). This criterion was chosen to alert managers to species with modest, but certain, population declines.

7. Area Importance (AI) - The abundance of a species within a state, province, or physiographic area relative to its abundance throughout its range. This criterion helps direct conservation efforts toward areas that are most important to a species' survival. Area Importance is scored locally; therefore, high scores indicate that a large proportion of the species' breeding or winter range occurs in Wyoming, or a species is using a habitat that is only available in Wyoming. Low scores indicate that a small proportion of the species' range occurs in Wyoming, or the preferred habitat is widespread across its range. Used for both breeding and wintering birds.

Priority Species

Priority bird species in Wyoming were identified from the PIF Priority Database (Carter et al. 1997) and by qualitative, informed decisions. Those species with a total score of 18 or above, Area Importance (AI) of 3 or above, and/or Population Trend (PT) of 3 or above from the database, or with a total score less than 18 but of significant local interest were identified as the highest priority species. However, as more information becomes available, the highest priority species for Wyoming may change, as this is a dynamic database that allows for updated information to be periodically inserted and reviewed. The primary habitat type or types required for breeding were identified for each species to determine the highest priority habitat types for the state.

Literature Cited

Carter, M. F., W. C. Hunter, D. N. Pashley, J. S. Bradley, C. S. Aid, J. Price, and G. S. Butcher. 1997. Setting landbird conservation priorities for states, provinces, and physiographic areas of North America. Partners In Flight Priority Database Final Report, Colorado Bird Observatory, Brighton.

Cerovski, A., M. Gorges, T. Byer, K. Duffy, and D. Felley. 2000. Wyoming Bird Conservation Plan, Version 1.0. Wyoming Partners In Flight, Lander, WY.

Nicholoff, S. 2002. Wyoming Bird Conservation Plan, Version 1.1. Wyoming Partners In Flight and Wyoming Game and Fish Department, Lander. In press.

U.S. Fish and Wildlife Service, Wyoming Ecological Services Field Office

Protections for Raptors

Raptors, or birds of prey, and the majority of other birds in the United States are protected by the Migratory Bird Treaty Act, 16 U.S.C. 703 (MBTA). A complete list of migratory bird species can be found in the Code of Federal Regulations at 50 CFR 10.13. Eagles are also protected by the Bald and Golden Eagle Protection Act, 16 U.S.C. 668 (Eagle Act).

The MBTA protects migratory birds, eggs and nests from possession, sale, purchase, barter, transport, import, export, and take. The regulatory definition of take, defined in 50 CFR 10.12, means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to hunt, shoot, wound, kill, trap, capture, or collect a migratory bird. Activities that result in the unpermitted take (e.g., result in death, possession, collection, or wounding) of migratory birds or their eggs are illegal and fully prosecutable under the MBTA. Removal or destruction of active nests (i.e., nests that contain eggs or young), or causing abandonment of an active nest, could constitute a violation of the MBTA, the Eagle Act, or both statutes. Removal of any active migratory bird nest or any structure that contains an active nest (e.g., tree) where such removal results in take is prohibited. Therefore, if nesting migratory birds are present on or near a project area, project timing is an important consideration during project planning. As discussed below, the Eagle Act provides additional protections for bald and golden eagles and their nests. For additional information concerning nests and protections under the MBTA, please see the U.S. Fish and Wildlife Service's (Service) Migratory Bird Permit Memorandum, MBMP-2.

The Service's Wyoming Ecological Services Field Office works to raise public awareness about the possible occurrence of birds in proposed project areas and the risk of violating the MBTA, while also providing guidance to minimize the likelihood that take will occur. We encourage you to coordinate with our office before conducting actions that could lead to the take of a migratory bird, their young, eggs, or active nests (e.g., construction or other activity in the vicinity of a nest that could result in a take). If nest manipulation is proposed for a project in Wyoming, the project proponent should also contact the Service's Migratory Bird Office in Denver at 303-236-8171 to see if a permit can be issued. Permits generally are not issued for an active nest of any migratory bird species, unless removal of the nest is necessary for human health and safety. If a permit cannot be issued, the project may need to be modified to ensure take of migratory birds, their young or eggs will not occur.

For infrastructure (or facilities) that have potential to cause direct avian mortality (e.g., wind turbines, guyed towers, airports, wastewater disposal facilities, transmission lines), we recommend locating structures away from high avian-use areas such as those used for nesting, foraging, roosting or migrating, and the travel zones between high-use areas. If the wildlife survey data available for the proposed project area and vicinity do not provide the detail needed to identify normal bird habitat use and movements, we recommend collecting that information prior to determining locations for any infrastructure that may create an increased potential for avian mortalities. We also recommend contacting the Service's Wyoming Ecological Services office for project-specific recommendations.

Additional Protections for Eagles

The Eagle Act protections include provisions not included in the MBTA, such as the protection of unoccupied nests and a prohibition on disturbing eagles. Specifically, the Eagle Act prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagle or their body parts, nests, chicks or eggs, which includes collection, possession, molestation, disturbance, or killing. The term "disturb" is defined as "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" (50 CFR 22.3 and see also 72 FR 31132).

The Eagle Act includes limited exceptions to its prohibitions through a permitting process. The Service has issued regulations concerning the permit procedures for exceptions to the Eagle Act's prohibitions (74 FR 46836), including permits to take golden eagle nests which interfere with resource development or recovery operations (50 CFR 22.25). The regulations identify the conditions under which a permit may be issued (i.e., status of eagles, need for action), application requirements, and other issues (e.g., mitigation, monitoring) necessary in order for a permit to be issued.

For additional recommendations specific to Bald Eagles please see our Bald Eagle information web page (http://www.fws.gov/wyominges/Pages/Species/Species_SpeciesConcern/BaldEagle.html).

Recommended Steps for Addressing Raptors in Project Planning

Using the following steps in early project planning, agencies and proponents can more easily minimize impacts to raptors, streamline planning and permitting processes, and incorporate measures into an adaptive management program:

1. Coordinate with appropriate Service offices, Wyoming Game and Fish Department, Tribal governments, and land-management agencies at the earliest stage of project planning.
2. Identify species and distribution of raptors occurring within the project area by searching existing data sources (e.g., Wyoming Game and Fish Department, Federal land-management agencies) and by conducting on-site surveys.
3. Plan and schedule short-term and long-term project disturbances and human-related activities to avoid raptor nesting and roosting areas, particularly during crucial breeding and wintering periods
4. Determine location and distribution of important raptor habitat, nests, roost sites, migration zones and, if feasible, available prey base in the project impact area.
5. Document the type, extent, timing, and duration of raptor activity in important use areas to establish a baseline of raptor activity.
6. Ascertain the type, extent, timing, and duration of development or human activities proposed to occur, and the extent to which this differs from baseline conditions.
7. Consider cumulative effects to raptors from proposed projects when added to past, present, and reasonably foreseeable actions. Ensure that project mitigation adequately addresses cumulative effects to raptors.
8. Minimize loss of raptor habitats and avoid long-term habitat degradation. Mitigate for unavoidable losses of high-valued raptor habitats, including (but not limited to) nesting, roosting, migration, and foraging areas.
9. Monitor and document the status of raptor populations and, if feasible, their prey base post project completion, and evaluate the success of mitigation efforts.
10. Document meaningful data and evaluations in a format that can be readily shared and incorporated into wildlife databases (contact the Service's Wyoming Ecological Services office for details).

Protection of nesting, wintering (including communal roost sites), and foraging activities is considered essential to conserving raptors. In order to promote the conservation of migratory bird populations and their habitats, Federal agencies should implement those strategies directed by Executive Order 13186, "Responsibilities of Federal Agencies To Protect Migratory Birds" (66 FR 3853).

Recommended Seasonal and Spatial Buffers to Protect Nesting Raptors

Because many raptors are particularly sensitive to disturbance (that may result in take) during the breeding season, we recommend implementing spatial and seasonal buffer zones to protect individual nest sites/territories (Table 1). The buffers serve to minimize visual and auditory impacts associated with human activities near nest sites. Ideally, buffers would be large enough to protect existing nest trees and provide for alternative or

eplacement nest trees. The size and shape of effective buffers vary depending on the topography and other ecological characteristics surrounding the nest site. In open areas where there is little or no forested or topographical separation, distance alone must serve as the buffer. Adequate nesting buffers will help ensure activities do not take breeding birds, their young or eggs. For optimal conservation benefit, we recommend that no temporary or permanent surface occupancy occur within species-specific spatial buffer zones. For some activities with very substantial auditory impacts (e.g., seismic exploration and blasting) or visual impacts (e.g., tall drilling rig), a larger buffer than listed in Table 1 may be necessary, please contact the Service's Wyoming Ecological Services office for project specific recommendations on adequate buffers.

As discussed above, for infrastructure that may create an increased potential for raptor mortalities, the spatial buffers listed in Table 1 may not be sufficient to reduce the incidence of raptor mortalities (for example, if a wind turbine is placed outside a nest disturbance buffer, but inadvertently still within areas of normal daily or migratory bird movements); therefore, please contact the Service's Wyoming Ecological Services office for project specific recommendations on adequate buffers.

Buffer recommendations may be modified on a site-specific or project-specific basis based on field observations and local conditions. The sensitivity of raptors to disturbance may be dependent on local topography, density of vegetation, and intensity of activities. Additionally, individual birds may be habituated to varying levels of disturbance and human-induced impacts. Modification of protective buffer recommendations may be considered where biologically supported and developed in coordination with the Service's Wyoming Ecological Services Field Office.

Because raptor nests are often initially not identified to species (e.g., preliminary aerial surveys in winter), we first recommend a generic raptor nest seasonal buffer guideline of January 15th – August 15th. Similarly, for spatial nesting buffers, until the nesting species has been confirmed, we recommend applying a 1-mile spatial buffer around the nest. Once the raptor species is confirmed, we then make species-specific and site-specific recommendations on seasonal and spatial buffers (Table 1).

Activities should not occur within the spatial/seasonal buffer of any nest (occupied or unoccupied) when raptors are in the process of courtship and nest site selection. Long-term land-use activities and human-use activities should not occur within the species-specific spatial buffer of occupied nests. Short-term land use and human-use activities proposed to occur within the spatial buffer of an occupied nest should only proceed during the seasonal buffer after coordination with the Service, State, and Tribal wildlife resources management agencies, and/or land-management agency biologists. If, after coordination, it is determined that due to human or environmental safety or otherwise unavoidable factors, activities require temporary incursions within the spatial and seasonal buffers, those activities should be planned to minimize impacts and monitored to determine whether impacts to birds occurred. Mitigation for habitat loss or degradation should be identified and planned in coordination with applicable agencies.

Please contact the Service's Wyoming Ecological Services Field Office if you have any questions regarding the status of the bald eagle, permit requirements, or if you require technical assistance regarding the MBTA, Eagle Act, or the above recommendations. The recommended spatial and seasonal buffers are voluntary (unless made a condition of permit or license) and are not regulatory, and they do not supersede provisions of the MBTA, Eagle Act, Migratory Bird Permit Memorandum (MBMP-2), and Endangered Species Act. Assessing legal compliance with the MBTA or the Eagle Act and the implementing regulations is ultimately the authority and responsibility of the Service's law enforcement personnel. Our recommendations also do not supersede Federal, State, local, or Tribal regulations or permit conditions that may be more restrictive.

Table 1. Service's Wyoming Ecological Services Field Office's Recommended Spatial and Seasonal Buffers for Breeding Raptors

Raptors of Conservation Concern (see below for more information)

Common Name	Spatial buffer (miles)	Seasonal buffer
Golden Eagle	0.50	January 15 - July 31
Ferruginous Hawk	1.00	March 15 - July 31
Swainson's Hawk	0.25	April 1 - August 31
Bald Eagle	see Bald Eagle information web page[1]	
Prairie Falcon	0.50	March 1 - August 15
Peregrine Falcon	0.50	March 1 - August 15
Short-eared Owl	0.25	March15- August 1
Burrowing Owl	0.25	April 1 – September 15
Northern Goshawk	0.50	April 1 - August 15

Additional Wyoming Raptors

Common Name	Spatial buffer (miles)	Seasonal buffer
Osprey	0.25	April 1 - August 31
Cooper's Hawk	0.25	March 15 – August 31
Sharp-shinned Hawk	0.25	March 15 – August 31
Red-tailed Hawk	0.25	February 1 – August 15
Rough-legged Hawk (winter resident only)	----	----
Northern Harrier	0.25	April 1 - August 15
Merlin	0.50	April 1 - August 15
American Kestrel	0.125	April 1 – August 15
Common Barn Owl	0.125	February 1 – September 15
Northern Saw-whet Owl	0.25	March 1 - August 31
Boreal Owl	0.25	February 1 – July 31
Long-eared Owl	0.25	February 1 – August 15
Great Horned Owl	0.125	December 1 – September 30
Northern Pygmy-Owl	0.25	April 1 – August 1
Eastern Screech -owl	0.125	March 1 – August 15
Western Screech-owl	0.125	March 1 – August 15
Great Gray Owl	0.25	March 15 – August 31

[1] http://www.fws.gov/wyominges/Pages/Species/Species_SpeciesConcern/BaldEagle.html

Raptors of Conservation Concern

The Service's Birds of Conservation Concern (2008) report identifies "species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing" under the Endangered Species Act (16 U.S.C 1531 et seq.). This report is intended to stimulate coordinated and proactive conservation actions among Federal, State, and private partners. The Wyoming Partners in Flight Wyoming Bird Conservation Plan identifies priority bird species and habitats, and establishes objectives for bird populations and habitats in Wyoming. This plan also recommends conservation actions to accomplish the population and habitat objectives.

We encourage project planners to develop and implement protective measures for the Birds of Conservation Concern as well as other high-priority species identified in the Wyoming Bird Conservation Plan. For

Additional information on the Birds of Conservation Concern that occur in Wyoming, please see our Birds of Conservation Concern web page.

Additional Planning Resources

Avian Power Line Interaction Committee (APLIC). 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, CA.

Edison Electric Institute and the Raptor Research Foundation. 1996. Suggested Practices for Raptor Protection on Power Lines - The State of the Art in 1996. Washington, D.C.

Edison Electric Institute's Avian Power Line Interaction Committee and U.S. Fish and Wildlife Service. 2005. Avian Protection Plan Guidelines.

Edison Electric Institute and the Raptor Research Foundation. 1994. Mitigating Bird Collisions with Power Lines - The State of the Art in 1994. Washington, D.C.

U.S. Fish and Wildlife Service. 2000. Siting, Construction, Operation and Decommissioning of Communications Towers and Tower Site Evaluation Form (Directors Memorandum September 14, 2000), Arlington, Virginia.

U.S. Fish and Wildlife Service. 2007. National Bald Eagle Management Guidelines. United States Department of Interior, Fish and Wildlife Service, Arlington, Virginia. 23 pp.

Wyoming Game and Fish Department Internet Link to Raptor Information

References

50 CFR 10.12 – Code of Federal Regulations. Title 50--Wildlife and Fisheries, Chapter I--United States Fish and Wildlife Service, Department of the Interior, Part 10--General Provisions.

50 CFR 10.13– Code of Federal Regulations. Title 50--Wildlife and Fisheries, Chapter I--United States Fish and Wildlife Service, Department of the Interior, Part 10--General Provisions.

50 CFR 22.3 – Code of Federal Regulations. Title 50--Wildlife and Fisheries, Chapter I--United States Fish and Wildlife Service, Department of the Interior, Part 22—Eagle Permits.

50 CFR 22.25– Code of Federal Regulations. Title 50--Wildlife and Fisheries, Chapter I--United States Fish and Wildlife Service, Department of the Interior, Part 22—Eagle Permits.

66 FR 3853 - Presidential Documents. Executive Order 13186 of January 10, 2001. Responsibilities of Federal Agencies To Protect Migratory Birds. Federal Register, January 17, 2001.

72 FR 31132 - Protection of Eagles; Definition of "Disturb". Final Rule. Federal Register, June 5, 2007.

74 FR 46836 - Eagle Permits; Take Necessary To Protect Interests in Particular Localities. Final Rule. Federal Register, September 11, 2009.

U.S. Fish and Wildlife Service. 2003. Migratory Bird Permit Memorandum, MBMP-2, Nest Destruction (Directors Memorandum April 15, 2003), Washington, D.C.

U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp.

[redacted]art, Jan (Laramie,WY-US)

From: Melanie Arnett [Arnett@uwyo.edu]
Sent: Monday, July 23, 2012 8:07 AM
To: Hart, Jan (Laramie,WY-US)
Subject: data request results
Attachments: TRC 120720 Invoice.pdf; Shapefiles.zip

UNIVERSITY OF WYOMING

Wyoming Natural Diversity Database
Department 3381 • 1000 E. University Avenue • Laramie, WY 82071
(307) 766-3023 • fax (307) 766-3026 • e-mail: arnett@uwyo.edu • www.uwyo.edu/wyndd

Jan Hart
TRC
605 Skyline Dr
Laramie, WY 82072

23 July 2012

Dear Jan,

[redacted]Attached are the invoice and results for your 7/20/2012 request for documented rare species occurrences in T43N R76 W, [redacted]ampbell and Johnson Counties, Wyoming. Observations within 4 miles of the request area were also included to provide adequate information for the appropriate application of these data (records distinguished by "Request" or "Buffer" in the Area field). We are unable to offer biologist comments at this time because our biologists are all engaged in field work.

Two shapefiles in UTM zone 13 NAD83 are included in the Shapefiles.zip file (because some email systems filter out emails with .zip attachments, please reply as soon as possible and let me know if you received this email and attached data):

1) **The source.shp file contains complete WYNDD occurrence record data for this request**. The polygons represent the locational uncertainty of observations (as indicated in the MAP_PRECIS field in meters). Please pay attention to the ID_CONFIRM and ID_NOTES fields as many records may not be positively identified, at least to our knowledge. This shapefile contains a complete metadata file, however, please check out our online Data Dictionary if you have further questions or would like more information about our sensitive data policy or the abbreviations found in the attribute tables of the shapefiles.
2) The **request_area.shp** file contains the boundaries of the area referred to in the results as the "request area" (see the Area field).

The fee for your invoice in the amount of $112.50 was determined based on the following formula: 1 Townships X 625 Taxa = 625 (if<6251 fee = $112.50, if between 6250-62500 then multiply by 0.030 for fee, if >62500 then multiply by 0.0495 for fee). Please pay within 30 days.

Recommended citation:
Wyoming Natural Diversity Database. 2012. Data compilation for J. Hart, completed July 23, 2012. Unpublished report. Wyoming Natural Diversity Database, University of Wyoming, Laramie, Wyoming.

WYNDD would benefit greatly from the sharing of any new information on species locations that result from your project. Please contact us about our data trading policy, which would help your organization reduce costs while improving and updating our database.

[redacted]Thank you for your data request. Please do not hesitate to call if you have any questions about the search. We ask that you do not disseminate these data without our permission, they are provided here for use in your WY DEQ Land Quality and FERC permit requirement for Uranerz Uranuin company.

Sincerely,

Melanie Arnett
Database Specialist
Wyoming Natural Diversity Database
University of Wyoming
315 Berry Center, Dept. 3381
1000 E. University Ave
Laramie, WY 82071-3381
Phone: 307.766.2296
Email: arnett@uwyo.edu
Web: http://www.uwyo.edu/wyndd

ADDENDUM JD-D9-B:

WILDLIFE SPECIES LIST,
JANE DOUGH UNIT

Addendum JD-D9-B Wildlife Species That Were Observed or Have the Potential to Occur Within or in the Vicinity of the Jane Dough Unit.

		Sources [1]	
Common Name	Scientific Name	A [2]	B
Mammals			
Merriam's shrew	*Sorex merriami*	B	
Dusky shrew	*Sorex monticolus*	B	
Western small-footed myotis	*Myotis ciliolabrum*	h	
Long-eared myotis	*Myotis evotis*	O	
Little brown myotis	*Myotis lucifugus*	O	
Long-legged myotis	*Myotis volans*	B	
Hoary bat	*Lasiurus cinereus*	h	
Silver-haired bat	*Lasionycteris noctivagans*	O	
Big brown bat	*Eptesicus fuscus*	h	
Townsend's big-eared bat	*Plecotus townsendii*	O	
Desert cottontail	*Sylvilagus auduboni*	B	X
Mountain cottontail	*Sylvilagus nutallii*	b	?
Black-tailed jackrabbit	*Lepus californicus*	B	
White-tailed jackrabbit	*Lepus townsendii*	B	X
Least chipmunk	*Tamias minimus*	B	
Wyoming ground squirrel	*Spermophilus elegans*	B	
Thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*	B	X
Yellow-bellied marmot	*Marmota flaviventris*	B	
White-tailed prairie dog	*Cynomys leucurus*	B	
Black-tailed prairie dog	*Cynomys ludovicianus*	B	X
Eastern fox squirrel	*Sciurus niger*	b	
Northern pocket gopher	*Thomomys talpoides*	h, B	
Olive-backed pocket mouse	*Perognathus fasciatus*	B	
Silky pocket mouse	*Perognathus flavus*	b	
Ord's kangaroo rat	*Dipodomys ordii*	B	
Beaver	*Castor canadensis*	B	
Western harvest mouse	*Reithrodontomys megalotis*	h, B	
Deer mouse	*Peromyscus maniculatus*	B	
White-footed mouse	*Peromyscus leucopus*	B	
Northern grasshopper mouse	*Onychomys leucogaster*	B	
Bush-tailed woodrat	*Neotoma cinerea*	B	
Southern red-backed vole	*Clethrionomys gapperi*	B	
Prairie vole	*Microtus ochrogaster*	B	

Addendum JD-D9-B (Continued)

Common Name	Scientific Name	Sources [1] A [2]	Sources [1] B
Mammals (cont.)			
Meadow vole	*Microtus pennsylvanicus*	h	
Water vole	*Microtus richardsoni*	b	
House mouse	*Mus musculus*	B	
Porcupine	*Erethizon dorsatum*	B	X
Coyote	*Canis latrans*	B	X
Swift fox	*Vulpes velox*	b	
Red fox	*Vulpes vulpes*	B	
Gray fox	*Urocyon cinereoargenteus*	B	
Racoon	*Procyon lotor*	B	
Long-tailed weasel	*Mustela frenata*	b	
Black-footed ferret	*Mustela nigripes*	h	
Mink	*Mustela vison*	b	
Badger	*Taxidea taxus*	B	X
Western spotted skunk	*Spilogale gracilis*	b	
Eastern spotted skunk	*Spilogale putorius*	b	
Striped skunk	*Mephitis mephitis*	B	
Mountain lion	*Felis concolor*	B	
Bobcat	*Felis rufus*	B	
Elk	*Cervas elaphus*	B	
Mule deer	*Odocoileus hemionus*	B	X
White-tailed deer	*Odocoileus virginianus*	B	
Pronghorn	*Antilocapra americana*	B	X
Bighorn sheep	*Ovis canadensis*	h	
Birds			
Common loon	*Gavia immer*	O	
Eared grebe	*Podiceps nigricollis*	O	
Pied-billed grebe	*Podilymbus podiceps*	B	
Western grebe	*Aechmophorus occidentalis*	O	
Horned grebe	*Podiceps auritus*	O	
Clark's grebe	*Aechmophorus clarkii*	O	
American white pelican	*Pelecanus erythrorhynchos*	O	
Double-crested cormorant	*Phalacrocorax auritus*	B, O	
American bittern	*Botaurus lentiginosus*	O	

Addendum JD-D9-B (Continued)

Common Name	Scientific Name	Sources [1] A [2]	Sources [1] B
Birds (cont.)			
Great blue heron	*Ardea herodias*	B	
Cattle egret	*Bubulcus ibis*	O	
Black-crowned night-heron	*Nycticorax nycticorax*	O	
White-faced ibis	*Plegadis chihi*	O	
Tundra swan	*Cygnus columbianus*	O	
Trumpeter swan	*Cygnus buccinator*	O	
Snow goose	*Chen caerulescens*	O	
Canada goose	*Branta canadensis*	B	
Wood duck	*Aix sponsa*	O	
Green-winged teal	*Anas crecca*	B	
Mallard	*Anas platyrhynchos*	B	X
Northern pintail	*Anas acuta*	B	
Blue-winged teal	*Anas discors*	B	
Cinnamon teal	*Anas cyanoptera*	B	
Northern shoveler	*Anas clypeata*	B	
Gadwall	*Anas strepera*	B	
American wigeon	*Anas americana*	B	
Canvasback	*Aythya valisineria*	O	
Redhead	*Aythya americana*	O	
Ring-necked duck	*Aythya collaris*	O	
Lesser scaup	*Aythya affinis*	O	
Common goldeneye	*Bucephala clangula*	O	
Barrow's goldeneye	*Bucephala islandica*	O	
Bufflehead	*Bucephala albeola*	O	
Hooded merganser	*Lophodytes cucullatus*	O	
Common merganser	*Mergus merganser*	O	
Red-breasted merganser	*Mergus serrator*	O	
Ruddy duck	*Oxyura jamaicensis*	O, b	
Turkey vulture	*Cathartes aura*	b, O	
Osprey	*Pandion haliaetus*	O	
Bald eagle	*Haliaeetus leucocephalus*	B	X
Northern harrier	*Circus cyaneus*	B	
Sharp-shinned hawk	*Accipiter striatus*	O	
Cooper's hawk	*Accipiter cooperii*	b, O	

Addendum JD-D9-B (Continued)

Common Name	Scientific Name	Sources [1] A [2]	Sources [1] B
Birds (cont.)			
Swainson's hawk	*Buteo swainsoni*	B	
Red-tailed hawk	*Buteo jamaicensis*	B	X
Ferruginous hawk	*Buteo regalis*	B	
Rough-legged hawk	*Buteo lagopus*	O	X
Golden eagle	*Aquila chrysaetos*	B	X
American kestrel	*Falco sparverius*	B	X
Merlin	*Falco columbarius*	B	
Peregrine falcon	*Falco peregrinus*	O	
Prairie falcon	*Falco mexicanus*	B	X
Gray partridge	*Perdix perdix*	O, B	X
Chukar	*Alectoris chukar*	B	
Ring-necked pheasant	*Phasianus colchicus*	B	
Greater sage-grouse	*Centrocercus urophasianus*	B	X
Sharp-tailed grouse	*Tympanuchus phasianellus*	O, B	
Wild turkey	*Meleagris gallopavo*	B	
Sora	*Porzana carolina*	O	
American coot	*Fulica americana*	B	
Sandhill crane	*Grus canadensis*	B	
Black-bellied plover	*Pluvialis squatarola*	O	
Semipalmated plover	*Charadrius semipalmatus*	O	
Killdeer	*Charadrius vociferus*	B	
Mountain plover	*Charadrius montanus*	O, B	
Black-necked stilt	*Himantopus mexicanus*	O	
American avocet	*Recurvirostra americana*	B	
Greater yellowlegs	*Tringa melanoleuca*	O	
Lesser yellowlegs	*Tringa flavipes*	O	
Solitary sandpiper	*Tringa solitaria*	O	
Willet	*Catoptrophorus semipalmatus*	B, O	
Spotted sandpiper	*Actitis macularia*	B	
Upland sandpiper	*Bartramia longicauda*	B	
Whimbrel	*Numenius phaeopus*	O	
Long-billed curlew	*Numenius americanus*	O	
Marbled godwit	*Limosa fedoa*	O	

Addendum JD-D9-B (Continued)

Common Name	Scientific Name	Sources [1] A [2]	B
Birds (cont.)			
Sanderling	*Calidris alba*	O	
Semipalmated sandpiper	*Calidris pusilla*	O	
Western sandpiper	*Calidris mauri*	O	
Least sandpiper	*Calidris minutilla*	O	
White-rumped sandpiper	*Calidris fuscicollis*	O	
Baird's sandpiper	*Calidris bairdii*	O	
Pectoral sandpiper	*Calidris melanotos*	O	
Stilt sandpiper	*Calidris himantopus*	O	
Long-billed dowitcher	*Limnodromus scolopaceus*	O	
Wilson's phalarope	*Phalaropus tricolor*	b, B	
Red-necked phalarope	*Phalaropus lobatus*	O	
Franklin's gull	*Larus pipixcan*	O	
Bonapartes gull	*Larus philadelphia*	O	
Ring-billed gull	*Larus delawarensis*	O	
California gull	*Larus californicus*	O	
Herring gull	*Larus argentatus*	O	
Caspian tern	*Sterna caspia*	O	
Common tern	*Sterna hirundo*	O	
Forster's tern	*Sterna forsteri*	O	
Black tern	*Chlidonias niger*	O, b	
Rock dove	*Columba livia*	b, B	
Mourning dove	*Zenaida macroura*	B	
Black-billed cuckoo	*Coccyzus erythropthalmus*	O	
Yellow-billed cuckoo	*Coccyzus americanus*	O	
Barn owl	*Tyto alba*	O	
Great horned owl	*Bubo virginianus*	B	X
Snowy owl	*Nyctea scandiaca*	O	
Burrowing owl	*Athene cunicularia*	B	
Long-eared owl	*Asio otus*	O, B	X
Short-eared owl	*Asio flammeus*	O, B	
Northern saw-whet owl	*Aegolius acadicus*	O	

Addendum JD-D9-B (Continued)

Common Name	Scientific Name	Sources [1] A [2]	Sources [1] B
Birds (cont.)			
Common nighthawk	*Chordeiles minor*	b, B	
Common poorwill	*Phalaenoptilus nuttallii*	O, b	
Chimney swift	*Chaetura pelagica*	O	
White-throated swift	*Aeronautes saxatalis*	O	
Broad-tailed hummingbird	*Selasphorus platycercus*	O	
Rufous hummingbird	*Selasphorus rufus*	O	
Belted kingfisher	*Ceryle alcyon*	b, B	
Lewis' woodpecker	*Melanerpes lewis*	O	
Red-headed woodpecker	*Melanerpes erythrocephalus*	O, B	
Red-naped sapsucker	*Sphyrapicus nuchalis*	O	
Williamson's sapsucker	*Sphyrapicus thyroideus*	O	
Downy woodpecker	*Picoides pubescens*	b, B	
Hairy woodpecker	*Picoides villosus*	b, O	
Northern flicker	*Colaptes auratus*	B	
Olive-sided flycatcher	*Contopus cooperi*	B	
Western wood-pewee	*Contopus sordidulus*	b, B	
Willow flycatcher	*Empidonax traillii*	O, B	
Least flycatcher	*Empidonax minimus*	O	
Dusky flycatcher	*Empidonax oberholseri*	O	
Cordilleran flycatcher	*Empidonax occidentallis*	O	
Say's phoebe	*Sayornis saya*	B	
Western kingbird	*Tyrannus verticalis*	b, B	
Eastern kingbird	*Tyrannus tyrannus*	b, B	
Horned lark	*Eremophila alpestris*	b, B	X
Tree swallow	*Tachycineta bicolor*	B, O	
Ash-throated flycatcher	*Myiarchus cinerascens*	O	
Violet-green swallow	*Tachycineta thalassina*	B	
Northern rough-winged swallow	*Stelgidopteryx serripennis*	b	
Bank swallow	*Riparia riparia*	O	
Cliff swallow	*Hirundo pyrrhonota*	B	
Barn swallow	*Hirundo rustica*	b, B	
Gray jay	*Perisoreus canadensis*	O	
Blue jay	*Cyanocitta cristata*	O	
Pinyon jay	*Gymnorhinus cyanocephalus*	b, O	

Addendum JD- D9-B (Continued)

Common Name	Scientific Name	Sources [1] A [2]	Sources [1] B
Birds (cont.)			
Clark's nutcracker	*Nucifraga columbiana*	B, O	
Black-billed magpie	*Pica hudsonia*	B	X
American crow	*Corvus brachyrhynchos*	b, O	
Common raven	*Corvus corax*	O	
Black-capped chickadee	*Parus atricapillus*	B	
Mountain chickadee	*Poecile gambeli*	b, O	
Red-breasted nuthatch	*Sitta canadensis*	O, B	
White-breasted nuthatch	*Sitta carolinensis*	O	
Pygmy nuthatch	*Sitta pygmaea*	O	
Rock wren	*Salpinctes obsoletus*	b, B	
Canyon wren	*Catherpes mexicanus*	b	
House wren	*Troglodytes aedon*	B	
Bewick's wren	*Thyromanes bewickii*	O	
Marsh wren	*Cistothorus palustris*	B	
Ruby-crowned kinglet	*Regulus calendula*	O	
Western bluebird	*Sialia mexicana*	B	
Mountain bluebird	*Sialia currucoides*	B	
Townsend's solitaire	*Myadestes townsendi*	O	
Veery	*Catharus fuscescens*	O	
Swainson's thrush	*Catharus ustulatus*	O, b	
Hermit thrush	*Catharus guttatus*	O	
American robin	*Turdus migratorius*	B	
Gray catbird	*Dumetella carolinensis*	B, O	
Northern mockingbird	*Mimus polyglottos*	O, B	
Sage thrasher	*Oreoscoptes montanus*	b, B	
Brown thrasher	*Toxostoma rufum*	b	
American pipit	*Anthus rubescens*	O	
Bohemian waxwing	*Bombycilla garrulus*	O	
Cedar waxwing	*Bombycilla cedrorum*	b, O	
Northern shrike	*Lanius excubitor*	O	
Loggerhead shrike	*Lanius ludovicianus*	B	
European starling	*Sturnus vulgaris*	b, B	
Solitary vireo	*Vireo solitarius*	b, O	
Warbling vireo	*Vireo gilvus*	b, O	

Addendum JD-D9-B (Continued)

Common Name	Scientific Name	Sources [1] A [2]	B
Birds (cont.)			
Orange-crowned warbler	*Vermivora celata*	B, O	
Yellow warbler	*Dendroica petechia*	b, B	
Yellow-rumped warbler	*Dendroica coronata*	O, B	
Chestnut-sided warbler	*Dendroica pensylvanica*	O	
American redstart	*Setophaga ruticilla*	b, O	
Ovenbird	*Seiurus aurocapillus*	O	
Macgillivray's warbler	*Oporornis tolmiei*	O	
Common yellowthroat	*Geothlypis trichas*	b, B	
Wilson's warbler	*Wilsonia pusilla*	O	
Yellow-breasted chat	*Icteria virens*	b	
Western tanager	*Piranga ludoviciana*	b	
Rose-breasted grosbeak	*Pheucticus ludovicianus*	O	
Black-headed grosbeak	*Pheucticus melanocephalus*	b, B	
Lazuli bunting	*Passerina amoena*	O, b	
Dickcissel	*Spiza americana*	O	
Green-tailed towhee	*Pipilo chlorurus*	B, b	
Spotted towhee	*Pipilo maculatus*	b, O	
American tree sparrow	*Spizella arborea*	O	
Chipping sparrow	*Spizella passerina*	b, B	
Clay-colored sparrow	*Spizella pallida*	O	
Brewer's sparrow	*Spizella breweri*	b, B	X
Field sparrow	*Spozella pusilla*	O	
Vesper sparrow	*Pooecetes gramineus*	B	
Lark sparrow	*Chondestes grammacus*	B	
Lark bunting	*Calamospiza melanocorys*	B	
Savannah sparrow	*Passerculus sandwichensis*	O, b	
Grasshopper sparrow	*Ammodramus savannarum*	b, B	
Baird's sparrow	*Ammodramus bairdii*	b *	
Fox sparrow	*Passerella iliaca*	O	
Sage sparrow	*Amphispiza belli*	O, B	
Song sparrow	*Melospiza melodia*	b	
Lincoln's sparrow	*Melospiza lincolnii*	B, O	
White-throated sparrow	*Zonotrichia albicollis*	O	
White-crowned sparrow	*Zonotrichia leucophrys*	O	

Addendum JD-D9-B (Continued)

Common Name	Scientific Name	Sources [1] A [2]	B
Birds (cont.)			
Harris' sparrow	*Zonotrichia querula*	O	
Dark-eyed junco	*Junco hyemalis*	O, B	
McCown's longspur	*Calcarius mccownii*	b, B	
Lapland longspur	*Calcarius lapponicus*	O	
Chestnut-collared longspur	*Calcarius ornatus*	b	
Snow bunting	*Plectrophenax nivalis*	O	
Bobolink	*Dolichonyx oryzivorus*	O	
Red-winged blackbird	*Agelaius phoeniceus*	B	
Western meadowlark	*Sturnella neglecta*	b, B	
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	B, O	
Brewer's blackbird	*Euphagus cyanocephalus*	b, B	
Rusty blackbird	*Euphagus carolinus*	O	
Common grackle	*Quiscalus quiscula*	b, B	
Brown-headed cowbird	*Molothrus ater*	O, B	
Bullock's oriole	*Icterus bullockii*	B	
Gray-crowned rosy-finch	*Leucosticte tephrocotis*	O	
Cassin's finch	*Carpodacus cassinii*	O	
House finch	*Carpodacus mexicanus*	O	
Red crossbill	*Loxia curvirostra*	b, B	
Common redpoll	*Carduelis flammea*	O	
Pine sisken	*Carduelis pinus*	O, b	
American goldfinch	*Carduelis tristis*	B, b	
Evening grosbeak	*Coccothraustes vespertinus*	O	
House sparrow	*Passer domesticus*	B	
Reptiles and Amphibians			
Tiger salamander	*Ambystoma tigrinum*	O	
Plains spadefoot	*Scaphiopus bombifroms*	O *	
Great plains toad	*Bufo cognatus*	O	
Woodhouse's toad	*Bufo woodhousei woodhousei*	O	
Northern leopard frog	*Rana pipiens*	O	
Western painted turtle	*Chrysemys picta belli*	O	
Greater short-horned lizard	*Phrynosoma hernandesi*	H *	
Plains hog-nose snake	*Heterodon nasicus nasicus*	O	

Addendum JD-D9-B (Continued)

Common Name	Scientific Name	Sources [1] A [2]	Sources [1] B
Reptiles and Amphibians (cont.)			
Prairie rattlesnake	*Crotalus viridis viridis*	O, H *	X
Bullsnake	*Pituophis melanoleucas sayi*	O	X
Wandering garter snake	*Thamnophis elegans vagrans*	O	
Eastern yellowbelly racer	*Coluber constrictor flaviventris*	H *	X

[1] A = Atlas of Birds, Mammals, Reptiles and Amphibians in Wyoming (Cerovski 2004).
B = Based on field studies conducted in 2006 for the existing Nichols Ranch ISR Permit 778 Area.

[2] **For Mammals:**

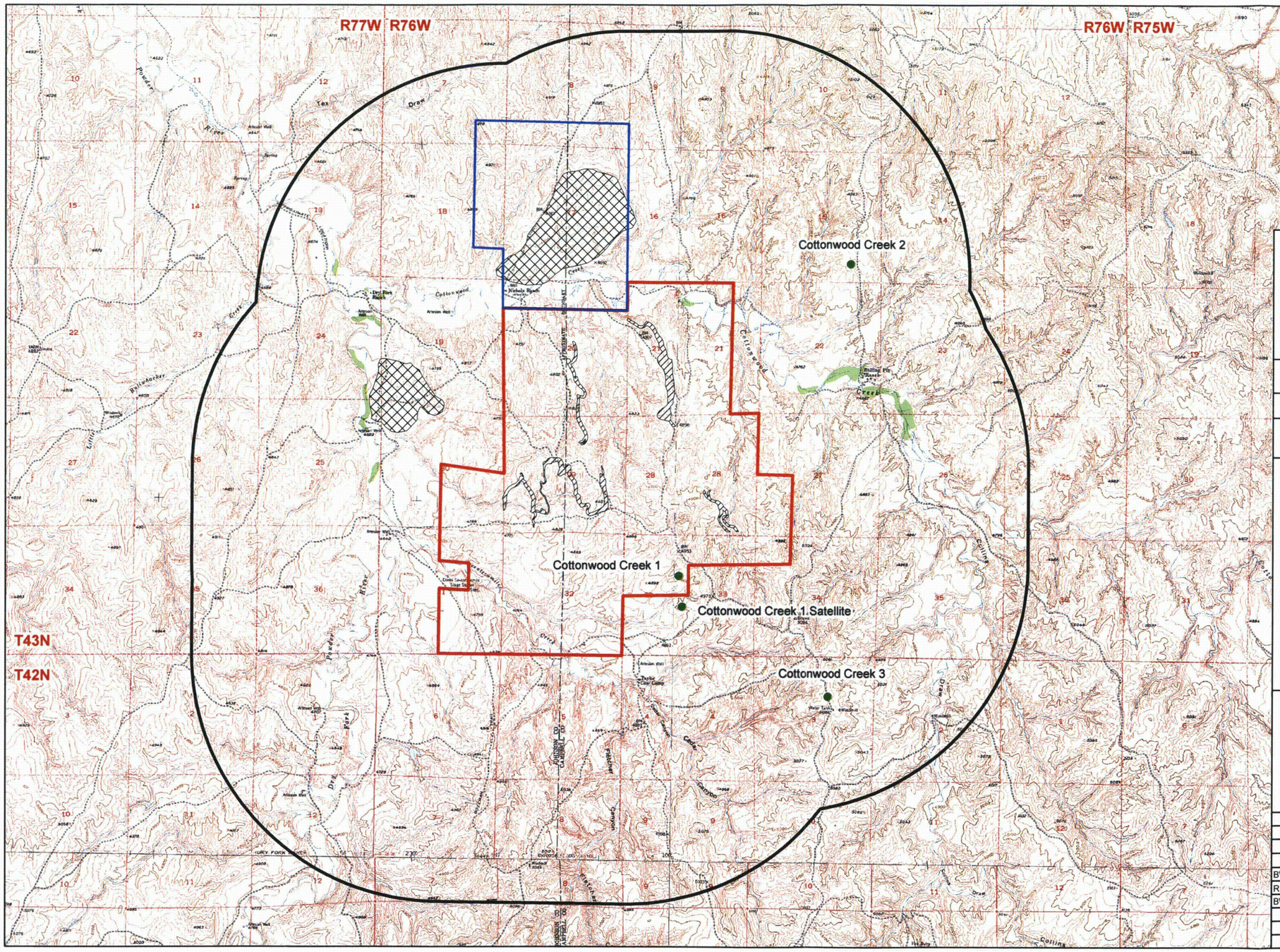
B = Nest, dependent young, juvenile animals, lactating or post-lactation females, or males in breeding condition were observed.
b = Animals were observed and, due to limited mobility, breeding is assumed (bats and large ungulates are highly mobile and are not automatically placed in this category).
O = The species has been observed but, due to the mobility of the species' group and lack of factors listed under (B), breeding cannot be assumed (applies to bats and large ungulates).
h = Historical record of occurrence before 1965. No recent data to suggest occurrence.

For Birds:

B = Nest or young dependent upon parent birds was observed.
b = Circumstantial evidence of nesting.
O = The species has been observed, but there was no evidence of nesting. The observation may have been recorded during any season of the year, but observations are most likely to correspond with seasonal occurrences.
h = Historical record with no indication of nesting.

For Reptiles and Amphibians:

O = The species has been observed but, due to the lack of factors listed under (B) or (b), breeding cannot be assumed.
h = Historical record of occurrence.
* = Record was obtained from the University of Wyoming Museum.



Uranerz
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Figure JD-D9-3

Jane Dough Unit

Greater Sage-grouse Lek's and Black-tailed Prairie Dog Colony Locations

Legend

N

- Greater Sage-grouse Lek
- Black-tailed Prairie Dog Town
- 2.0-mi Buffer Around Jane Dough Unit
- Jane Dough Unit
- Jane Dough Wellfield
- Existing Nichols Ranch ISR Permit Number 778 Area

0 2 Miles

0 3 Kilometers

1:55,000 1 inch = 4,583 feet

USGS 7.5' Quadrangles: Dry Fork Ranch (1953, Photoinspected 1973), and Rolling Pin Ranch (1953, Photoinspected 1973), Wyoming

Drawn: RFB Checked: SK

Date: 11/11/2013

Revision	Description
BW 03/13/14	Update Boundary
RFB 03/26/14	Change legend
BW 03/13/14	Update Legend

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APPENDIX JD-D10:

WETLANDS

April 2014

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LIST OF ABBREVIATIONS AND ACRONYMS

CBM	Coalbed methane
COE	U.S. Army Corps of Engineers
FAC	Facultative
FACU	Facultative upland
FACW	Facultative wetland
GPS	Global positioning system
ISR	In Situ Recovery
NI	Insufficient information for wetland indicator species
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
OBL	Obligate wetland
PEMA	Palustrine emergent temporarily flooded
PEMAh	Palustrine emergent temporarily flooded, diked/impounded
PEMC	Palustrine emergent seasonally flooded
TRC	TRC Environmental Corporation
UPL	Upland species
USGS	U.S. Geological Survey
WDEQ/LQD	Wyoming Department of Environmental Quality/Land Quality Division
WUS	Waters of the U.S.

JD-D10.1.0 INTRODUCTION

A survey for potential wetlands (and other waters of the U.S. [WUS]) within the Jane Dough Unit area was conducted as required by the Wyoming Department of Environmental Quality, Land Quality Division (WDEQ/LQD) Guideline No. 6 (1997). Wetlands are defined in Appendix D10 of the Nichols Ranch Unit permit.

The purpose of the wetland survey is to establish the location and quantity of premine wetland habitats and WUS. The information presented herein includes a description of the wetland and WUS habitat, its distribution, and vegetative species composition.

JD-D10.1.1 LOCATION OF PROJECT

The Jane Dough Unit is located in Campbell and Johnson counties, Wyoming. The project area encompasses approximately 3,680 acres in portions of Sections 19, 20, 21, 22, 27, 28, 29, 30, 31, 32, and 34, T43N, R76W and is located immediately adjacent and south of the Nichols Ranch Unit. The project area is within the 10- to 14-inch Northern Plains (10-14NP) zone of northeastern Wyoming (Natural Resources Conservation Service [NRCS] 1988). Topographic relief ranges from 4,670 to 4,960 ft above mean sea level in the Jane Dough Unit. Annual precipitation varies from 10 to 14 inches, with approximately 35-41% falling during the normal growing season (NRCS 1988). Growth of native cool-season plants begins about April 1 and continues to about July 1. Growth of native warm-season plants begins about May 15 and continues to about August 15. According to Wyoming Gap data, three primary vegetation types occur in the project area--Wyoming big sagebrush, grass dominated riparian, and mixed grass prairie (Wyoming Gap Analysis 2000).

There are no perennial streams in the project area; however, the Jane Dough Unit is located in an active coalbed methane (CBM) field; therefore, CBM ponds are scattered throughout the project area. At the time of the July site visits, all of the CBM ponds contained water. One developed ground water well provides water to a constructed pond that overflows to an otherwise ephermal drainage creating the only flowing stream in the Jane Dough Unit. Cottonwood Creek and

Seventeenmile both ephemeral streams, are the main drainages in the Jane Dough Unit. Cottonwood Creek occurs in the north portion of the Jane Dough Unit and the Seventeenmile drainage occurs in the southwestern corner of the Jane Dough Unit project area. No springs occur in the project area. Within the project area, both Cottonwood Creek and Seventeenmile drainage have been physically altered by local ranches, and a system of irrigation ditches has been constructed to supply water to the area for hay production; therefore, there is no defined bed/bank with a typical pool-riffle riverine system in the project area. Current land use (refer to Appendix JD-D1) in the project area is primarily livestock grazing, wildlife habitat, and CBM and natural gas development.

JD-D10.1.2 PERMITTING REQUIREMENTS

Protection of wetlands and other WUS is the responsibility of the COE. In order to comply with WDEQ/LQD permitting requirements and Section 404 of the federal *Clean Water Act*, a Nationwide Permit 44 from the COE may be required if there are discharges of dredged or fill material into a WUS that exceeds 0.5 acre in size. The Nationwide Permit 44 is specific to mining activities and requires the delineation and verification of jurisdictional wetlands and WUS in the affected area.

JD-D10.2.0 SURVEY METHODS

On-site inspections of the project area for jurisdictional wetlands and WUS were conducted in July 2010 and August 2012 using procedures outlined in COE (1987). Prior to fieldwork, background information was obtained from National Wetland Inventory (NWI) maps, U.S. Geological Survey (USGS) topographic maps, and aerial photographs. Information from the NWI maps is presented in Figure JD-D10-1. These sources were used to identify areas likely to contain wetlands and other WUS. All potential wetland and WUS sites identified on the NWI or USGS maps were visited to determine if a wetland or WUS were present. Other areas not designated as wetlands on the NWI map were investigated if standing water or other primary or secondary hydrology indicators were present or if areas of hydrophytic vegetation were observed.

During the on-site inspection, geomorphic and hydrologic characteristics of the site were investigated to determine if primary wetland hydrology indicators were present, including inundation, saturation, water marks, sediment deposits, drainage patterns, and drift lines. Secondary indicators (e.g., oxidized root channels) were searched for only if no primary indicators were identified.

Dominant plant species were identified at each potential wetland site to determine if hydrophytic vegetation was present. Plant species were either identified on-site or taken to the Rocky Mountain Herbarium at the University of Wyoming in Laramie and identified. An ocular estimate of percent cover was used to determine dominant species at each wetland site. *The National List of Plant Species that Occur in Wetlands: North Plains (Region 4)* (Reed 1988) was used to determine the indicator status of dominant plants within each community, and plant species were classified as obligate wetland (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU), upland (UPL) species, or insufficient information is available to determine an indicator species (NI).

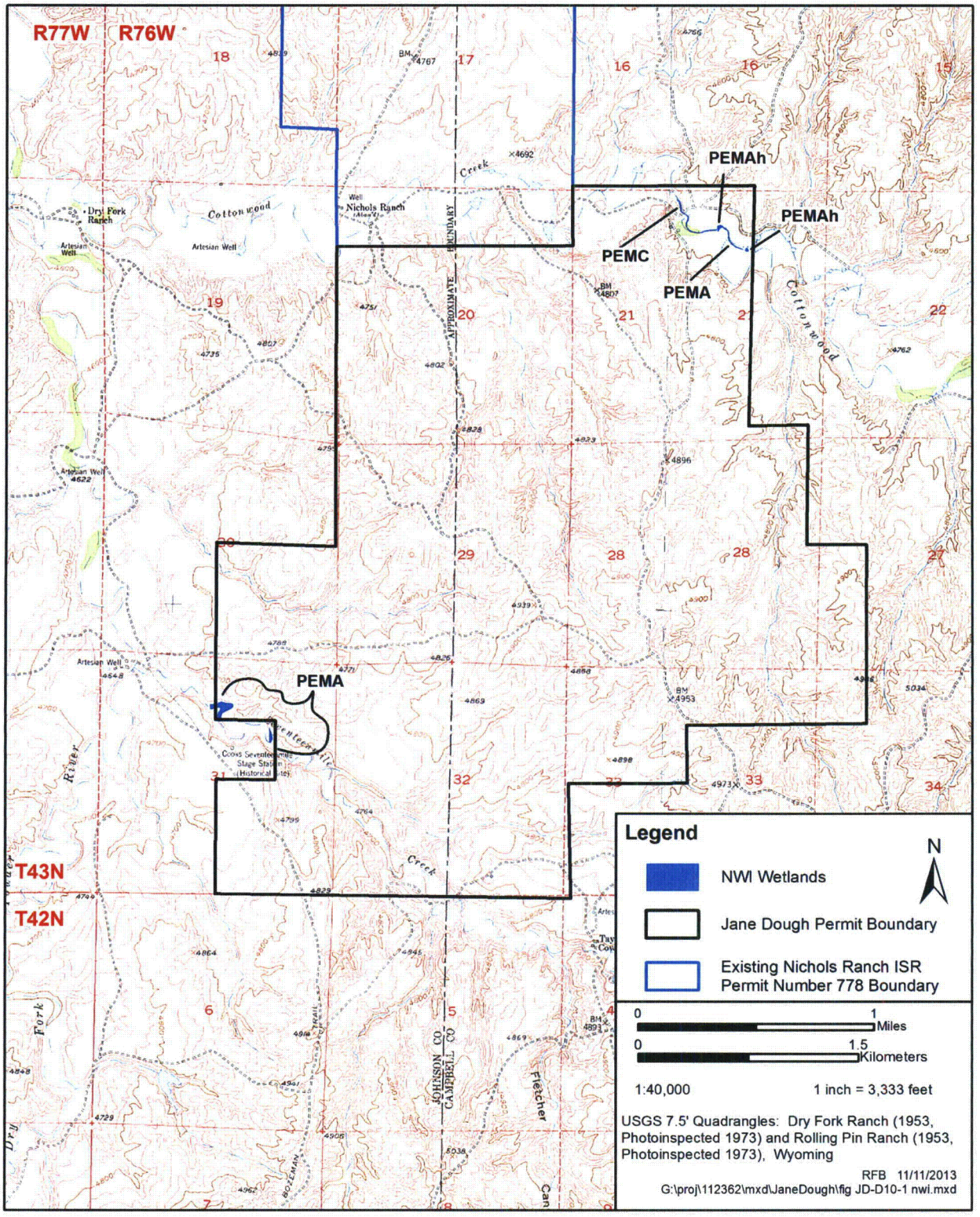


Figure JD-D10-1 NWI Information, Jane Dough Unit, 2012.

If vegetative and hydrologic wetland criteria were met, soil profiles were examined for hydric soil characteristics (e.g., mottling, gleying, saturation). Soil color was determined using a Munsell Soil Color Chart. Soil information was obtained from the Order 2 Soil Survey for the project (refer to Appendix JD-D7). Wetland acreage was measured in the field and wetland boundaries were recorded with a Trimble XM handheld global positioning system (GPS) unit. Relevant information about potential jurisdictional wetlands was then documented on appropriate COE-approved wetland delineation forms.

JD-D10.3.0 RESULTS

JD-D10.3.1 OVERVIEW

The survey of potential jurisdictional wetlands and WUS was completed on July, 9 2010, in accordance with the survey methods presented in Section JD-D10-2. A second site visit was conducted August 27, 2012, to investigate WUS. The survey was conducted by Ms. Jan Hart of TRC Environmental Corporation (TRC), Laramie, Wyoming. Ms. Hart is a COE-certified wetland delineator, has received formal wetland training from the Wetland Training Institute in 1998, and has been conducting jurisdictional wetland surveys since 1998.

NWI map information for each unit of the project area is presented on Figure JD-D10-1. The locations of wetland sites investigated are presented on Figure JD-D10-2. All potential wetland or WUS areas identified on the NWI maps were visited; however, not all NWI wetlands fit the COE criteria (i.e., the presence of either primary or secondary indicators of wetland hydrology, hydric soils or hydrophytic vegetation). Photographs of wetland and WUS are presented in Addendum JD-D10-A. Wetland delineation forms were completed for each site determined to be a wetland and are presented in Addendum JD-D10-B.

JD-D10.3.2 WETLANDS

Three wetland sites were investigated in the Jane Dough Unit. Two palustrine emergent wetland areas are identified on the NWI map (refer to Figure JD-D10-1). One wetland area, Site 1 is associated with the Cottonwood Creek drainage and the second area, Site 2 is associated with the Seventeenmile Creek drainage (refer to Figure JD-D10-2). However, only Site 2 was determined to be a jurisdictional wetland site in the Seventeenmile Creek drainage in the project area (Table JD-D10-1). Site 3 is a man-induced wetland created by overflow of a ground water well.

Site 1 is located in the Cottonwood Creek drainage and it was investigated because the NWI map designed the presence of palustrine emergent wetlands (Figures JD-D10-1 and JD-D10-2);

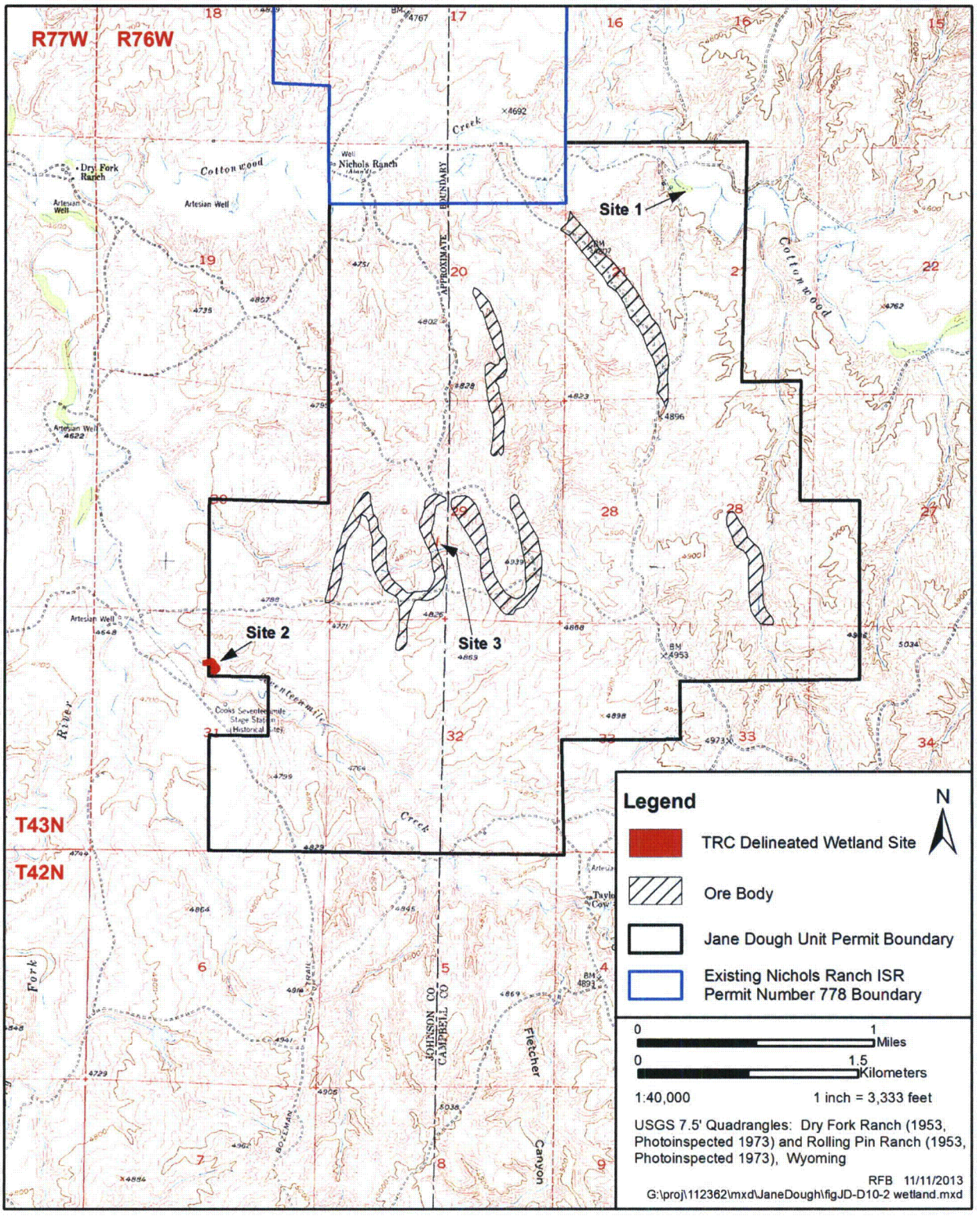


Figure JD-D10-2 Wetland Sites Investigated, Jane Dough Unit, 2010 and 2012.

Table JD-D10-1 Wetland Sites Investigated, Jane Dough Unit, 2010 and 2012.

Site Number	Description	NWI Designation[1]	Field Determination	Wetland Acres in Project Area	Wetland Acres Affected
1	Cottonwood Creek	PEMA, PEMC, PEMAh	Non-Wetland	0.0	0
2	Seventeenmile Creek	PEMA	Wetland	2.1	0
3	Man-induced wetland	n/a	Wetland[2]	0.1	0
Total				2.2	0

[1] PEMA = Palustrine emergent temporarily flooded; PEMC = Palustrine emergent seasonally flooded; PEMAh = Palustrine emergent temporarily flooded, diked/impounded.
[2] Man-induced, may not be under COE jurisdiction.

however, no wetlands were found. In addition, this site is indicated as an intermittent/ephermeral stream on the 1:24,000 USGS topographic maps. There were several excavated depressions and abandoned irrigation ditches in Cottonwood Creek; however, the drainage was dry with no recent sign of inundation or a defined channel. With the exception of scattered cottonwood trees, no hydropythic vegetation was noted. Vegetation was composed of smooth brome and crested wheatgrass with weedy annuals such as cheatgrass, peppergrass, and kochia. Based on the composition of upland vegetation, it appears that this site has not been irrigated in the past few years. No wetlands or WUS occur in the portion of Cottonwood Creek in the Jane Dough Unit.

Site 2 is a wetland located in the Seventeenmile drainage and is designated as a palustrine emergent temporarily flooded wetland (PEMA) on the NWI map. The site was inundated at the time of the July 2010 site visit. Vegetation was composed of hydrophytic species such four-square bulrush, Baltic rush, rabbitfoot grass, barnyard grass, and foxtail barley. Soils were determined to be hydric. The wetlands extend outside the Jane Dough Unit area (Figure JD-D10-2) and approximately 2.1 acres of wetland occur in the Jane Dough Unit

(Table JD-D10-1). No channel bed or bank was observed in the portion of Seventeenmile drainage in the Jane Dough Unit. Site 2 will not be disturbed by mining activities.

Site 3 is a man-induced wetland downslope from a developed ground water well. A CBM pad is located upslope from this location and it is possible this groundwater well is associated with the CBM well. Site 3 is not identified as a wetland on the NWI map. Several photographs of the area are provided in Addendum JD-D10-A. Site 3 was not identified as a wetland during the 2010 site visit; therefore, it is likely that water was not flowing from the well and; therefore, no wetland was present. However, at the time of the 2012 site visit; water was flowing from the well into a fenced-in area containing a series of small constructed retention ponds and weirs. Flow from the ponds eventually empties into a buried drain pipe with an outlet to a slight depression at the head of an un-named ephemeral drainage. Site 3 is located at the outlet of the pipe where an area of cattails encompassing 0.1 acre has formed. Water continues downslope from Site 3 to a constructed CBM pond located in the unnamed drainage. Much of the Site 3 has been grazed by cattle and cattle were present at the time of the August 2012 site visit. Soils were gleyed and the site was inundated with 3- to 12- inches of water. This site exhibited all three wetland criteria of wetland hydrology, hydric soils, and hydrophytic vegetation; however, given normal circumstances, it is likely that without the input of water, Site 3 would not be a wetland. Therefore, it is likely Site 3 would not be designated as a jurisdictional water by the COE.

Several excavated and constructed CBM ponds are scattered throughout the Jane Dough Unit; however, no wetlands have developed in association with the ponds.

JD-D10.3.3 WUS

The 1:24,000 USGS scale topographic maps indicate the presence of numerous intermittent/ephemeral streams in the Jane Dough Unit (Figure JD-D10-3). Many of the Jane Dough Unit drainages lack a defined bed and bank structure and are vegetated with sagebrush and grass, indicating that surface flows are infrequent, of low intensity, and return interval to scour a channel.

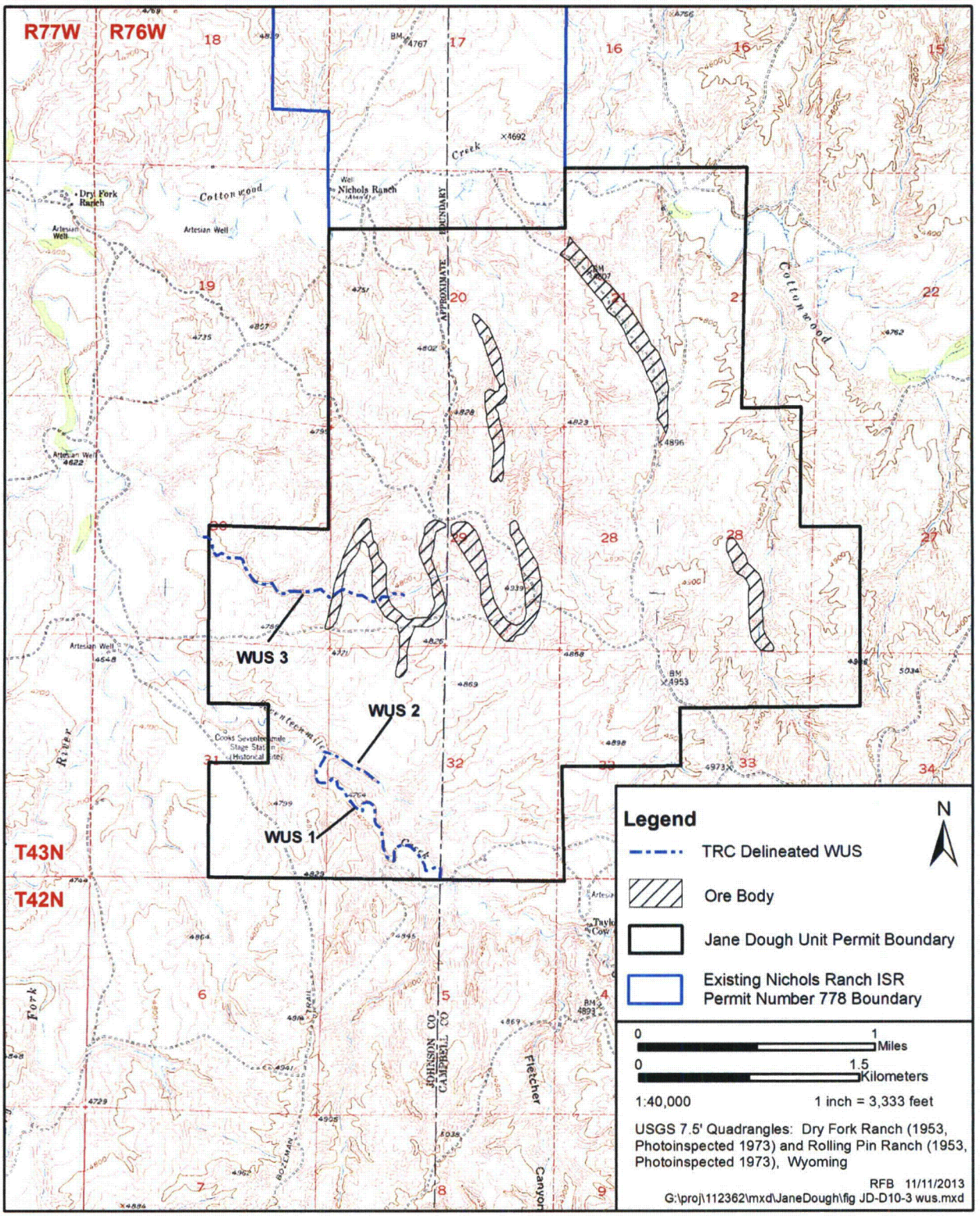


Figure JD-D10-3 WUS Locations on the Jane Dough Unit, 2010.

However, based on a field investigation for the presences of a defined bed and base, approximately 12,989 linear feet (2.46 linear mile) of WUS actually occur in the Jane Dough Unit (Figure JD-D10-3 and Table JD-D10-2). WUS 1 and 2 are in the Seventeenmile Creek Drainage and were dry at the time of the August 2012 site visit. WUS channel bed width ranges from 3- to 8- feet with a sandy bed, banks from 1- to 3- feet, and the channel bed width was approximately 4 feet. WUS 3 is located in an un-named drainage below the Site 3 wetland and the constructed CBM pond. At the time of the August 2012 site visit, this WUS was flowing with about 4 inches of water and a bank was forming generally less than 6 inches entrenched. The channel bed was a mix of bedrock, sand, and gravel. There was no developed pool riffle or meandering pattern to the WUS, indicating that WUS 3 may be relatively new in the fluvial geomorphic process brought about by the water from CBM groundwater well and/or output from the constructed pond. It is likely, that without the influx of groundwater that WUS 3 would likely revert to similar drainage characteristics of the other ephemeral drainages present in the Jane Dough Unit.

Drainage is generally to the north of Cottonwood Creek, and drainage in the southwestern portion of the Jane Dough Unit is to Seventeenmile Creek. There are no defined channel banks or channel beds present in either Cottonwood Creek or Seventeenmile Creek. Cottonwood Creek and Seventeenmile Creek have been altered with a system of irrigation ditches and spreader dikes have been constructed to supply water to the area for hay production; therefore, there is no typical pool-riffle riverine system in the Jane Dough Unit. The spreader dikes in Cottonwood Creek are referred to in a 1927 description of the ranch (personal communication, March 1, 2007, with Patricia Clark, T-Chair Ranch). Drainage is via small ephemeral moderately to deeply incised (1- to 15-feet banks) channels that range from 1- to 15- feet wide.

Table JD-D10-2 Linear Feet of WUS, Jane Dough Unit, 2010 and 2012.

WUS Identification Number	Miles	Linear Feet
1	1.13	5,966
2	0.27	1,426
3	1.06	5,597
Total	2.46	12,989

JD-D10.4.0 CONCLUSION AND RECOMMENDATIONS

No jurisdictional wetlands will be disturbed by mining or construction activities. However, approximately 300 feet of WUS 3 is located inside of the southwest wellfield and this area may be disturbed by wellfield development activities in the Jane Dough Unit. Within the 300 feet of WUS 3 located in the wellfield the channel is approximately 4 feet wide and disturbance may result in a maximum of 0.027 acres of WUS disturbance from pipeline installation and road construction. Pipelines will be installed below grade, backfilled during installation, and would not block off any surface water flow. For road crossings, appropriately sized culverts will be installed as required for any new roads constructed for the project. Therefore, Uranerz's activities would comply with the specifications for a Nationwide 12 and/or 14 permit and Uranerz will prepare and submit an appropriate application to the COE for such coverage under a Nationwide permit. Therefore, the Jane Dough Unit will have no impact on jurisdictional wetlands and minimal impacts on WUS. Such development activities in WUS 3 will be permitted by COE.

JD-D10.5.0 REFERENCES

Analysis, Wyoming Gap. 2000. 19961201, Land Cover for Wyoming: University of Wyoming, Spatial Data and Visualization Center, Laramie, Wyoming. <http://www.sdvs.uwyo.edu/24k/landcov.html>. Accessed June 2006.

Natural Resource Conservation Service. 1988. Technical guide to range sites and range condition 10-14 inch, Northern Plains. Technical Guide Notice No. WY-99, Section IIB. U.S. Department of Agriculture, Natural Resources Conservation Service, Casper, Wyoming.

Reed, P.B., Jr. 1988. National list of plant species that occur in wetlands: North Plains (Region 4). U.S. Department of the Interior, Fish and Wildlife Service. Biological Report 88 (26.7). 66 pp.

U.S. Army Corps of Engineers. 1987. Wetland delineation manual, technical report V-87-1. U.S. Army Engineer Waterways Experiment Station, Vicksburg. Mississippi. 100 pp. + append.

Wyoming Department of Environmental Quality, Land Quality Division. 1997. Guideline no. 6: organization and topic guideline for an application for a "permit to mine," or an amendment; noncoal. Cheyenne, Wyoming. 16 pp.

ADDENDUM JD-D10-A:
PHOTOGRAPHS OF WETLAND SITES

April 2014

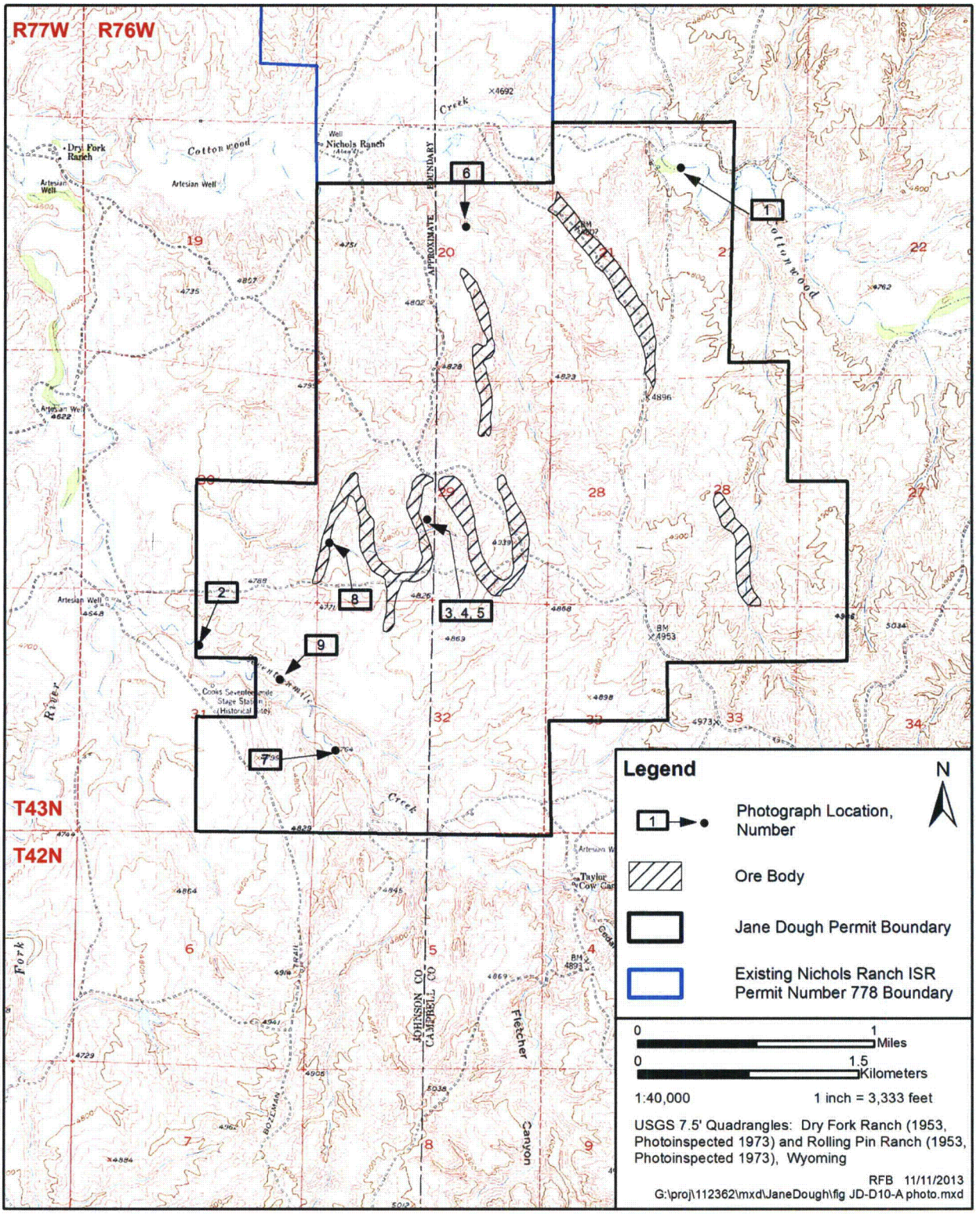
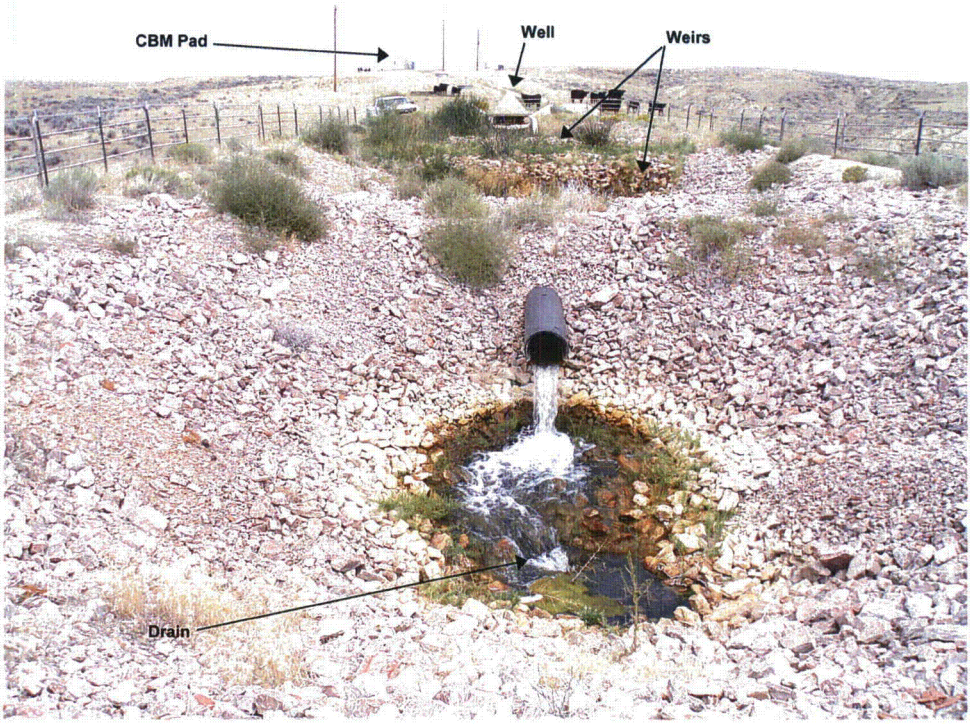


Figure JD-D10-A Location of Photographs, Jane Dough Unit, 2010 and 2012.

Photograph JD-D10-1 Site 1, Cottonwood Creek Drainage, Non-wetland.

Photograph JD-D10-2 Site 2, Seventeenmile Creek Wetland.

Photograph JD-D10-3 Site 3, a Man-induced Wetland, Looking South.



Photograph JD-D10-4 Looking North, a Fenced in Well Head Area with Weirs and Drain.

Photograph JD-D10-5 Looking South from Southern End of Site 3 Toward Constructed Pond, 2012.

Photograph JD-D10-6 Typical Intermittent/ephemeral Stream. Note: No Defined Bed/bank.

Photograph JD-D10-7 WUS #1, Seventeenmile Creek. Note: Defined Bed/bank.

Photograph JD-D10-8 WUS #3, Downstream from Site 3, Constructed Pond.

Photograph JD-D10-9 Typical CBM Pond, Non-Wetland, Jane Dough Project, 2010.

ADDENDUM JD-D10-B:
WETLAND DELINEATION FORMS

April 2014

WETLAND DETERMINATION DATA FORM – Great Plains Region (DRAFT)

Project/Site: Jane Dough / Site 1 City/County: Campbell Sampling Date: 7/9/2010
Applicant/Owner: Uranerz State: WY Sampling Point:
Investigator(s): Dan Hart / TRC Section, Township, Range: Sec 21 T43N, R76W
Landform (hillslope, terrace, etc.): drainage Local relief (concave, convex, none): concave Slope (%): <3%
Subregion (LRR): LRR-G Lat: Long: Datum:
Soil Map Unit Name: NWI classification: PEMA/PEMC/PEMA

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. Populus deltoides	<5%	N	FAC
2.			
3.			
4.			
Total Cover:	<5%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum			
1. Bromus inermis	10%	Y	UPL
2. Agropyron repens	5%	Y	FAC
3. Bromus tectorum	10%	Y	UPL
4. Thlaspi arvense	10%	Y	NI
5. Kochia scoparia	10%	Y	FAC
6. Cirsium arvense	5%	Y	FACU
7. Elymus elongatus	10	Y	UPL
8.			
Total Cover:	100%		
Woody Vine Stratum			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 0%

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 6 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 0.33 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	2	x 3 =	6
FACU species	1	x 4 =	4
UPL species	3	x 5 =	15
Column Totals:	6 (A)		25 (B)

Prevalence Index = B/A = 4.2

Hydrophytic Vegetation Indicators:
__ Dominance Test is >50%
__ Prevalence Index is ≤3.0[1]
__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: This site was managed as a haymeadow. In the past Smooth brome dominated the drainage Evidence of grazing. This site was mowed and harvested by the end of July 2010.

SOIL

Sampling Point: _____

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 of LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No _____

Remarks: No soil pit was dug due to the prevalence of non-hydrophytic vegetation

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Frost-Heave Hummocks (C11) **(LRR F)**
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Local Soil Survey Data (D8)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: This site is Cottonwood Creek. There are several excavated areas and irrigation ditches but all are vegetated - No evidence of recent irrigation or secondary indicators

WETLAND DETERMINATION DATA FORM – Great Plains Region (DRAFT)

Project/Site: Jane Dough / Site 2 City/County: Johnson Sampling Date: 7/9/2010

Applicant/Owner: Uranerz State: WY Sampling Point:

Investigator(s): Jan Hart / TRC Section, Township, Range: Sec 31 T43N R 76W

Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): <3 %

Subregion (LRR): LRR-G Lat: Long: Datum:

Soil Map Unit Name: NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?** Yes X No
Hydric Soil Present?	Yes X	No	
Wetland Hydrology Present?	Yes X	No	

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. Populus deltoides	<5%	N	FAC
2.			
3.			
4.			
Total Cover:	<5%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum			
1. Scirpus pungens	20%	Y	OBL
2. Spartina pectinata	5%	N	FACW
3. Scirpus acutus	5%	N	OBL
4. Alopecurus pratensis	30%	Y	FACW
5. Hordeum jubatum	20%	Y	FACW
6. Juncus balticus	10%	Y	OBL
7.			
8.			
Total Cover:	100%		
Woody Vine Stratum			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 0%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	3	x 1 =	3
FACW species	3	x 2 =	6
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	6 (A)		9 (B)

Prevalence Index = B/A = 1.5

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No

Remarks: The cottonwood trees are scattered around the edge of the Site.

SOIL

Sampling Point: _____

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/2						Sandy Loam	
2-18	10YR 3/2	80	7.5YR 5/6	20	D	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR F)
- ___ 1 cm Muck (A9) (LRR F, G, H)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- ___ 5 cm Mucky Peat or Peat (S3) (LRR F)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) (MLRA 72 & 73 of LRR H)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (LRR I, J)
- ___ Coast Prairie Redox (A16) (LRR F, G, H)
- ___ Dark Surface (S7) (LRR G)
- ___ High Plains Depressions (F16) (LRR H outside MLRA 72 & 73)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ____

Remarks: Some gleying observed

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Frost-Heave Hummocks (C11) (LRR F)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Local Soil Survey Data (D8)

Field Observations:

Surface Water Present? Yes X No ____ Depth (inches): 3

Water Table Present? Yes X No ____ Depth (inches): 0

Saturation Present? (includes capillary fringe) Yes X No ____ Depth (inches): 0

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: This site is located in Swanmile Creek. No channel was observed, however this site is irrigated. Not sure of water source.

WETLAND DETERMINATION DATA FORM – Great Plains Region (DRAFT)

Project/Site: Jane Dough / Site 3 City/County: Johnson Sampling Date: August 27, 2012

Applicant/Owner: Uranerz State: WY Sampling Point: _____

Investigator(s): Jan Hart Section, Township, Range: Sec 29, T43N, R76W

Landform (hillslope, terrace, etc.): hillslope depression Local relief (concave, convex, none): concave Slope (%): 2

Subregion (LRR): LRR-G Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation X, Soil X or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes _____ No X

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks: Water is supplied from overflowing ground water Well - This site would likely change to a non-wetland if water supply is shut off - Likely non-jurisdiction

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:			
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum			
1. Typha angustifolia	95%	Yes	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	95%		
Woody Vine Stratum			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 5%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species 1	x 1 = 1
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: 1 (A)	1 (B)

Prevalence Index = B/A = 1

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No _____

Remarks: Area grazed by cattle; portion of site void of vegetation and/or grazed to a stage that unable to determine species composition.

SOIL

Sampling Point: _____

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
surface	white frost	5%					sandy loam	Salt deposits on surface.
1-12"	10YR 3/1	80%	3/5GY	20%	RM	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 of LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ____

Remarks: Trampled by cattle, therefore difficult to assess soil profile - Soils gleyed and low chroma

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Frost-Heave Hummocks (C11) **(LRR F)**
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Local Soil Survey Data (D8)

Field Observations:

Surface Water Present? Yes X No ____ Depth (inches): 3 - 12

Water Table Present? Yes X No ____ Depth (inches): 0

Saturation Present? (includes capillary fringe) Yes X No ____ Depth (inches): 0

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Water from groundwater. Outlet pipe empties to a slight depression in a normally ephemeral drainage; water collects then flows overland to a constructed pond in an un-named drainage.

APPENDIX JD-D11:

RADIOLOGY

April 2014

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JD-D11.1 SURFACE SOIL, SUBSURFACE SOILS AND SEDIMENT

JD-D11.1.1 Purpose and Procedure

In September 2011 surface soil, subsurface soil, and sediment samples were collected throughout the Jane Dough Unit of Uranerz Energy Corporation's Nichols Ranch ISR Project. The purpose of the effort was to develop a representative radiological baseline for surface and subsurface soils and sediments.

The procedure that was employed to choose sample site locations and the number of samples followed the plan that was previously used in the uranium recovery license application for the Hank and Nichols Units. After completing a thorough reconnaissance of the proposed license area and delineating the general outline and location of the new wellfields and potential pipeline routes, the sample sites were mapped, using geographic information system (GIS), on a large-scale (1 inch = 1000 feet) U.S. Geological Survey topographic base map. Drainage features were analyzed in terms of their location within and adjacent to the wellfield areas. Sediment sample locations were then chosen on the basis of their potential to receive runoff from the wellfields.

In determining the number and distribution of sampling locations, pertinent Nuclear Regulatory Commission (NRC) documents were used, along with professional judgment and experience developing pre-operational and operational environmental monitoring programs for in situ recovery (ISR) operations. The primary documents included: (1) NRC Regulatory Guide 4.14 (1980); (2) NUREG-1569 (NRC 2003a); and (3) NUREG-1748 (NRC 2003b).

Regulatory Guide 4.14 is the document that provides specific information on a pre-operational radiological monitoring program. Table 1 in the guide, for example, lists the suggested number, type, location, and frequency of samples. However, because the guide is (1) somewhat dated (1980); (2) addresses conventional mills; and (3) has not yet been revised, Uranerz, as it did in its

previous application, employed a modified baseline sampling program designed for a contemporary ISR operation. In short, the sampling pattern was designed to thoroughly characterize those areas where activities will occur, as well as adjacent areas that could potentially be affected by the operation. In addition to the aforementioned information sources and approach, Uranerz took into account NRC's comments that were received via Requests for Additional Information (RAIs) during the licensing of its Hank and Nichols Units.

From a standpoint of physical disturbance (construction/operations/reclamation) and from potential radiological impacts, it is widely recognized that modern-day ISR operations do not have a significant impact on surface and subsurface soils and sediments.

There are three major reasons why impacts on soils/sediments from modern ISR operations are insignificant: (1) the recovery technique does not require the removal of overburden nor does it require physical removal of the ore zone; (2) it is a wet process up to the stage of drying and packaging; and (3) modern rotary vacuum dryers and packaging systems do not have significant particulate discharges. Thus in the absence of significant particulate sources, radiological impacts on soils and sediments through aerial dispersal and subsequent deposition are not associated with modern ISR operations. As discussed below, potential impact from uranium-loaded fluids are also insignificant. The long record of the ISR industry shows that potential radiological impacts are almost exclusively associated with accidental spills from pipeline leaks or ruptures that occur off of the process facility pad (i.e., within the wellfields or between the wellfields and the process facility).

Spills occurring on the process pad are fully contained by the curbed volume of the pad and its sump system. Experience has shown that an accidental spill from a pipe break in a wellfield does not necessarily result in a major impact on soils or sediments. Engineering controls and standard operating procedures (SOPs) have improved over the years and provide a high level of assurance that impacts will be minimal. To illustrate, a pipeline break would cause a loss in pressure and this would be quickly detected by the monitoring system. Corrective action would then immediately follow to minimize the loss of fluid and to assess the impact. In addition to engineering controls, employees who are in the wellfields on a daily basis are trained to observe

routinely the condition pipelines and wellheads. The Mine Plan has been revised through the SERP to incorporate the Benchmark approach. In this regard, spills that occur will be evaluated to determine prudence of reclamation at the time of the spill or at the time of decommissioning. Spills will be assessed using the radium benchmark dose and the unit rule at the time of decommissioning. Spills that result in a total effective dose in excess of 100 mrem per year analyzed through sampling and RESRAD modeling software will be cleaned up prior to decommissioning.

Knowing that potential impacts are attributed to pipeline ruptures and leaks, the pre-operational sampling program was designed to characterize radiological baseline conditions in the areas most likely to experience potential impacts. Exhibit JD-D11-2, Jane Dough Radiological Sample Location, shows that the focus of the baseline radiological characterization that was conducted on the wellfield areas and the intermittent/ephemeral streams passing through the proposed Jane Dough license expansion area. A close examination of the map shows that sediment samples were collected from upstream and downstream locations in all of the streambeds. In addition to thoroughly sampling the wellfields and intermittent water courses, the radiological baseline was supplemented by including samples from areas within the general license area (see sample sites labeled License Area Sample (or LAS) on Exhibit JD-D11-2), and at the air monitoring sites (see Air Sample Location JD-1 through JD-7 on Exhibit JD-D11-2). Again, using Regulatory Guide 4.14 for general guidance, all soils and sediments were analyzed for Ra-226 and a large percentage of the total number of samples included analyses for Uranium, Pb-210 and Th-230. The extensive coverage of the sampling effort provides a representative radiological baseline against which potential impacts can be measured.

JD-D11.1.2 Sampling Methodology

Using the GIS coordinates for the sample site locations on the map described above, field personnel were guided to the sampling sites. Surface and subsurface soils were collected with a 3-inch diameter bucket auger. Surface soils were collected from surface to a depth of 6-inches, and subsurface soils were collected intervals of 6-12 inches; 12-24; inches and 24-36 inches.

To avoid cross-contamination, the sampler and other tools were cleaned after each use with de-ionized water and paper towels. Samples were placed in 1-gallon plastic freezer bags and stored in ice chests prior to delivery to the laboratory. While collecting the soil samples, gamma measurements were taken using a Ludlum Model 19 μR Survey Meter. While holding the meter at waist level, the area at and proximate to the sample point was surveyed for approximately two minutes. Gamma levels were recorded along with the global positioning system coordinates for each site.

The procedure for collecting sediment samples varied slightly from the soil sampling methodology. Instead of a single incremental sample, several samples of approximate equal volume were collected around each site to form a composite sample. As with the soil samples, sediments were placed in 1-gallon plastic freezer bags and placed in ice chests prior to delivery to the laboratory. Gamma measurements were taken following the protocol just described.

JD-D11.1.3 Radiological Survey Results: Jane Dough Unit

JD-D11.1.3.1 Surface Soil

Table JD-D11-1, Surface Soil Radiological Baseline: Jane Dough Unit provides a summary of the analyses for each sample point as well as some basic statistical measures (minimum, maximum, average, and standard deviation).

The average background values are typical for surface soils in the U.S., averaging less than 1 pCi/g for Ra-226, Pb-210 and Th-230. According to (NCRP Report No.78), the average value of Ra-226 reported in surface soil is 1 pCi/g. The average Ra-226 background at the Jane Dough is a little lower but similar to a mean of 1.1 pCi/g background reported in a survey covering 33 states. Not surprising, the background at the Jane Dough and in the 33-state survey are similar to the natural values reported in sandstone (0.71 pCi/g), shale (1.1 pCi/g) and igneous rock (1.3 pCi/g). Similarly, the uranium values at the Jane Dough comport with typical natural background soils, which average approximately 2 pCi/g or 3 ppm (du Preez 1989; National

Table JD-D11-1 Surface Soils Radiological Baseline: Jane Dough Unit.

Sample Site	Depth (Inches)	Uranium (mg/kg*)	Pb-210 (pCi/g)	Precision Plus/Minus	Ra-226 (pCi/g)	Precision Plus/Minus	Th-230 (pCi/g)	Precision Plus/Minus
JD-1	0-6	1.16	1.0	0.1	0.8	0.06	0.5	0.2
JD-2	0-6	1.14	0.6	0.1	0.7	0.06	0.6	0.2
JD-3	0-6	1.80	0.7	0.1	0.7	0.05	0.6	0.2
JD-4	0-6	0.69	0.4	0.1	0.4	0.04	0.4	0.2
JD-5	0-6	0.75	0.3	0.1	0.4	0.04	0.4	0.2
JD-6	0-6	2.42	0.5	0.1	1.1	0.07	0.6	0.2
JD-7	0-6	2.32	1.3	0.1	0.9	0.06	0.8	0.3
LAS-1	0-6	1.80	0.6	0.1	0.9	0.06	0.8	0.3
LAS-2	0-6				1.0	0.06		
LAS-3	0-6				0.9	0.06		
LAS-4	0-6	1.40	0.6	0.1	1.0	0.06	0.7	0.2
LAS-5	0-6				1.0	0.07		
LAS-6	0-6				0.4	0.04		
LAS-7	0-6				0.6	0.05		
LAS-8	0-6				0.9	0.06		
LAS-9	0-6				0.9	0.06		
LAS-10	0-6				0.6	0.05		
LAS-11	0-6	1.06	1.0	0.1	0.6	0.05		
LAS-12	0-6				0.8	0.06		
LAS-13	0-6	1.39	1.0	0.1	0.7	0.05	0.7	0.2
LAS-14	0-6				0.4	0.04		
SS-1	0-6	1.25	0.7	0.1	0.9	0.06	0.9	0.3
SS-2	0-6				1.1	0.07		
SS-3	0-6				0.9	0.06		
SS-4	0-6				0.8	0.06		
SS-5	0-6	1.04	1.2	0.1	0.6	0.05	0.5	0.2
SS-6	0-6				0.8	0.06		
SS-7	0-6				0.7	0.05		
SS-8	0-6				0.5	0.04		
SS-9	0-6				0.6	0.05		
SS-10	0-6				0.8	0.05		
SS-11	0-6	2.17	1.2	0.1	0.8	0.05	0.7	0.2
SS-12	0-6				2.4	0.09		
SS-13	0-6				0.3	0.03		
SS-14	0-6				0.5	0.05		
SS-15	0-6				1.5	0.08		
SS-16	0-6				0.9	0.06		
SS-17	0-6	0.88	1.2	0.1	0.6	0.04	0.6	0.2
SS-18	0-6				0.8	0.05		
SS-19	0-6				0.6	0.05		
SS-20	0-6	1.16	0.8	0.1	0.7	0.05		
SS-21	0-6				0.8	0.06		
SS-22	0-6				0.9	0.06		
SS-23	0-6				0.7	0.06		
SS-24	0-6				0.9	0.06		
SS-25	0-6				0.6	0.05		
SS-26	0-6				0.8	0.06		
SS-27	0-6				0.4	0.04		
SS-28	0-6				0.5	0.04		

Table JD-D11-1 (continued)

Sample Site	Depth (Inches)	Uranium (mg/kg*)	Pb-210 (pCi/g)	Precision Plus/Minus	Ra-226 (pCi/g)	Precision Plus/Minus	Th-230 (pCi/g)	Precision Plus/Minus
SS-29	0-6				0.9	0.07		
SS-30	0-6				0.6	0.05		
SS-31	0-6	1.65	0.5	0.1	0.8	0.06	0.5	0.2
SS-32	0-6				1.1	0.09		
SS-33	0-6				0.7	0.05		
SS-34	0-6				0.6	0.05		
SS-35	0-6				0.6	0.06		
SS-36	0-6				1.0	0.06		
SS-37	0-6				0.6	0.05		
SS-38	0-6				0.8	0.05		
SS-39	0-6				0.7	0.05		
SS-40	0-6	1.17	1.2	0.1	0.7	0.05	0.4	0.2
SS-41	0-6				0.7	0.05		
SB-1**	0-6	1.18	0.3	0.1	0.6	0.05	0.8	0.3
	6-12	0.96	0.2	0.1	0.5	0.04	0.4	0.2
	12-24	0.78	0.2	0.1	0.4	0.04	0.3	0.1
	24-36	0.65	0.2	0.1	0.4	0.04	0.3	0.2
SB-2**	0-6				0.6	0.05		
	6-12				0.6	0.05		
	12-24				0.6	0.05		
	24-36				0.6	0.05		
SB-3**	0-6				0.7	0.05		
	6-12				0.6	0.05		
	12-24				0.6	0.05		
	24-36				0.7	0.05		
SB-4**	0-6	1.34	1.0	0.1	0.6	0.05	0.5	0.2
	6-12	1.30	0.4	0.1	1.1	0.07	0.5	0.2
	12-24	1.28	0.4	0.1	0.6	0.05	0.3	0.1
	24-36	1.13	0.5	0.1	0.6	0.04	0.5	0.2
SB-5**	0-6	1.09	0.5	0.1	0.8	0.05	0.7	0.2
	6-12	1.17	0.6	0.1	0.9	0.06	0.8	0.3
	12-24	1.29	0.8	0.1	0.9	0.06	0.6	0.2
	24-36	2.15	0.8	0.1	1.0	0.06	0.9	0.3
SB-6**	0-6				0.8	0.06		
	6-12				0.9	0.06		
	12-24				0.8	0.05		
	24-36				0.8	0.06		
SB-7**	0-6				0.7	0.05		
	6-12				0.5	0.05		
	12-24				0.6	0.06		
	24-36				0.6	0.05		
SB-8**	0-6				0.6	0.05		
	6-12				0.8	0.06		
	12-24				0.3	0.03		
	24-36				0.3	0.03		
SB-9**	0-6				0.6	0.05		
	6-12				0.5	0.05		
	12-24				0.5	0.05		
	24-36				0.6	0.05		

Table JD-D11-1 (continued)

Sample Site	Depth (Inches)	Uranium (mg/kg*)	Pb-210 (pCi/g)	Precision Plus/Minus	Ra-226 (pCi/g)	Precision Plus/Minus	Th-230 (pCi/g)	Precision Plus/Minus
SB-10**	0-6	1.20	0.4	0.1	0.7	0.05	0.5	0.2
	6-12	1.40	0.3	0.1	0.5	0.05	0.3	0.2
	12-24	1.63	0.4	0.1	0.2	0.03	0.4	0.2
	24-36	2.18	0.5	0.1	0.3	0.04	0.3	0.2
SB-11**	0-6				0.8	0.06		
	6-12				0.8	0.06		
	12-24				0.7	0.05		
	24-36				0.7	0.06		
SB-12**	0-6				0.8	0.05		
	6-12				0.8	0.05		
	12-24				0.7	0.05		
	24-36				0.7	0.05		
SB-13**	0-6	1.35	0.6	0.1	0.8	0.06	0.6	0.2
	6-12	1.65	0.5	0.1	0.7	0.05	0.6	0.2
	12-24	2.19	0.5	0.1	0.7	0.05	0.8	0.2
	24-36	4.01	0.9	0.1	0.9	0.06	0.7	0.2
Surface Soil:								
Minimum		**0.69**	**0.3**		**0.3**		**0.4**	
Maximum		**2.42**	**1.3**		**2.4**		**0.9**	
Average		**1.37**	**0.8**		**0.8**		**0.6**	
Standard Deviation		**0.46**	**0.3**		**0.3**		**0.1**	
Subsurface Soil:								
Minimum		**0.65**	**0.2**		**0.2**		**0.3**	
Maximum		**4.01**	**0.9**		**1.1**		**0.9**	
Average 6-12		**1.30**	**0.4**		**0.7**		**0.5**	
Average 12-24		**1.43**	**0.5**		**0.6**		**0.5**	
Average 24-36		**2.02**	**0.6**		**0.6**		**0.6**	

Note:
*Reporting Limit: 0.02 mg/kg dry.

Council on Radiation Protection and Measurement 1984). Although the single 2.4 pCi/g Ra-226 sample reported at sample site SS-12 is somewhat above the average found at the site, it is not outside the natural range of background Ra-226 in soils. However, it could also be an outlier or a reflection of uranium exploration activity. Although the 2+ mg/kg uranium values at JD-6, JD-7 and SS-11 are above the average at the site, these levels are in line with the 3 ppm average for U.S. soils. Another factor that may cause isolated values to exceed general background averages in the U.S. can be attributed to outcropping of mineralized formations. The Wasatch Formation, which contains uranium and radium, is known to outcrop in areas of the Jane Dough project area, and the elevated samples could well be a reflection of outcropping. One additional

comparison (see table below) shows that the values reported for the Jane Dough Unit are also in agreement with values previously reported for the Hank and Nichols Units. The averages presented in the summary table are based on 156 surface soil samples that were collected throughout the project area. Because the averages in all three unit areas are consistent, and because they compare favorably with averages reported in the literature for surface soils, it can be concluded that the soils are representative of natural background conditions.

	Radiological Background: Average Values			
Mine	**Uranium**	**Pb-210**	**Ra-226**	**Th-230**
Unit	(mg/kg)	(pCi/g)	(pCi/g)	(pCi/g)
Jane Dough Unit	1.37	0.8	0.8	0.6
Hank Unit	1.73	0.4	1.0	0.6
Nichols Ranch Unit	1.69	0.7	0.9	0.6

JD-D11.1.3.2 Subsurface Soil

As can be seen from Exhibit JD-D11-2 Jane Dough Radiological Sample Location Map, subsurface soil was sampled at 13 different locations. Samples were collected from subsurface intervals of 6-12 inches, 12-24 inches and 24-36 inches. All samples were analyzed for Ra-226 and, although Regulatory Guide 4.14 recommends analyzing a single set for uranium, Pb-210 and Th-230, five sets (SB-1, SB-4, SB-5, SB-10 and SB-13) were analyzed for the additional constituents. The sampling approach was designed to obtain Ra-226 values throughout all of the wellfields and a full set of analyses from each of the five wellfield areas.

The results of the sampling effort are summarized in Table JD-D11-2, and Table JD-D11-3 provides a comparison of the values by depth and site location. The subsurface average uranium values of 1.30 mg/kg and 1.43 mg/kg in the 6-12 and 12-24 inch intervals, respectively, are consistent with the 1.37 mg/kg average reported for the 0-6 inch average in surface soil at the site. However, the 24 to 36 inch interval has an average value of 2.02 mg/kg. This elevated average can be traced to the contribution of a single high value of 4.01 mg/kg at sample site SB-13. As can be seen from Tables JD-D11-2 and JD-D11-3, all other values are much lower and in line with the numerous other values reported across the site. As noted previously, outcropping from the Wasatch Formation can cause local uranium and radium values to be

Table JD-D11-2 Radiological Background in Sediment – Jane Dough Unit.

Sample Site	Uranium (mg/kg*)	Pb-210 (pCi/g)	Precision Plus/Minus	Ra-226 (pCi/g)	Precision Plus/Minus	Th-230 (pCi/g)	Precision Plus/Minus
SD-1	1.37	1.4	0.1	0.9	0.06	0.4	0.2
SD-2	1.84	0.8	0.1	0.7	0.05	0.7	0.2
SD-3	1.57	1.7	0.1	0.8	0.06	0.5	0.2
SD-4	2.15	2.4	0.2	0.9	0.06	0.7	0.2
SD-5	1.94	2.1	0.2	1.0	0.06	0.6	0.2
SD-6	1.51	1.5	0.1	0.7	0.05	0.6	0.2
SD-7	1.62	2.4	0.2	0.8	0.05	0.9	0.3
SD-8	1.92	0.7	0.1	0.6	0.05	0.5	0.2
SD-9	2.77	1.3	0.1	0.6	0.04	0.7	0.2
SD-10	3.40	1.1	0.2	0.7	0.05	0.6	0.2
SD-11	8.93	2.0	0.2	0.7	0.05	0.4	0.2
SD-12	1.20	0.7	0.1	0.5	0.04	0.7	0.2
SD-13	1.76	1.3	0.1	0.9	0.06	0.4	0.2
SD-14	1.38	1.6	0.1	1.0	0.07	0.5	0.2
SD-15	2.10	0.8	0.1	1.1	0.07	0.6	0.2
SD-16	9.21	1.8	0.2	0.8	0.05	0.5	0.2
SD-17	1.58	2.8	0.2	0.7	0.05	0.5	0.2
SD-18	1.49	1.3	0.1	0.7	0.05	0.5	0.2
SD-19	1.69	2.4	0.1	1.0	0.07	0.8	0.3
Minimum	**1.20**	**0.7**		**0.5**		**0.4**	
Maximum	**9.21**	**2.8**		**1.1**		**0.9**	
Average	**2.60**	**1.6**		**0.8**		**0.6**	
Standard Deviation	**2.34**	**0.6**		**0.2**		**0.1**	
Hank	**2.38**	**1.0**		**1.2**		**0.6**	
Nichols	**2.34**	**1.3**		**9.6**		**.06**	

Notes:
SD = Sediment.
*Reporting Limit: 0.02 mg/kg dry.
See Exhibit D11-2 for sample locations.
Radionuclide methods are as follows: Radium 226-E903.0, Uranium-SW6020, Lead 210-NERHL-65-4, Thorium 230-E907.0.

greater than general U.S. averages. Given this, the 4.01 mg/kg value may well be reflection of the presence of the Wasatch Formation. With respect to the other radionuclides, all of the averages are tightly grouped and consistent with typical background. As shown in Table JD-D11-3, the average values (pCi/g) have the following ranges: Pb-210 (0.4 to 0.6); Ra-226 (0.6 to 0.7); and Th-230 (0.5 to 0.5). In summary the values are consistent and within the range of background expected in U.S. soils.

Table JD-D11-3 Subsurface Soil Radiological Baseline Comparison by Depth and Sample Site: Jane Dough Unit.

	Uranium	**Uranium**	**Uranium**	**Pb-210**	**Pb-210**	**Pb-210**
Sample Site	6 to 12" (mg/kg)	12 to 24" (mg/kg)	24 to 36" (mg/kg)	6 to 12" (pCi/g)	12 to 24" (pCi/g)	24 to 36" (pCi/g)
SB-1	0.96	0.78	0.65	0.2	0.2	0.2
SB-4	1.30	1.28	1.13	0.4	0.4	0.5
SB-5	1.17	1.29	2.15	0.6	0.8	0.8
SB-10	1.40	1.63	2.18	0.3	0.4	0.5
SB-13	1.62	2.19	4.01	0.5	0.5	0.9
Avg.	**1.30**	**1.43**	**2.02**	**0.4**	**0.5**	**0.6**

	Ra-226	**Ra-226**	**Ra-226**	**Th-230**	**Th-230**	**Th-230**
Sample Site	6 to 12" (pCi/g)	12 to 24" (pCi/g)	24 to 36" (pCi/g)	6 to 12" (pCi/g)	12 to 24" (pCi/g)	24 to 36" (pCi/g)
SB-1	0.5	0.4	0.4	0.4	0.3	0.3
SB-2	0.6	0.6	0.6	0.5	0.3	0.5
SB-3	0.6	0.6	0.7	0.8	0.6	0.9
SB-4	1.1	0.6	0.6	0.3	0.4	0.3
SB-5	0.9	0.9	1.0	0.6	0.8	0.7
SB-6	0.9	0.8	0.8			
SB-7	0.5	0.6	0.6			
SB-8	0.8	0.3	0.3			
SB-9	0.5	0.5	0.6			
SB-10	0.5	0.2	0.3			
SB-11	0.8	0.7	0.7			
SB-12	0.8	0.7	0.7			
SB-13	0.7	0.7	0.9			
Avg.	**0.7**	**0.6**	**0.6**	**0.5**	**0.5**	**0.5**

JD-D11.1.3.3 Sediment

Baseline radionuclides in sediments at the Jane Dough Unit are generally similar to those measured at the Hank and Nichols Units. A comparison of the averages at the three sites is provided in the table below. With regard to uranium, the averages are closely matched but the slightly higher average at Jane Dough was influenced by two anomalous values recorded at sample sites SD-11 and SD-16. As shown on Table JD-D11-4, these two sites have values of 8.93 mg/kg and 9.21 mg/kg, respectively. Although the Hank Unit did not have any values approaching 9 mg/kg, it had four values greater than 3 mg/kg, compared to the single 3+ value at

Table JD-D11-4 Radiological Baseline in Sediments: Jane Dough Unit.

Sample	Uranium	Pb-210	Ra-226	Th-230
Site	(mg/kg)	(pCi/g)	(pCi/g)	(pCi/g)
SD-1	1.37	1.4 +/-0.1	0.9 +/-0.06	0.4 +/-0.2
SD-2	1.84	0.8 +/-0.1	0.7 +/-0.05	0.7 +/-0.2
SD-3	1.57	1.7 +/-0.1	0.8 +/-0.06	0.5 +/-0.2
SD-4	2.15	2.4 +/-0.2	0.9 +/-0.06	0.7 +/-0.2
SD-5	1.94	2.1 +/-0.2	1.0 +/-0.06	0.6 +/-0.2
SD-6	1.51	1.5 +/-0.1	0.7 +/-0.05	0.6 +/-0.2
SD-7	1.62	2.4 +/-0.2	0.8 +/-0.05	0.9 +/-0.3
SD-8	1.92	0.7 +/-0.1	0.6 +/-0.05	0.5 +/-0.2
SD-9	2.77	1.3 +/-0.1	0.6 +/-0.04	0.7 +/-0.2
SD-10	3.40	1.1 +/-0.2	0.7 +/-0.05	0.6 +/-0.2
SD-11	8.93	2.0 +/-0.2	0.7 +/-0.05	0.4 +/-0.2
SD-12	1.20	0.7 +/-0.1	0.5 +/-0.04	0.7 +/-0.2
SD-13	1.76	1.3 +/-0.1	0.9 +/-0.06	0.4 +/-0.2
SD-14	1.38	1.6 +/-0.1	1.0 +/-0.07	0.5 +/-0.2
SD-15	2.10	0.8 +/-0.1	1.1 +/-0.07	0.6 +/-0.2
SD-16	9.21	1.8 +/-0.2	0.8 +/-0.05	0.5 +/-0.2
SD-17	1.58	2.8 +/-0.2	0.7 +/-0.05	0.5 +/-0.2
SD-18	1.49	1.3 +/-0.1	0.7 +/-0.05	0.5 +/-0.2
SD-19	1.69	2.4 +/-0.1	1.0 +/-0.07	0.8 +/-0.3
Minimum	1.20	0.7	0.5	0.4
Maximum	9.21	2.8	1.1	0.9
Average	**2.60**	**1.6**	**0.8**	**0.6**
Stdev	2.34	0.6	0.2	0.1
Hank Unit	**2.38**	**1.0**	**1.2**	**0.6**
Nichols Ranch	**2.34**	**1.3**	**9.6**	**0.6**

*Reporting Limit: 0.02 mg/kg-dry.

Jane Dough. Because of this, the two averages are not far apart. Similarly, although the Nichols Ranch Unit did not have any values approaching 9 mg/kg, it had a value over 4 mg/kg and a 2.73 mg/kg value. Also because there are many fewer sample points at the Nichols Unit compared to the Jane Dough Unit (10 vs. 19), the average at the Nichols Ranch Unit is more strongly influenced by higher values.

With respect to Pb-210, the background average slightly exceeds the averages at the Hank and Nichols Units. The reason for this can be attributed to the number of samples (5 in total) that have values greater than 2 pCi/g. By comparison, the Hank and Nichols sites each had only one

value greater than 2 pCi/g. It is difficult to say why the frequency of Pb-210 above 2 pCi/g is greater at the Jane Dough Unit than the Hank and Nichols Units. All three sites share a common history of land use, which includes exploration and development of shallow coal bed methane and the exploration of uranium.

	Average Values In Sediments			
	Uranium	**Pb-210**	**Ra-226**	**Th-230**
Sample Location	(mg/kg)	(pCi/g)	(pCi/g)	(pCi/g)
Jane Dough Unit	2.60	1.6	0.8	0.6
Hank Unit	2.38	1.0	1.2	0.6
Nichols Ranch	2.34	1.3	9.6	0.6

Referring again to Table JD-D11-4 it can be seen that Ra-226 values at the Jane Dough Unit are very much in line with values typically reported in the U.S. The values are for the most part at or below 1 pCi/g. The average of 0.8 pCi/g for the Jane Dough Unit is just below the 1.2 pCi/g value measured at the Hank Unit. As reported in the original license application, approximately 40% of the Ra-226 values at the Nichols Ranch Unit were in excess of typical background and therefore a comparison cannot be made with the Jane Dough. Lastly, there is little to say with regard to the values for Th-230 other than they are normal baseline values for U.S. soils, and the averages for Jane Dough, Hank and Nichols Ranch Units are all the same (0.6 pCi/g).

JD-D11.2.0 BASELINE GAMMA SURVEY

JD-D11.2.1 PURPOSE AND PROCEDURE

Baselines serve as a backdrop against which operational impacts can be measured. Baselines also serve as targets for reclamation goals, which in turn are eventually used for license termination and site release to unrestricted use. The procedure for establishing gamma background at the Jane Dough Unit followed is the procedure employed during previous gamma surveying for the Hank and Nichols Ranch Units.

The gamma survey that was performed for the project site differs in pattern from the survey described in Regulatory Guide 4.14. The layout of the pattern given in the guide is based on a conventional mine and mill, which have significant particulate source terms. Particulate sources at ISR facilities are negligible because of the vast difference between ISR and conventional mining and milling, a procedure was used to measure baseline gamma levels in a more concentrated pattern, in the areas where operational activities will occur.

Referring back to the discussion in the soils section, it was noted that potential impacts on soils and sediments from ISR operations are attributed to accidental spills from pipeline breaks or leaks. This aspect of potential impact served as a major guide in the baseline sampling pattern for soils, sediments and gamma. In addition to the large number of gamma readings taken throughout the proposed wellfield areas at the Jane Dough Unit, readings were also taken at the sediment sampling locations in the drainages passing through the proposed license area; the air monitoring sites; the nearest residences; and the vegetation sampling sites. Exhibit JD-D11-2 (see map pocket) shows the gamma sample site locations.

JD-D11.2.1 Survey Methodology

A Ludlum Model 19 μR Survey Meter was the instrument used in the gamma survey. As described in the soils section of the application, a sample site map was developed prior to conducting the survey. Gamma sample site locations are shown on Exhibit JD-D11-2 (see map

pocket). Gamma measurements were recorded by holding the meter at waist level and slowly passing it over each sample point and over the area proximate to the sample location.

JD-D11.2.2 Jane Dough Unit Gamma Survey Results

Table JD-D11-5 provides a summary of the gamma measurements. A review of the table shows a range of 4 μR/hr (13 to 17 μR/hr) for the surface soil locations and the same 4 μR/hr range (14 to 18 μR/hr) for the sediment sample sites. The high end range for the surface soil locations is represented by a single reading of 17 μR/hr at LAS-13. Similarly, only two sediment sample locations support the 18 μR/hr top range value. Most of the values are within 14 to 16 μR/hr, and the averages for the surface soil sites and the sediment locations are 15 and 16 μR/hr, respectively. The averages at the Jane Dough Unit are a little higher but similar to the 13 μR/hr average measured at the Hank and Nichols Ranch Units.

In summary, the density of the survey and its consistent values provide reasonable assurance that a representative baseline was established.

Table JD-D11-5 Gamma Survey Results: Jane Dough Unit.

Sample Site	Gamma (μR/hr)	Sample Site	Gamma (μR/hr)	Sample Site	Gamma (μR/hr)	Sample Site	Gamma (μR/hr)
Random 1*	14	LAS-8	15	SS-10	16	SS-26	15
Random 2*	16	LAS-9	15	SS-11	15	SS-27	16
JD-1	14	LAS-10	13	SS-12	16	SS-28	14
JD-2	14	LAS-11	16	SS-13	14	SS-29	13
JD-3	16	LAS-12	14	SS-14	15	SS-30	15
JD-4	13	LAS-13	17	SS-15	15	SS-31	13
JD-5	13	LAS-14	14	SS-16	16	SS-32	14
JD-6**	15	SS-1	14	SS-17	14	SS-33	15
JD-7**	15	SS-2	14	SS-18	14	SS-34	15
LAS-1	15	SS-3	15	SS-19	14	SS-35	16
LAS-2	16	SS-4	15	SS-20	13	SS-36	16
LAS-3	16	SS-5	15	SS-21	14	SS-37	14
LAS-4	14	SS-6	16	SS-22	15	SS-38	15
LAS-5	15	SS-7	15	SS-23	14	SS-39	16
LAS-6	14	SS-8	14	SS-24	15	SS-40	15
LAS-7	14	SS-9	14	SS-25	15	SS-41	15
SB-1	15	SD-1	15	SD-14	16	--	--
SB-2	15	SD-2	14	SD-15	14	--	--

Table JD-D11-5 (Continued)

Sample Site	Gamma (µR/hr)	Sample Site	Gamma (µR/hr)	Sample Site	Gamma (µR/hr)	Sample Site	Gamma (µR/hr)
SB-3	15	SD-3	15	SD-16	14	--	--
SB-4	15	SD-4	17	SD-17	18	--	--
SB-5	15	SD-5	15	SD-18	15	--	--
SB-6	15	SD-6	16	SD-19	16	--	--
SB-7	14	SD-7	18	--	--	--	--
SB-8	15	SD-8	15	--	--	--	--
SB-9	16	SD-9	17	--	--	--	--
SB-10	14	SD-10	17	--	--	--	--
SB-11	15	SD-11	16	--	--	--	--
SB-12	16	SD-12	15	--	--	--	--
SB-13	16	SD-13	17	--	--	--	--
Average						**15**	**16**
Minimum						**13**	**14**
Maximum						**17**	**18**

Notes:

*Random 1 and 2 are additional vegetation sample sites.
**Nearest residences.
JD-1 through 7: gamma exposure rate/air/vegetation sample sites.
SS: Surface Soil Site
SB: Subsurface Soil Site
SD: Sediment Sample Site
LAS: License Area Sample Site

JD-D11.3.0 BASELINE RADON-222 AND GAMMA EXPOSURE RATES

JD-D11.3.1 PURPOSE AND PROCEDURE

As described in discussions on soil, sediment, and gamma baselines, although ISR operations do not generate significant levels of particulates, they do have Rn-222 emissions, which include radon daughter products with varying half-lives. For this reason, ambient baseline Rn-222 levels should be established. In establishing the baseline, the monitoring procedure outlined in Regulatory Guide 4.14 was followed, and it involved deploying Rn-222 detectors and gamma dosimeters at suggested locations.

JD-D11.3.1 Survey Methodology

Landauer Extra Sensitive Outdoor Rn-222 Detectors and X-9 Gamma Dosimeters were deployed at seven monitoring sites (JD-1 through JD-7). Detectors were placed at the two nearest residence locations (JD-6NR-2 and JD-7NR-1) and the remaining five were located as shown on Exhibit JD-D11-2. The five detectors were located at or near the following locations: (1) the proposed license boundary; (2) a control site (upwind and removed from operational activities); and (3) in the prevailing downwind direction.

JD-D11.3.2 Jane Dough Unit Results

Monitoring covered a full year beginning in the third quarter of 2010 and ending in the second quarter of 2011. The results of the baseline year are summarized in Table JD-D11-6. A review of the table shows that the third quarter had the highest average (0.9 pCi/l) and the first quarter had the lowest average (0.3 pCi/l). It is also interesting to note that five of the seven sites had readings greater than 1.0 pCi/l during the third quarter while all of the sites had values well below 1.0 pCi/l throughout the remaining three quarters. A similar result was recorded at the Hank and Nichols Ranch Units when baseline surveys were conducted.

To illustrate, the first and third quarter averages for all five monitoring locations at the Hank and Nichols Ranch Units are summarized as follows.

Radon-222 Quarterly Averages: Hank Unit and Nichols Ranch Unit

Hank Unit	Nichols Ranch Unit
1st Quarter: 0.6 pCi/l	1st Quarter: 0.8 pCi/l
3rd Quarter: 1.9 pCi/l	3rd Quarter: 1.4 pCi/l

Table JD-D11-6 Baseline Radon-222 at the Jane Dough Unit.

	Third Quarter 2010 (pCi/l)	**Fourth Quarter 2010** (pCi/l)	**First Quarter 2010** (pCi/l)	**Second Quarter 2010** (pCi/l)	**Average by Site** (pCi/l)
JD-1	1.0 +/- 0.09	0.6+/-0.05	0.3 +/-0.04	0.6 +/-0.05	**0.6**
JD-2	1.2 +/-0.10	0.5+/-0.05	0.3 +/-0.04	0.7 +/-0.06	**0.7**
JD-3	0.7 +/-0.07	0.6+/-0.06	0.3 +/-0.04	0.6 +/-0.05	**0.6**
JD-4	0.6 +/-0.07	0.7+/-0.06	0.5 +/-0.05	0.4 +/-0.04	**0.6**
JD-5	1.0 +/-0.09	0.6+/-0.05	0.4 +/-0.04	0.6 +/-0.05	**0.7**
JD-6/NR-2*	1.1 +/-0.09	0.6+/-0.06	0.3 +/-0.04	0.7 +/-0.06	**0.7**
JD-7/NR-1*	1.1 +-/0.10	0.8+/-0.07	0.3 +/-0.04	0.5 +/-0.05	**0.7**
Average	**1.0**	**0.6**	**0.3**	**0.6**	

Notes: *Nearest residence upwind and downwind.
U.S. average outdoor Rn-222 level: 0.4 pCi/l (U.S. EPA).

Although the second quarter average at the Nichols site was slightly higher than the third quarter (1.6 pCi/l vs.1.4 pCi/l), a sample location in the second quarter had a single high value of 2.3 pCi/l which raised the average. If the value had been closer to the values of 0.6 pCi/l and 1.4 pCi/l that were measured at that location during other quarters, the third quarter average would have been the highest as is was at Hank and Jane Dough. The apparent cycle of higher values occurring in the third quarter and the lower values in the first quarter could likely be the result of weather conditions. The first quarter is usually the months of colder weather with snow cover which adds another barrier; whereas the third quarter is generally the months of warmer and drier weather. The colder months tend to suppress radon exhalation rates, while the warmer

months tend to increases the emanation rate. In addition, radon exhalation rates fluctuate with wet and dry soil conditions and with changes in vegetative cover. This explanation is further supported by the fact that highest and lowest values are not found at a single site; instead, the highest and lowest values vary with the time of year.Table JD-D11-6 also shows the annualized average for all locations combined as being 0.6 pCi/l. This average is lower than the averages of 1.0 pCi/l and 1.2 pCi/l recorded at the Hank and Nichols Ranch Units, respectively. The range of the averages at all three units are consistent with values found in the U.S. Background radon varies considerable in the U.S. due to factors such as soil and rock types and the presence of naturally occurring uranium. The 0.6 pCi/l average measured at the Jane Dough Unit is consistent with but slightly above the U.S. average outdoor Rn-222 level of 0.4 pCi/l (U.S. EPA).

JD-D11.3.3 Background Gamma Exposure Rate

Background gamma exposure rates from the one year monitoring in the Jane Dough Unit are summarized in Table JD-D11-7. The quarterly average for all seven sites ranged from 11.3 mrem (second quarter 2011) to 45.8 mrem (fourth quarter 2010). When compared to previous baseline surveys at the Hank and Ranch Nichols Ranch, the quarterly averages for all monitoring locations ranged from 34.4 mrem to 55.0 mrem (Hank) and 35.0 mrem to 47.9 mrem (Nichols Ranch). An additional comparison can be made to values from an even earlier baseline that was developed for the nearby North Butte project. The quarterly averages from North Butte ranged from 32.3 mrem to 39.7 mrem (Pathfinder Mines Corporation 1988).

Although there is a high level of consistency between the 3rd, 4th, and 1st quarters of data from the Jane Dough Unit, the 2nd quarter is significantly below (approximately 72% lower) the 39.4 mrem average of the other three quarters combined. Also, the spread between the 11.3 mrem recorded during the second quarter at Jane Dough compared to the values from Hank and Nichols (50.5 mrem and 47.9 mrem, respectively) exceeds 35 mrems. Because the second quarter values at Jane Dough appear to be somewhat low, the averages shown on Table JD-D11-7 are approximately 7 mrems too low. The ~7 mrem estimate was derived by comparing the average for all of the Jane Dough values from three quarters (39.7 mrem) and

Table JD-D11-7 Baseline Gamma Exposure Rate at the Jane Dough Unit Air Monitoring Stations.

Sample Site	Third Quarter 2010 (mrems)	Fourth Quarter 2010 (mrems)	First Quarter 2011 (mrems)	Second Quarter 2011 (mrems)	Average by Site (mrems)
JD-1	34.7	45.0	44.5	11.0	33.8
JD-2	38.8	45.1	38.0	11.3	33.0
JD-3	33.9	46.9	34.0	10.9	31.4
JD-4	30.8	42.7	34.7	11.8	30.0
JD-5	35.0	45.9	33.0	11.5	31.4
JD-6/NR-2*	37.4	49.4	38.4	10.9	34.0
JD-7/NR-1*	36.2	45.7	38.0	11.5	32.9
Average	**35.3**	**45.8**	**37.2**	**11.3**	**32.4**
Nichols Ranch	**39.6**	**35.0**	**47.5**	**47.9**	**42.5**
Hank	**41.5**	**34.4**	**55.0**	**50.5**	**45.4**

Notes: *Nearest residence upwind and downwind.
Minimum detectable dose equivalent: 0.10 mrem

comparing this value to the 32.4 mrem average that includes the second quarter data. The 39.7 mrem value is much more consistent with the 42.5 to 45.4 mrem average recorded for Nichols Ranch and the Hank Unit.

Apart from the comparisons just noted, the average values recorded the three project sites of approximately 40 to 45 mrem/year can be put into a better perspective when compared to the following:

- Average dose to the U.S. Public from natural sources: 300 mrem/year.
- Background radiation (total) in the Colorado Plateau: 75 to 140 mrem/year.
- Terrestrial background (Rock Mountains): 40 mrem/year.
- Average dose to the public from all sources: 360 mrem/year

As the comparison shows, the average background at the project site is very similar to terrestrial background (Rocky Mountains) of 40 mrem/year.

JD-D11.4.0 FLORA AND FAUNA

JD-D11.4.1 PURPOSE AND PROCEDURE

According to Section 2.1.4 in Regulatory Guide 4.14, vegetation, food and fish samples should be collected if, in individual licensing cases, a significant pathway to man is identified. As discussed previously in this report, pathways for significant radiological contaminants to enter the environment from current-day ISR operations have been nearly eliminated. ISR operations do not have fluid discharges nor do they generate significant particulate emissions. The main avenue for radiological constituents to enter the environment is limited to the emission of Rn-222. Because emissions are restricted to nearly-particulate-free Rn-222, significant buildup of radionuclides in soil, vegetation and other media is not likely to occur. The minimal accumulation of radionuclides is supported by MILDOS modeling results, and is borne out in the required operational monitoring data that had been collected at ISR facilities over the past 30 years.

The baseline sampling program for the Jane Dough Unit closely followed the approach used in the license application for the Hank and Nichols Ranch Units. It will be recalled that the program was modified from the guidance given in Regulatory Guide 4.14. Departure from the guide is discussed in the Methods Section below. While developing the pre-operational baseline studies, it was understood through experience and through the evolution of ISR, that pathways to flora and fauna are not significant. As noted above, all ISR facilities were required to conduct routine operational monitoring throughout their operational life. Monitoring included measuring radionuclides in vegetation and soils. The long operational record (lab reports on vegetation and soil sampling) at ISR facilities shows that there was no significant accumulation of radionuclides in soil or vegetation.

Even though potential impacts from ISR operations on flora, fauna, and the food chain have been shown to be insignificant, good baseline characterizations continue to be an important and necessary part of a license application. Baseline values can be compared to values during actual operations to validate the minimal to no-impact of the project.

JD-D11.4.1 Methods

According to the field reconnaissance, no permanent surface water exists at or immediately adjacent to the site. Given the absence of water, fish are absent. The site was surveyed for the presence a crop-growing areas and none was found. Agricultural activities appear to be limited to cattle grazing. Although the guide suggests sacrificing livestock to obtain samples, it is Uranerz's opinion that this is not necessary for modern ISR operations. Lacking a pathway for a source term of sufficient strength, grazing animals will not be exposed in a meaningful way.

Based on the existing land use, samples were collected from wildlife browsing/grazing areas (Random-1 and Random-2 sites); the nearest residences (JD-6 and JD-7); and at the Rn-222/gamma/air monitoring sites (JD-1 through JD-5). Exhibit JD-D11-2 show the sample site locations. Samples were collected in September 2011 and delivered to the laboratory within 24 hours of collection. While collecting the samples, care was taken to clip the vegetation approximately one inch above the ground to avoid mixing with surface soil. All samples were analyzed for Uranium, Pb-210, Ra-226 and Th-230.

JD-D11.4.2 Jane Dough Unit Results

Table JD-D11-8 summarizes of the laboratory analyses for the vegetation samples collected in the Jane Dough Unit. Although there is the usual variation, the values are within normal background ranges. To illustrate the consistency in the background values, a comparison was made with the baseline previously established for the Hank and Nichols Ranch Units. As can be seen from Table JD-D11-9, the averages for all three sites are in close agreement.

JD-D11.5.0 RADON FLUX

Regulatory Guide 4.14 indicates that radon flux measurements should be conducted at eight locations within 1.5 km of the site. Because there will be no tailings impoundments or evaporation ponds in the Jane Dough Unit, radon flux is not an applicable radiological parameter for baseline characterization.

Table JD-D11-8 Radiological Baseline Values in Vegetation: Jane Dough Unit.

Sample Site	Uranium (µCi/kg)	Pb-210 (µCi/kg)	Ra-226 (µCi/kg)	Th-230 (µCi/kg)
JD-1	2.7E-05+/- 3.7E-07*	2.1E-04+/- 4.7E-06	4.3E-06+/- 8.9E-07	2.1E-06+/- 3.0E-06
JD-2	5.5E-05+/- 2.0E-07*	5.8E-04+/- 8.7E-06	1.1E-05+/-1.6E-06	7.4E-06+/- 4.7E-06
JD-3	5.8E-05+/- 2.0E-07*	7.4E-04+/- 1.0E-05	2.4E-05+/-2.5E-06	2.5E-05+/- 8.9E-06
JD-4	5.9E-05+/- 2.0E-07*	4.1E-04+/- 8.4E-06	8.4E-06+/-1.6E-06	5.5E-06+/- 4.7E-06
JD-5	3.4E-05+/- 2.0E-07*	2.1E-04+/- 6.7E-06	1.0E-05+/-1.6E-06	6.6E-06+/- 4.5E-06
JD-6	1.2E-05+/- 2.0E-07*	2.4E-04+/- 7.4E-06	6.9E-06+/-1.4E-06	9.4E-06+/- 6.0E-06
JD-7	5.5E-05+/- 2.0E-07*	1.9E-04+/- 8.3E-06	5.5E-06+/-1.5E-06	9.1E-06+/- 6.8E-06
Random-1	8.2E-05+/- 2.0E-07*	9.5E-04+/- 1.3E-05	1.2E-05+/-2.0E-06	3.8E-05+/- 8.8E-06
Random-2	9.7E-05+/- 2.0E-07*	6.1E-04+/- 1.0E-05	1.9E-05+/-2.3E-06	2.4E-05+/- 6.6E-06

*Reporting limit.

Table JD-D11-9 Comparison of Average Baseline Values: Jane Dough, Nichols Ranch, and Hank Unit.

	Average Baseline Values			
Mine Unit	Uranium (µCi/kg)	Pb-210 (µCi/kg)	Ra-226 (µCi/kg)	Th-230 (µCi/kg)
Jane Dough Unit	5.3E-05	4.6E-04	1.1E-05	1.5E-05
Nichols Ranch	1.2E-04	5.4E-04	1.9E-04	4.1E-05
Hank Unit	3.2E-05	3.9E-04	7.0E-05	1.6E-05

JD-D11.6.0 AIR PARTICULATES

JD-D11.6.1 PURPOSE AND PROCEDURE

Regulatory Guided 4.14 provides guidelines for establishing a baseline for radiological air particulates. As with all baselines, the central purpose is to develop a background prior to initiating operations. The background is then used for comparing potential changes brought on by operations. The procedure described in Regulatory Guide 4.14 was generally followed in developing the radiological air particulate baseline for the Jane Dough Unit. As will be shown in the sections to follow, the number of monitors and their locations actually exceeded Regulatory Guide 4.14.

JD-D11.6.1 Sampling Methodology

According to Regulatory Guide 4.14, monitoring stations should be established as follows:

- Three monitors at or near the site boundary;
- One monitor at the nearest residence or occupiable structure within 10 km or where predicted doses exceed 5% of the standards in any area as provided in 40 CFR Part 190 and;
- One at a remote location that will not be impacted by operations.

Air particulate monitors were deployed during the third quarter of 2010. Filters were collected and analyzed on a quarterly basis for five quarters (third quarter 2011 through the third quarter of 2011).

A total of seven monitoring sites (JD-1 through JD-7) were developed for the Jane Dough Unit. In addition to these sites, Uranerz developed a total of eight sites for the Hank and Nichols Ranch Units. Because of this extensive coverage the seven sites at the Jane Dough exceed regulatory guidelines. The locations of the seven monitoring sites are shown on Exhibit JD-D11-2 Sample Site Location Map.

In locating the monitors, guidance provided in Regulatory Guide 4.14 was followed. Stations were placed at nearest residences, on or near proposed license boundaries in the direction of prevailing winds and at a control site. Each of these locations will be discussed in more detail in the following section.

JD-D11.6.2 Monitoring Results

Although one full year of monitoring is required, Uranerz has included five quarters of baseline measurements. Because of the multiple sites, multiple quarters and multiple constituents, three sets of tables are provided: the first, Table JD-D11-10 through JD-D11-14 tabulates the quarterly values by site; the second, Table JD-D11-5, is arranged to conveniently show quarterly comparisons; and the third, Table JD-D11-6, shows average air concentrations by site for each constituent throughout the monitoring period. Because of the consistency of the values over time and at each site it can be concluded that the data are representative of baseline. Additionally, the data from Jane Dough compares favorably with previously-collected data from eight locations at the Hank and Nichols Ranch Units. Lastly, and as expected, the baseline data is orders of magnitude below the 10 CFR 20 Effluent Concentration Limits of U (9E-14); Pb-210 (6E13); Ra-226 (9E-13); and Th-230 (3E-14).

Table JD-D11-10 Jane Dough Baseline Radionuclide Concentrations in Air Third Quarter 2010.

	Third Quarter 2010			
Sample Site	**Uranium (µCi/ml)**	**Pb-210 (µCi/ml)**	**Ra-226 (µCi/ml)**	**Th-230 (µCi/ml)**
LLD*	1E-16	2E-15	1E-16	1E-16
JD-1	2E-16	1.1E-14	1E-17	-9E-17
Precision	N/A	1E-14	5E-17	7E-17
JD-2	2E-16	1.0E-14	3E-17	-3E-18
Precision	N/A	1E-15	3E-17	8E-17
JD-3	4E-16	1.3E-14	6E-17	-6E-17
Precision	N/A	1E-15	4E-17	8E-17
JD-4	2E-16	6.0E-15	2E-17	-1E-17
Precision	N/A	1E-15	3E-17	8E-17
JD-5	2E-16	1.4E-14	5E-17	1E-16
Precision	N/A	1E-15	4E-17	1E-16
JD-6	3E-16	9.9E-15	6E-16	7E-17
Precision	N/A	1E-15	8E-17	9E-17
JD-7	3E-16	5.0E-15	2E-16	2E-17
Precision	N/A	1E-15	6E-17	1E-15

*Lower Limit of Detection: Regulatory Guide 4.14

Table JD-D11-11 Jane Dough Baseline Radionuclide Concentrations in Air Fourth Quarter 2010. (continued)

	Fourth Quarter 2010			
Sample Site	**Uranium (µCi/ml)**	**Pb-210 (µCi/ml)**	**Ra-226 (µCi/ml)**	**Th-230 (µCi/ml)**
LLD*	1E-16	2E-15	1E-16	1E-16
JD-1	1E-16	2.4E-14	1E-17	-9E-17
Precision	N/A	3E-15	6E-17	6E-17
JD-2	2E-16	2.1E-14	4E-17	-1E-16
Precision	N/A	2E-15	6E-17	7E-17
JD-3	2E-16	2.2E-14	5E-17	-1E-16
Precision	N/A	2E-15	6E-17	6E-17
JD-4	1E-16	2.3E-15	3E-17	-7E-17
Precision	N/A	3E-15	6E-17	6E-17
JD-5	2E-16	2.2E-14	5E-17	-2E-16
Precision	N/A	2E-15	6E-17	5E-16
JD-6	1E-16	2.0E-14	7E-18	-7E-17
Precision	N/A	2E-15	6E-17	7E-17
JD-7	2E-16	2.0E-15	4E-17	-3E-17
Precision	N/A	2E-15	6E-17	6E-17

*Lower Limit of Detection: Regulatory Guide 4.14.

Table JD-D11-12 Jane Dough Baseline Radionuclide Concentrations in Air First Quarter 2011. (continued)

	First Quarter 2011			
Sample Site	**Uranium (µCi/ml)**	**Pb-210 (µCi/ml)**	**Ra-226 (µCi/ml)**	**Th-230 (µCi/ml)**
LLD*	1E-16	2E-15	1E-16	1E-16
JD-1	1E-16	2.1E-14	-1E-17	2E-16
Precision	N/A	2E-15	6E-17	7E-17
JD-2	2E-16	1.2E-14	4E-17	1E-16
Precision	N/A	2E-15	7E-17	7E-17
JD-3	2E-16	1.3E-14	3E-17	2E-16
Precision	N/A	2E-15	6E-17	8E-17
JD-4	2E-16	1.2E-14	-4E-17	1E-16
Precision	N/A	2E-15	5E-17	7E-17
JD-5	2E-16	1.1E-14	7E-17	1E-16
Precision	N/A	2E-15	7E-17	6E-17
JD-6	2E-16	1.2E-14	2E-17	9E-17
Precision	N/A	2E-15	6E-17	6E-17
JD-7	2E-16	1.2E-14	5E-18	1E-16
Precision	N/A	2E-15	6E-17	6E-17

*Lower Limit of Detection: Regulatory Guide 4.14.

Table JD-D11-13 Jane Dough Baseline Radionuclide Concentrations in Air Second Quarter 2011. (continued)

Second Quarter 2011				
Sample Site	**Uranium (µCi/ml)**	**Pb-210 (µCi/ml)**	**Ra-226 (µCi/ml)**	**Th-230 (µCi/ml)**
LLD*	1E-16	2E-15	1E-16	1E-16
JD-1	1E-16	8.7E-15	-3E-17	2E-16
Precision	N/A	1E-15	6E-17	7E-17
JD-2	2E-16	9.3E-15	2E-17	2E-16
Precision	N/A	2E-15	1E-16	9E-17
JD-3	2E-16	8.7E-15	-3E-17	2E-16
Precision	N/A	1E-15	6E-17	8E-17
JD-4	1E-16	8.9E-15	9E-17	2E-16
Precision	N/A	2E-15	5E-17	7E-17
JD-5	2E-16	9.0E-15	6E-17	2E-16
Precision	N/A	2E-15	1E-16	1E-16
JD-6	2E-16	9.0E-15	8E-17	2E-16
Precision	N/A	1E-15	1E-16	9E-17
JD-7	2E-16	8.3E-15	1E-16	2E-16
Precision	N/A	1E-15	9E-17	8E-17

*Lower Limit of Detection: Regulatory Guide 4.14.

Table JD-D11-14 Jane Dough Baseline Radionuclide Concentrations in Air Third Quarter 2011. (continued)

Third Quarter 2011				
Sample Site	**Uranium (µCi/ml)**	**Pb-210 (µCi/ml)**	**Ra-226 (µCi/ml)**	**Th-230 (µCi/ml)**
LLD*	1E-16	2E-15	1E-16	1E-16
JD-1	4E-16	8.7E-15	9E-17	4E-16
Precision	N/A	4E-15	3E-16	2E-16
JD-2	4E-16	1.5E-14	5E-16	6E-16
Precision	N/A	4E-15	4E-16	2E-16
JD-3	4E-16	1.5E-14	2E-16	6E-16
Precision	N/A	4E-15	3E-16	2E-16
JD-4	4E-16	1.2E-14	3E-16	4E-16
Precision	N/A	4E-15	4E-16	2E-16
JD-5	4E-16	1.5E-14	5E-16	2E-16
Precision	N/A	4E-15	4E-16	2E-16
JD-6	8E-16	1.4E-14	8E-16	3E-16
Precision	N/A	4E-15	4E-16	2E-16
JD-7	4E-16	1.3E-15	4E-16	3E-16
Precision	N/A	4E-15	4E-16	2E-16

Lower Limit of Detection: Regulatory Guide 4.14.

Table JD-D11-15 Radionuclide Air Concentrations: Quarterly Comparison.

Sample Period	Uranium (μC/ml)	Pb-210 (μC/ml)	Ra-226 (μC/ml)	Th-230 (μC/ml)
		JD-1		
3rd Q 2010	2E-16	1.1E-14	1E-17	-9E-17
4th Q 2010	1E-16	2.4E-14	1E-17	-9E-17
1st Q 2011	1E-16	1.2E-14	-1E-17	2E-16
2nd Q 2011	1E-16	8.7E-15	-3E-17	2E-16
3rd Q 2011	4E-16	8.7E-15	9E-17	4E-16
		JD-2		
3rd Q 2010	2E-16	1.0E-14	3E-17	-3E-18
4th Q 2010	2E-16	2.1E-14	4E-17	-1E-16
1st Q 2011	2E-16	1.2E-14	4E-17	1E-16
2nd Q 2011	2E-16	9.3E-15	2E-17	2E-16
3rd Q 2011	4E-16	1.5E-14	5E-16	6E-16
		JD-3		
3rd Q 2010	4E-16	1.3E-14	6E-17	-6E-17
4th Q 2010	2E-16	2.2E-14	5E-17	-1E-16
1st Q 2011	2E-16	1.3E-14	3E-17	2E-16
2nd Q 2011	2E-16	8.7E-15	-3E-17	2E-16
3rd Q 2011	4E-16	1.5E-14	2E-16	6E-16
		JD-4		
3rd Q 2010	2E-16	6.0E-15	2E-17	-1E-17
4th Q 2010	1E-16	2.3E-14	3E-17	-7E-17
1st Q 2011	2E-16	1.2E-14	-4E-17	1E-16
2nd Q 2011	1E-16	8.9E-15	9E-17	2E-16
3rd Q 2011	4E-16	1.2E-14	3E-16	4E-16

Table JD-D11-15 (continued)

Sample Period	Uranium (μC/ml)	Pb-210 (μC/ml)	Ra-226 (μC/ml)	Th-230 (μC/ml)
		JD-5		
3rd Q 2010	2E-16	1.4E-14	5E-16	1E-16
4th Q 2010	2E-16	2.2E-14	5E-17	-2E-17
1st Q 2011	2E-16	1.1E-14	7E-17	1E-16
2nd Q 2011	2E-16	9.0E-15	6E-17	2E-16
3rd Q 2011	4E-16	1.5E-14	5E-16	2E-16
		JD-6		
3rd Q 2010	3E-16	9.9E-15	6E-16	7E-17
4th Q 2010	1E-16	2.0E-14	7E-18	-7E-17
1st Q 2011	2E-16	1.2E-14	2E-17	9E-17
2nd Q 2011	2E-16	9.0E-15	8E-17	2E-16
3rd Q 2011	8E-16	1.4E-14	8E-16	3E-16
		JD-7		
3rd Q 2010	3E-16	9.9E-15	2E-16	2E-17
4th Q 2010	2E-16	2.0E-14	4E-17	-3E-17
1st Q 2011	2E-16	1.2E-14	5E-18	1E-16
2nd Q 2011	2E-16	8.3E-15	1E-16	2E-16
3rd Q 2011	4E-16	1.3E-14	4E-16	3E-16

Table JD-D11-16 Average Air Concentrations Over Five Quarters of Monitoring: Jane Dough Unit.

	Uranium (μCi/kg)						**Pb-210** (μCi/kg)					
Site	**Q3/2010**	**Q4/2010**	**Q1/2011**	**Q2/2011**	**Q3/2011**	**Ave.**	**Q3/2010**	**Q4/2010**	**Q1/2011**	**Q2/2011**	**Q3/2011**	**Ave.**
JD-1	2E-16	1E-16	1E-16	1E-16	4E-16	**2E-16**	1.1E-14	2.4E-14	1.2E-14	8.7E-15	8.7E-15	**1.3E-14**
JD-2	2E-16	2E-16	2E-16	2E-16	4E-16	**2E-16**	1.0E-14	2.1E-14	1.2E-14	9.3E-15	1.5E-14	**1.4E-14**
JD-3	4E-16	2E-16	2E-16	2E-16	4E-16	**3E-16**	1.3E-14	2.2E-14	1.3E-14	8.7E-15	1.5E-14	**1.4E-14**
JD-4	2E-16	1E-16	2E-16	1E-16	4E-16	**2E-16**	6.0E-15	2.3E-14	1.2E-14	8.9E-15	1.2E-14	**1.2E-14**
JD-5	2E-16	2E-16	2E-16	2E-16	4E-16	**2E-16**	1.4E-14	2.2E-14	1.1E-14	9.0E-15	1.5E-14	**1.4E-14**
JD-6	3E-16	1E-16	2E-16	2E-16	8E-16	**3E-16**	9.9E-15	2.0E-14	1.2E-14	9.0E-15	1.4E-14	**1.3E-14**
JD-7	3E-16	2E-16	2E-16	2E-16	2E-16	**2E-16**	9.9E-15	2.0E-14	1.2E-14	8.3E-15	1.3E-14	**1.3E-14**

	Ra-226 (μCi/kg)						**Th-230** (μCi/kg)					
Site	**Q3/2010**	**Q4/2010**	**Q1/2011**	**Q2/2011**	**Q3/2011**	**Ave**	**Q3/2010**	**Q4/2010**	**Q1/2011**	**Q2/2011**	**Q3/2011**	**Ave.**
JD-1	1E-17	1E-17	-1E-17	-3E-17	9E-17	**3E-17**	-9E-17	-9E-17	2E-16	2E-16	4E-16	**2E-16**
JD-2	3E-17	4E-17	4E-17	2E-17	5E-16	**3E-17**	-3E-18	-1E-16	1E-16	2E-16	6E-16	**2E-16**
JD-3	6E-17	5E-17	3E-17	-3E-17	2E-16	**7E-17**	-6E-17	-1E-16	2E-16	2E-16	6E-16	**2E-16**
JD-4	2E-17	3E-17	-4E-17	9E-17	3E-16	**1E-16**	-1E-17	-7E-17	1E-16	2E-16	4E-16	**2E-16**
JD-5	5E-16	5E-17	7E-17	6E-17	5E-16	**2E-16**	1E-16	-2E-17	1E-16	2E-16	2E-16	**1E-16**
JD-6	6E-16	7E-18	2E-17	8E-17	8E-16	**3E-16**	7E-17	-7E-17	9E-17	2E-16	3E-16	**2E-16**
JD-7	2E-16	4E-17	5E-18	1E-16	4E-16	**1E-16**	2E-17	-3E-17	1E-16	2E-16	3E-16	**1E-16**

Regulatory Guide 14 Lower Limit of Detection: Uranium (1E-16); Pb-210 (2E-15); Ra-226 (1E-16); and Th-230 (1E-16). 10 CFR 20 Effluent Concentration Limits: U (9E-14); Pb-210(6E-13); Ra-226 (9E-13); and Th-230 (3E-14).

All values in the table are as reported in the laboratory reports. To allow the Average to be approximated, negative values were revised to the lower limit of detection.

JD-D11.7.0 MILDOS

Release rates of airborne radioactivity were estimated for the Jane Dough Unit of the Nichols Ranch ISR Project. Dose commitments received by individuals and the general population within an 80 km radius of site were estimated from atmospheric dispersal of such radioactivity using data from an on-site meteorological station. Meteorological data for the Jane Dough Unit is presented in Appendix JD-D4. Only airborne releases of radon are considered. Particulate emissions are not considered since such releases are not expected under normal operating conditions.

The computer code MILDOS-Area (MILDOS) was used to calculate both the release rates (source terms) and the dose commitments. The dose commitments include contribution from each of the Nichols Ranch, the Hank Unit, and the Jane Dough Unit. Extra-regional population doses are also estimated as a result of transport of radon. The results are provided as total effective dose equivalent per year.

JD-D11.7.1 SITE DESCRIPTION

The physical description of the sites is provided in the Mine Plan. The location of the sites is presented in Exhibit JD-D11-1 (see map pocket). The dose estimates are provided for intervals, directions, and elevations relative to the Central Processing Plant at the Nichols Ranch facility; this location is subsequently referred to as the mill center.

JD-D11.7.1 Population Distribution

The population distribution within 80 km of the mill center is provided in Table JD-D11-17. Figure JD-D11-1 (see map pocket) shows the locations of the cities within 80 km of the mill center.

The population dose beyond 80 km is estimated using the code's predetermined population dose for year 1978. The population dose is adjusted for population growth by the ratio of estimated United States population for year 2000 of 268 million to the estimated United States population for year 1980 of 228 million, or 1.2 (National Council on Radiation Protection and Measurement. 1984).

Table JD-D11-17 Population Distribution within 80 km of Nichols Ranch Central Processing Plant.

Cities Within 80 km of Mill Center	Population[1]	Distance from Mill Center (km)	Direction from Mill Center
Gillette	28,729	74	NE
Kaycee	263	56	W
Midwest	404	40	SW
Edgerton	195	37	SW
Wright	1,807	35	E

[1] Source: U.S. Census Bureau Population Division (2010)

JD-D11.7.2 Individual Receptor Locations

The locations of the nearest residents to the Nichols Ranch Central Processing Plant are provided in Table JD-D11-18. Locations of site boundaries to the Nichols Ranch Central Processing Plant are provided in Table JD-D11-19. Exhibit JD-D11-1 shows the locations of the nearest residents to the mill center.

Table JD-D11-18 Nearest Residents to Nichols Ranch Central Processing Plant.

Nearest Residence	Number of Inhabitants	Distance from Mill Center (km) x(E)	Distance from Mill Center (km) y(N)	Elevation from mill center z (m)
T-Chair (Rolling Pin) Ranch	5	3.7	-2.2	-7
Dry Fork Ranch	3	-2.7	-1.1	-58
Christensen Ranch	1	1.8	7.8	-1
Pfister Ranch	3	7.8	7.4	78
Pumpkin Butte Ranch	2	11.1	3.6	218
Van Buggenum Ranch	0	15.4	5.3	130
Ruby Ranch	2	19.0	2.9	101
Hank Satellite Plant	0	7.9	3.5	121

Table JD-D11-19 Center of Site Boundary from Nichols Ranch Central Processing Plant.

Location		Distance from mill center (km) x(E)	Distance from mill center (km) y(N)	Elevation from mill center z (m)
Nichols Ranch	- north central	-0.4	1.3	57
	- east central	0.6	0.2	-2
	- south central	-0.3	-1.1	-18
	- west central	-1.4	0.5	12
Hank	- north central	7.9	6.6	86
	- east central	8.8	3.3	160
	- south central	7.9	1.3	139
	- west central	7.1	4.2	102
Jane Dough	- north central	0.4	-1.1	-15
	- east central	2.2	-3.2	35
	- south central	0.4	-5.6	18
	- west central	-1.0	-3.2	35

JD-D11.7.3 Time Parameters

The dose commitments were completed for development, production, and restoration of wellfields for the operating years 2014 through 2024. The respective schedule is provided in Figure 3-11 in the Mine Plan.

The time parameters were input as:

- Beginning Year: 2014.
- Number of Time Steps: 10.
- Time Increment: 1 year.
- Population Adjustment: 1.2 (see above "Population Distribution")
- Source Adjustment: varied per source to reflect development, production, and restoration schedule of Figure 3-11 in the Mine Plan.

The MILDOS is limited to 10 Time Steps. The restoration schedule would require 11 one-year time steps to be fully represented. The last time increment was set at 1.5 year in order to account for the last 0.5 year of Jane Dough Production Area #2 Groundwater Restoration.

JD-D11.7.4 Food Pathway Parameters

The MILDOS code requires four inputs to describe the feeding habits of livestock near the sites. The inputs used to describe the fraction of total annual livestock feed requirements are:

- Pasture Grass/Individual: 0.5 (default)
- Pasture Grass/Population: 0.5 (default)
- Hay/Individual: 0.5 (default)
- Hay/Population: 0.5 (default)

The MILDOS code also requires input of the areal food-production rate per unit area around the facility. The inputs used are presented below and were obtained from the National Council on Radiation Protection and Measurement (1975):

- Vegetables: 3120 kg/y-m^2
- Meat: 345 kg/y-m^2
- Milk: 134 kg/y-m^2

JD-D11.7.5 Meteorological Parameters

The meteorological parameters for the MILDOS code were input as:

- The annual average morning and afternoon mixing heights each as the code default of 100 meters
- The Briggs height cutoff vertical dispersion coefficient as the code default of 50 meters
- The fractional joint frequency distribution of wind speed, direction, and stability for an on-site meteorological station. This information is presented in Appendix JD-D4.

JD-D11.7.6 Source Terms

The input parameters and values used to develop the source terms and the resulting annual releases are presented in Tables JD-D11-20, JD-D11-21, and JD-D11-22 for Nichols Ranch, the Hank Unit, and the Jane Dough Unit, respectively. The respective source terms determined by MILDOS are included in these tables.

A source term for release of particulates from drying and packaging activities was not developed since no particulate emissions are expected under normal operating conditions for vacuum dryers.

The fraction of radon attributable to the site was input as one for Casper, Wyoming.

JD-D11.7.7 Results

Dose modeling was completed as described above for the primary years of operation of the Nichols Ranch ISR Project, including the Nichols Ranch Unit, Hank Unit, and Jane Dough Unit. The operations modeled included wellfield development, production, and wellfield restoration. The source terms were adjusted to reflect actual periods of activity per year. The results of the dose modeling are summarized below with respect to the nearest residents, site boundaries, and the surrounding population. The 40 CFR 190 doses are zero because dose from radon is excluded from the scope of the standard. The report of the MILDOS code execution is provided as Addendum JD-D11-A.

JD-D11.7.7.1 Individual Receptor Dose

Estimated annual doses at individual receptor locations (local ranches) are shown in Table JD-D11-23. The estimated doses result exclusively from radon daughters, since there are no particulate releases from the facility. The total effective dose equivalent (TEDE) is at least 100 times less than the dose limit to individual members of the public in 10 CFR 20 of 100 mrem/year.

Table JD-D11-20 MILDOS Input Parameters - Nichols Ranch Unit.

	(values in gray are calculated by MILDOS)*		
	Common Parameters (each wellfield)	Units	
Location	X (location relative to the plant which is considered (0,0,0)	-0.9	km
	Y (location relative to the plant which is considered (0,0,0)	0.4	km
	Z (location relative to the plant which is considered (0,0,0)	6	m
	area of active drilling (ore zone)	228,644	m^2
	emanation fraction	0.2	
	Ra concentration in ore	311	pCi/g
	Thickness	2.2	m
	Density	1.9	g/cm3
	Porosity	0.3	
	fraction of Rn	0.75	
	rate of Rn venting	0.01	/d
	volume in circulation	149068519	L
	New Wellfield Source Parameters (each wellfield)		
Mud pits	storage time in pit	30	d
	ore material into pit	136,534	g/y
	number of mud pits	966	
	Total amount of Rn-222 released from drilling activities	0.045	Ci/yr
	Production Wellfield Source Parameters (each wellfield)		
Ore zone	Rn-222 source	1.1 E+13	pCi/d
Process water	treated water purge rate	190,779	L/d
	Rn-222 release from purge water	20	Ci/yr
	Rn-222 release from well venting	150	Ci/yr
Ion exchange columns	column volume	14,158	L
	column unloading rate	2	/d
	porosity of resin	0.4	
	Rn-222 release from ion exchange column	1.2	Ci/yr
	Total amount of Rn-222 released from production activities	170	Ci/yr
	Restoration Wellfield Source Parameters (each wellfield)		
Ore zone	Rn-222 source	1.1 E+13	pCi/d
Process water	treated water purge rate	310,698	L/d
	operating days	360	d/yr
	Rn-222 release from purge water	31	Ci/yr
	Rn-222 release from well venting	150	Ci/yr
	Total Rn-222 released from restoration activities	180	Ci/yr

* Values may not sum within table due to rounding.

Table JD-D11-21 MILDOS Input Parameters - Hank Unit.

	(values in gray are calculated by MILDOS)*		
	Common Parameters (each wellfield)	Units	
Location	X (location relative to the plant which is considered (0,0,0)	8.2	km
	Y (location relative to the plant which is considered (0,0,0)	3.5	km
	Z (location relative to the plant which is considered (0,0,0)	142	m
	area of active drilling (ore zone)	313,627	m^2
	emanation fraction	0.2	
	Ra concentration in ore	277	pCi/g
	Thickness	2.6	m
	Density	1.9	g/cm3
	Porosity	0.3	
	fraction of Rn	0.75	
	rate of Rn venting	0.01	/d
	volume in circulation	245770913	L
Mud pits	**New Wellfield Source Parameters** (each wellfield)		
	storage time in pit	30	d
	ore material into pit	160,949	g/y
	number of mud pits	776	
	Total amount of Rn-222 released from drilling activities	0.038	Ci/yr
Ore zone	**Production Wellfield Source Parameters** (each wellfield)		
	Rn-222 source	1.6 E+13	pCi/d
Process water	treated water purge rate	408,813	L/d
	Rn-222 release from purge water	37	Ci/yr
	Rn-222 release from well venting	220	Ci/yr
Ion exchange columns	column volume	14,158	L
	column unloading rate	2	/d
	porosity of resin	0.4	
	Rn-222 release from ion exchange column	1.0	Ci/yr
	Total amount of Rn-222 released from production activities	260	Ci/yr
Ore zone	**Restoration Wellfield Source Parameters** (each wellfield)		
	Rn-222 source	1.6 E+13	pCi/d
Process water	treated water purge rate	119,918	L/d
	operating days	360	d/yr
	Rn-222 release from purge water	11	Ci/yr
	Rn-222 release from well venting	220	Ci/yr
	Total Rn-222 released from restoration activities	230	Ci/yr

* Values may not sum within table due to rounding.

Table JD-D11-22 MILDOS Input Parameters – Jane Dough Unit.

	(values in gray are calculated by MILDOS)*		
	Common Parameters (each wellfield)	Units	
Location	X (location relative to the plant which is considered (0,0,0)	0.1	km
	Y (location relative to the plant which is considered (0,0,0)	-3.0	km
	Z (location relative to the plant which is considered (0,0,0)	36	m
	area of active drilling (ore zone)	228,644	m^2
	emanation fraction	0.2	
	Ra concentration in ore	311	pCi/g
	Thickness	2.2	m
	Density	1.9	g/cm3
	Porosity	0.3	
	fraction of Rn	0.75	
	rate of Rn venting	0.01	/d
	volume in circulation	149068519	L
	New Wellfield Source Parameters (each wellfield)		
Mud pits	storage time in pit	30	d
	ore material into pit	136,534	g/y
	number of mud pits	966	
	Total amount of Rn-222 released from drilling activities	0.045	Ci/yr
	Production Wellfield Source Parameters (each wellfield)		
Ore zone	Rn-222 source	1.1 E+13	pCi/d
Process water	treated water purge rate	190779	L/d
	Rn-222 release from purge water	20	Ci/yr
	Rn-222 release from well venting	150	Ci/yr
Ion exchange columns	column volume	14,158	L
	column unloading rate	2	/d
	porosity of resin	0.4	
	Rn-222 release from ion exchange column	1.2	Ci/yr
	Total amount of Rn-222 released from production activities	170	Ci/yr
	Restoration Wellfield Source Parameters (each wellfield)		
Ore zone	Rn-222 source	1.1 E+13	pCi/d
Process water	treated water purge rate	310,698	L/d
	operating days	360	d/yr
	Rn-222 release from purge water	31	Ci/yr
	Rn-222 release from well venting	150	Ci/yr
	Total Rn-222 released from restoration activities	180	Ci/yr

* Values may not sum within table due to rounding.

Table JD-D11-23 Summary Results of Total Effective Dose Equivalent to Individual Receptors.

	Year[1]									
Receptor	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
T-Chair Ranch	0.05	0.08	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.2
Dry Fork Ranch	0.02	0.04	0.06	0.09	0.1	0.1	0.09	0.1	0.09	0.1
Christensen Ranch	0.03	0.09	0.1	0.2	0.3	0.3	0.2	0.2	0.09	0.06
Pfister Ranch	0.02	0.09	0.2	0.2	0.3	0.3	0.3	0.2	0.1	0.07
Pumpkin Butte Ranch	0.02	0.1	0.2	0.3	0.4	0.4	0.4	0.3	0.1	0.06
Van Buggenum Ranch	0.01	0.04	0.08	0.1	0.1	0.1	0.1	0.1	0.05	0.04
Ruby Ranch	0.01	0.03	0.06	0.08	0.1	0.1	0.08	0.08	0.04	0.03

[1] Units - mrem/year

Estimated annual doses at the 12 site boundary locations are presented in Table JD-D11-24. The estimated doses result exclusively from radon daughters, since there are no particulate releases from the facility. The TEDE is substantially less than the dose limit to individual members of the public in 10 CFR 20 of 100 mrem/year.

Table JD-D11-24 Summary of Total Effective Dose Equivalent Site Boundary.

	Year[1]									
Boundary Location	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Nichols Ranch - north central	0.6	0.8	1	2	2	1	0.3	0.3	0.2	0.2
- east central	0.3	0.4	0.5	0.8	0.9	0.6	0.2	0.2	0.2	0.2
- south central	0.1	0.2	0.3	0.5	0.5	0.4	0.1	0.2	0.1	0.2
- west central	5	7	9	14	15	9	0.2	0.3	0.2	0.2
Hank - north central	0.02	0.1	0.2	0.3	0.4	0.4	0.3	0.3	0.1	0.07
- east central	0.02	1	2	3	5	5	4	4	1	0.07
- south central	0.02	0.1	0.2	0.3	0.4	0.4	0.4	0.3	0.1	0.08
- west central	0.02	0.6	1	1	2	2	2	2	0.6	0.08
Jane Dough - north central	0.1	0.2	0.3	0.4	0.5	0.4	0.2	0.2	0.2	0.2
- east central	0.05	0.08	0.1	0.2	0.3	0.3	0.3	0.4	0.4	0.6
- south central	0.03	0.05	0.07	0.1	0.2	0.2	0.1	0.2	0.2	0.3
- west central	0.05	0.08	0.1	0.2	1	2	2	3	3	4

[1] Units - mrem/year

JD-D11.7.7.2 Population Dose

Estimated annual doses populations are shown in Table D11-25. The estimated doses result exclusively from radon daughters, since there are no particulate releases from the facility. There is no regulatory limit for population dose. The TEDE for the population within 80 km of the mill center is about 325,000 to 32,500 times less than the dose to this population attributable to natural background radon of 300 mrem/year (21,819 persons x 0.3 rem/year = ~ 6500 person-rem/year).

Table JD-D11-25 Summary of Total Effective Dose Equivalent to Populations.

	Year[1]									
Receptor	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Population within 80 km	0.02	0.06	0.09	0.1	0.2	0.2	0.1	0.1	0.08	0.08
Population beyond 80 km	2	3	5	6	10	9	6	7	4	4
All populations	2	3	5	7	10	9	6	7	4	4

note Values may not sum within table due to rounding.
[1] Units – person-rem/year

JD-D11.8.0 REFERENCES

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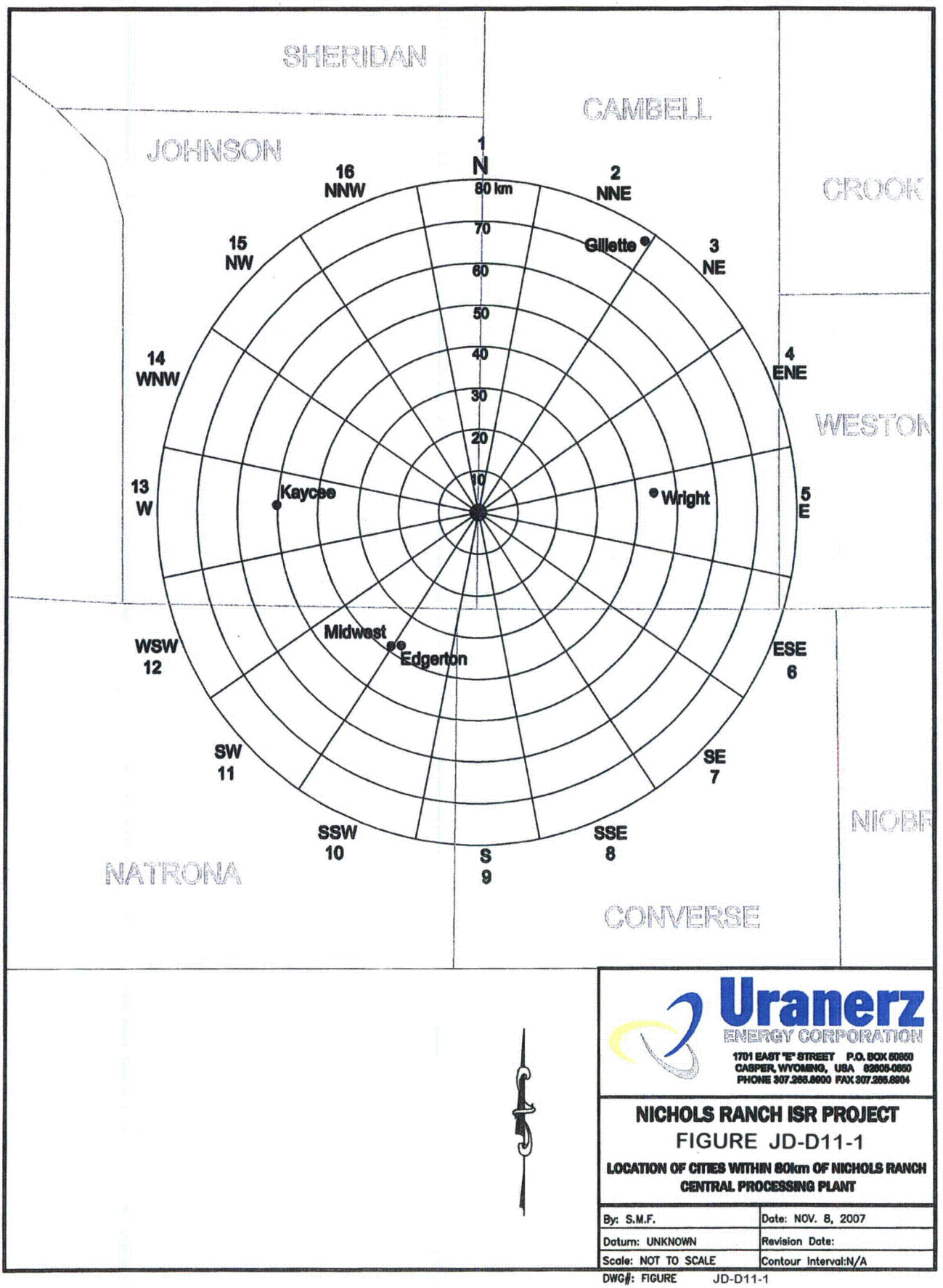

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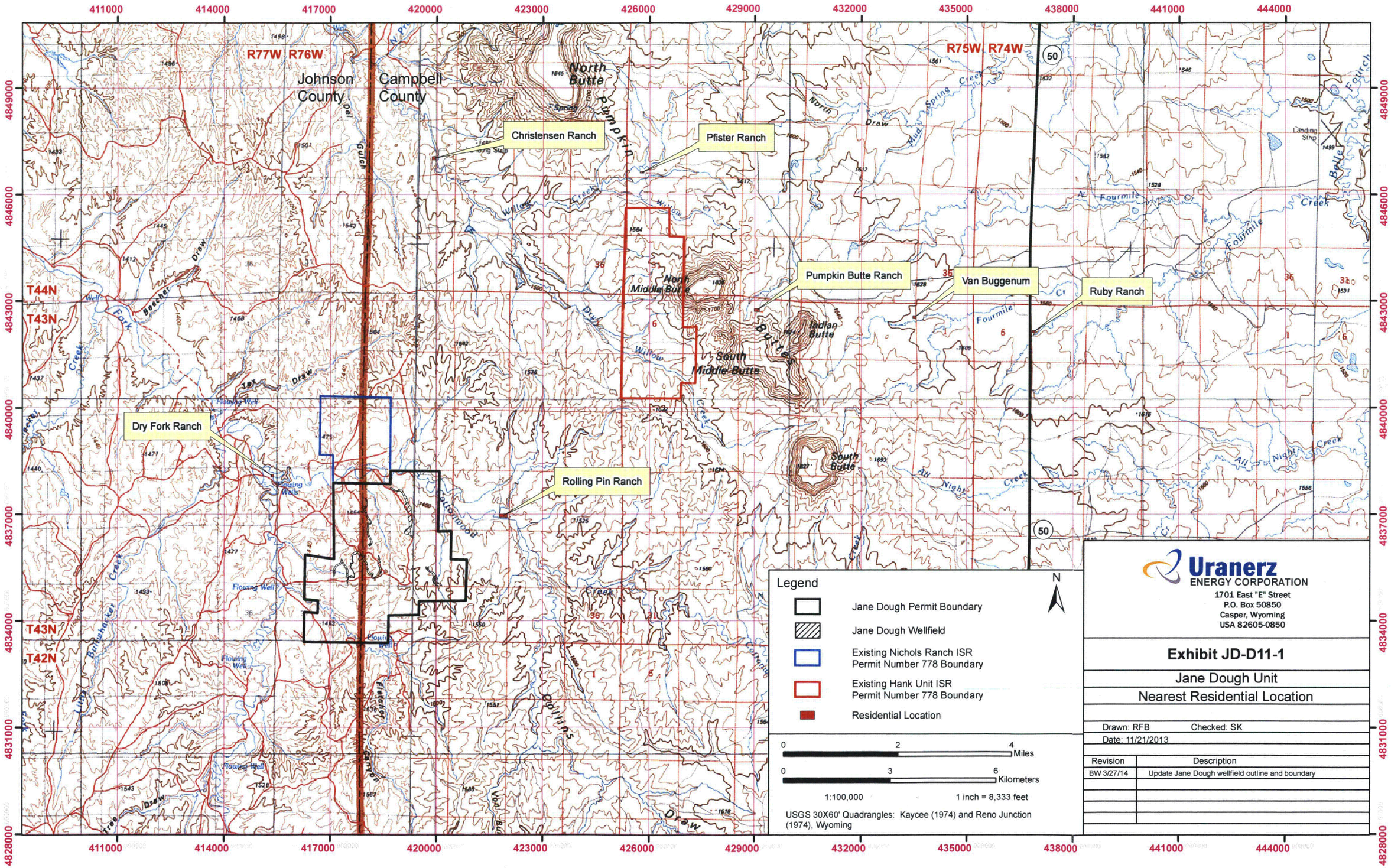
NICHOLS RANCH ISR PROJECT

FIGURE JD-D11-1

LOCATION OF CITIES WITHIN 80km OF NICHOLS RANCH CENTRAL PROCESSING PLANT

By: S.M.F.	Date: NOV. 8, 2007
Datum: UNKNOWN	Revision Date:
Scale: NOT TO SCALE	Contour Interval:N/A

DWG#: FIGURE JD-D11-1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R77W R76W
R75W R74W
Johnson County
Campbell County
T44N
T43N
T42N
Christensen Ranch
Pfister Ranch
Pumpkin Butte Ranch
Van Buggenum
Ruby Ranch
Dry Fork Ranch
Rolling Pin Ranch
North Butte
North Middle Butte
South Middle Butte
Indian Butte
South Butte
Pumpkin Butte
Willow Creek
Fourmile Creek
All Night Creek
Dry Fork Creek
Beaver Draw
Coal Gulch
Flowing Well
Landing Strip
50
N
Legend
Jane Dough Permit Boundary
Jane Dough Wellfield
Existing Nichols Ranch ISR Permit Number 778 Boundary
Existing Hank Unit ISR Permit Number 778 Boundary
Residential Location
0 2 4 Miles
0 3 6 Kilometers
1:100,000
1 inch = 8,333 feet
USGS 30X60' Quadrangles: Kaycee (1974) and Reno Junction (1974), Wyoming
Uranerz
ENERGY CORPORATION
1701 East "E" Street
P.O. Box 50850
Casper, Wyoming
USA 82605-0850
Exhibit JD-D11-1
Jane Dough Unit
Nearest Residential Location
Drawn: RFB
Checked: SK
Date: 11/21/2013
Revision
Description
BW 3/27/14
Update Jane Dough wellfield outline and boundary

The following 4 Drawings specifically reference

EXHIBIT
JD-D7-1 JANE DOUGH UNIT SOILS

JD-D8-1 JANE DOUGH UNIT VEGETATION

JD-D-9-1 JANE DOUGH UNIT RAPTOR NEST LOCATIONS

JD-D11-2 JANE DOUGH UNIT RADIOLOGICAL SAMPLE LOCATION

D01 to D04