Appendix K. Unanticipated Discoveries Plan for Paleontological Resources

Paleontological Resources Monitoring Plan

FERC Docket No. CP09-54-000

June 2010

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List of Abbreviations and Acronyms

BLM	Bureau of Land Management
MP	milepost
NEPA	National Environmental Policy Act
PFYC	potential fossil yield classification
PI	principal investigator
Project	Ruby Pipeline Project
ROW	right-of-way
Ruby	Ruby Pipeline, LLC

1. Introduction

The Ruby Pipeline Project (Project), proposed by Ruby Pipeline, LLC (Ruby), is composed of approximately 675.2 miles of 42-inch diameter natural gas pipeline, along with associated compression and measurement facilities, located between Opal, Wyoming, and Malin, Oregon. The Project would also include an approximate 2.6-mile lateral to be constructed in Klamath County, Oregon. As proposed, the Project will have a design capacity of approximately 1.5 million Dekatherms per day, depending on final subscriptions. The Project's right-of-way (ROW) will cross four states: Wyoming, Utah, Nevada, and Oregon. In addition to the existing King Compressor Station at Opal, Wyoming, Ruby proposes to install four new compressor stations for the Project: one located near the Opal Hub, one in western Utah, one near the mid-point of the Project north of Elko, Nevada, and one northwest of Winnemucca, Nevada.

This Paleontological Resources Monitoring Plan provides procedures to monitor those areas of the Ruby Pipeline Project (both federal and non-federal land) where there are potentially significant fossil resources (summary of procedures is supplemented by detailed guidelines in Bureau of Land Management (BLM) document IM 2009-011 (see Attachment B)) and addresses the unanticipated discovery of significant fossil resources that may be encountered during construction.

Primary elements of the Paleontological Resources Monitoring Plan include:

- Mitigation procedures (*e.g.*, avoidance, excavation) for fossil localities identified during Construction;
- Procedures for in-trench inspections and spot checking; and
- Provisions for the preparation and curation of fossil collections.

2. Construction Methods

The Project will be constructed in Wyoming, Utah, Nevada, and Oregon. Preparing the ROW will involve brush and topsoil removal, followed by mechanical grading to a working surface by blading machines, scrapers, and other heavy machinery. Trenching will be accomplished primarily via trenching machines and backhoes. In special cases, boring and directional drilling equipment or manual excavation may be utilized.

2.1 Qualified Paleontologist

The Principal Investigator (PI), a qualified paleontologist, will be contracted by Ruby to oversee paleontological activities. Prior to construction, the PI will obtain relevant Paleontological Use Permits for BLM lands. These permits require a monitoring and recovery plan for fossils, as well as a repository agreement with a recognized institution for the curation and storage of scientifically significant fossils. The PI will (1) oversee training of construction personnel, (2) conduct or oversee monitoring and spot checks of geologic formations classified as Potential Fossil Yield Classification (PFYC) 5 or 4, and some PFYC 3–ranked strata, (3) evaluate paleontological discoveries made by Ruby and construction contractors, and (4) determine appropriate actions regarding significant finds with BLM paleontologist/archaeologists. The PI that conducted pre-construction field surveys during the summer of 2008 and 2009 is Dr. Brooks Britt, PhD. Dr. Britt is a professional consulting paleontologist as well as a paleontology professor at Brigham Young University.

2.2 Training of Contractors

When a qualified paleontologist is not present during construction activities, Ruby environmental inspectors and contractor personnel will be responsible for reporting fossil discoveries. To this end, Ruby will train contractor personnel prior to construction to (1) understand what a fossil represents, (2) recognize a fossil, (3) know the procedures to be followed when fossils are discovered, and (4) refrain from collecting significant fossils, except as part of an emergency recovery procedure. This training will be conducted by a qualified paleontologist.

3. Areas to Be Monitored or Spot Checked

In the planning and surveying stages of the ROW, each geologic formation along the route was ranked according to the BLM PFYC. Formations ranked PFYC 3 or higher are listed in Table A-1 (Attachment A). Following a literature search, paleontological field surveys of segments ranked as PFYC 3 and higher were completed in the summer of 2008 along the Project route from the starting point near Opal, Wyoming, westward to near the intersection with Nevada State Highway 225, northwest of Elko. Based on the results of the 2008 field survey, the PI determined that surveys west of milepost (MP) 335 would encounter higher percentages of volcanic rock which typically do not contain fossil resources. For this reason, no more field surveys were conducted in 2008.

At the request of the Winnemucca BLM, additional field surveys were completed in August 2009. Ruby surveyed PFYC 3 strata between MPs 445 and 518, where sedimentary units re-classified as PFYC 3 are shown to outcrop and where playas are present. Particular attention was given to Mesozoic strata. No significant fossils were found. The surveys were stopped at MP 518 due to an increase in volcanic exposures, the reduction of playa deposits, and a marked decrease in units with PFYC ranks greater than 2.

Ruby's paleontology field survey team concentrated on strata with a PFYC ranking of 3 or greater during the field surveys; therefore, unlike the biological and archaeology field surveys, the entire length of the ROW was not field surveyed for paleontological resources. Alluvial deposits often bury fossil assemblages, and excavation offers the best chance of finding fossil assemblages. Depending on the depth of the alluvium and the depositional environment, excavation may or may not uncover significant fossil assemblages. A small possibility exists that scientifically significant remains of vertebrate fossils could be found during pipeline trenching in areas where thin a veneer of strata ranked PFYC 0-2 covers underlying fossil-bearing formations. Such vertebrate fossils are most likely to be found in the Pleistocene deposits (mainly unconsolidated alluvium and colluvium) scattered along the route.

In some surveyed areas, formation units ranked as PFYC 3 or higher did not yield fossil resources due to poor exposures, extreme weathering of outcrops, or the fact that no fossils could be identified. For these reasons, not all formations ranked as PFYC 3 were recommended for further field or spot checks prior to construction, as noted below. Field or spot checks occurred where geologic contact horizons appear the most promising for locating potential paleontologic resources.

Geologic formations with PFYC rankings of 3, 4, or 5 are listed in Table A-1. The following state-by-state construction phase recommendations are based on the PFYC rankings, literature reviews, and field surveys.

Archaeological surveys along the entire Project ROW resulted in five paleontological finds (EPG 2009) in Nevada. These finds are discussed in Attachment C and in Table C-1. Ruby will conduct paleontological investigations of three of these finds. Ruby will not survey the other locations because they are more than 630 feet from the centerline and will not be affected by the Project, nor will Ruby survey the site located on a Pleistocene shoreline where no vertebrate fossils were identified. Surveys are planned for the spring of 2010 prior to the start of construction.

3.1 Wyoming

Preconstruction field surveys of the ROW in Wyoming revealed vertebrate fossils on the surface only in the Opal area on outcrops of the Bridger Formation, which has a PFYC class 5 ranking. Accordingly, segments between MP 0 and 0.2 and between MP 1.8 and 6.1 will be monitored during construction. Alluvium and colluvial deposits (PFYC rank of 2) that outcrop along these areas between higher ranking formations will not require spot checking. Other outcrops of PFYC classes 4 and 5 will be spot checked after trenching, prior to trench infill. Trenches in the following PFYC-ranked 3 to 5 formations will be spot checked: Bridger, Gannet Group, Evanston, Green River, Sage Junction, Wasatch, Hilliard, and the Aspen Shale-Frontier contact (for false trunks of the fern *Tempskya* (Ash and Read 1976).

3.2 Utah

In Utah, the highest-ranked formation with significant exposures along the ROW is the Wasatch Formation, ranked by the BLM as PFYC class 4. Preconstruction surveys and literature reports, however, revealed no significant fossils. Consequently, the field survey PI recommended dropping the Wasatch Formation in this area of Utah to PFYC class 3. The PI recommended that post-trenching spot checks of the Wasatch formation should be conducted.

The Salt Lake Formation (PFYC 3) can contain significant vertebrate fossils. Although no fossils were observed during the summer 2008 field surveys, the eight instances where the Salt Lake Formation will be crossed will be spot checked after trenching, prior to trench infill. See Table A-1 for the MP start and end points. Similarly, other PFYC class 3 formations like the Kaibab, Toroweap, Park City, Summerville, Entrada, Carmel, Arapien, and Twin Creek formations may contain fossils and also will be spot checked after trenching, prior to trench infill.

3.3 Nevada

Post-trenching spot checks will be conducted for areas near known paleobotanical localities in northwestern Nevada because plant compressions, unlike vertebrates, are typically found only in freshly excavated matrix. As suggested by the BLM, Ruby will also conduct post-trenching spot checks of Pleistocene alluvial deposits along the ROW between MP 464.5 and 495.8.

Cenozoic vertebrate localities in northern Nevada occur primarily in fluvial deposits of varying ages. The pre-Pleistocene deposits are typified by Miocene stratigraphic units commonly assigned to the lithologically and stratigraphically similar Salt Lake, Esmeralda, Humboldt, and Truckee formations (Regnier, J. 1960; Tedrow and Robison 1999). These formations consist of tuffs and ashes intercalated with diatomites, limestones, mudstones, sandstone, and conglomerates. Fossil vertebrates are typically recovered from the clastic sedimentary units, which usually contain substantial reworked ash, commonly referred to as sandy or silty tuffs (MacDonald 1956; Regnier, J. 1960; Morea 1981, Nelson and Madsen 1987; Tedrow and Robison 1999), which consist of waterlain, reworked volcanic ash and clastics of fluvial or marginal lacustrine origin. Because clastic sediments are sourced from local topographic highs, the lithic clasts vary between depocenters (Tedrow and Robison 1999). Most of the bones are broken and disarticulated, and consist of more durable elements, although articulated skulls have been found (e.g. Morea 1981; Nelson and Madsen 1987). The more common large taxa include camels and antilocaprids (e.g., Nelson and Madsen 1987).

Paleontologists from the San Bernardino County Museum have recovered vertebrate fossils from localities in the Willow Creek area (BLM 2010) from tuffaceous units. Because laterally equivalent beds could yield additional fossils, Ruby will conduct a pre-construction paleontological survey of the ROW near Willow Creek from MP 352.7 to 353.6, near MP 368.3, and from MP 376.3 to MP 416.

Tuffaceous strata in the Winnemucca BLM District also hold potential to yield fossils; therefore, Ruby will conduct a detailed paleontological surface survey of outcrops along about four miles of ROW from MPs 532.8 to 533.4, MPs 533.7 to 533.9, MPs 538.6 to 540.2, MP 551.7 to 552.0, MPs 554.4 to 555.3, and MPs 555.7 to 556.0.

During archaeological investigations, five fossil locations were identified in Nevada (EPG 2009). Table C-1 lists the locations, taxonomy, suspected geological horizon and distance from the Project ROW. Ruby will survey three of the paleo locations: NV Paleo #1 at MP 346.6, NV Paleo #2 at MP 247.3, and NV Paleo #3 at MP 386.5. The other three locations are greater than 630 feet from the centerline and will not be encroached upon during construction. A survey report and, if needed, a mitigation plan for these paleontological sites will be forwarded to the Elko BLM District field office.

There are no formations with a PFYC of 4 or 5 along the ROW in Nevada.

The Winnemucca District BLM office requested a stand-alone Supplemental Paleontological Plan for its district. Detailed information on paleontologic resources and monitoring for the Winnemucca District is located in Attachment C.

3.4 Oregon

Because of the low PFYC classes of formations along the ROW in Oregon, Ruby did not conduct any field surveys or spot checks in this state. However, the Lakeview BLM District field office has expressed concern regarding potential exposure of Pleistocene mammoth bones during excavation in southern Oregon. If vertebrate fossils are encountered, construction will be halted, the BLM will be notified, and the Ruby's principal paleontologist will examine the find and develop a mitigation plan. Ruby will follow the stipulations in this plan along with BLM guidance.

4. Unanticipated Discoveries of Paleontological Resources

4.1 Paleontological Support During Construction

Fossils (paleontological resources) likely to be encountered during construction include plant compressions (carbonized leaf remains) and petrifactions (petrified wood); mollusk shells (snails, clams, and etc.); and isolated or fragmentary vertebrate remains, such as teeth and bones. If such fossils are encountered, they will be evaluated and addressed appropriately by Ruby's PI. There is a small possibility that scientifically significant articulated remains of vertebrate fossils may be encountered in excavations in areas that on the ground surface are classified as PFYC 2 or less but are underlain by fossil-bearing formations. Such vertebrate fossils are most likely to be found near Opal, Wyoming, or in the few Pleistocene deposits (mainly unconsolidated alluvium and colluvium) scattered along the route.

4.2 Procedures at Time of Discovery of Unanticipated Paleontological Resources

In accordance with BLM guidelines (IM 2009-011, Attachment B), if significant fossils are discovered, construction activity will cease in the immediate area of the discovery, and the discovery will be immediately reported to the Ruby construction supervisor responsible for protection of environmental resources on the associated spread or construction activity. The supervisor will ensure that the discovery is protected from damage and looting and will immediately report the discovery to Ruby's consultant paleontologist and to the appropriate BLM District Office. The paleontologist will examine and record the paleontological resource and evaluate its significance in collaboration with BLM paleontologist/archaeologists and determine if additional mitigation (collection and curation) is required. Ground-disturbing construction activities will not resume in the immediate area of the paleontological resource until the paleontologist (consulting and BLM) concur that construction may resume. Agencies may inform Ruby's PI of any required mitigation measures by telephone, with follow-up documentation by mail or email. The list of agency paleontological/archaeological contacts is provided in Section 5 of this plan.

4.3 Recording Procedures for Unanticipated Paleontological Resources

Paleontological materials of scientific significance discovered during construction will be recorded using methods consistent with modern professional paleontology standards, as detailed in IM 2009-011, Attachment B. Initially, Ruby paleontologists will identify the horizontal and vertical extent (i.e., features visible in an exposed trench profile) of fossil vertebrate materials. Scientifically significant fossil vertebrates will be collected and curated

into an acceptable museum or academic repository. Collection methods will depend on each individual fossil and its condition. Fractured vertebrate fossils may require the application of a consolidant, plaster, and burlap field jacket. Standard data on the discovered locality will be recorded, including Universal Transverse Mercator coordinates, geologic formation, lithology, and stratigraphic position. The localities will also be plotted on appropriate United States Geological Survey 7.5-minute quadrangle maps. In addition, the locality will be documented photographically. This information will be recorded on standard paleontological locality forms.

4.4 Emergency Salvage of Paleontological Resources

Unstable trench conditions and other unforeseen natural or work events could endanger paleontological resources discovered during construction of the pipeline. If paleontological resources are in imminent danger of destruction, Ruby will, without delay, take prudent action to preserve as much paleontological information as possible. Salvage activities will follow standard paleontological procedures to the greatest extent possible, but human safety concerns or the immediacy of the threat to the paleontological resource may require less exact methods of material extraction, including rapid shovel excavation or use of backhoes or other heavy equipment.

4.5 Reporting

After completion of paleontological surveys of NV Paleo locations #1, #2 and #3 (See Attachment C, Table C-1), Ruby will report the findings, significance, and recommendations to Elko District BLM for review. If mitigation is needed, and an excavation of more than one square meter is required, a paleontological excavation permit application will be filed and will need to be authorized by the BLM Nevada Reno State Office. In addition, a draft mitigation plan will be sent to the Elko District BLM and to the BLM regional paleontologist in Salt Lake City (Scott Foss) for review, comment, and acceptance prior to initiating the mitigation fieldwork.

Ruby will also prepare a final paleontological resource report at the completion of the Project that will describe the fossils discovered in each BLM district crossed by the Project.

5. Contacts for Unanticipated Discoveries

Table 5-1 Contact Information

Agency	Name	Contact Information
Ruby Pipeline, LLC	Nicole Pedigo	El Paso Corporation Two North Nevada Avenue Colorado Springs, CO 80903 Phone: 719.667.7529 Email: Nicole.Pedigo@elpaso.com
Ecology and Environment, Inc.	John Montgomery, R.G. Office Manager	333 SW Fifth, Suite 600 Portland, OR 97204 Phone: 503.248.5600 Fax: 503.248.5577 Email: jmontgomery@ene.com
Qualified Paleontologist	Brooks Britt, Ph.D. Principal Investigator	545 Robin Road Orem, Utah 84097 Phone: 801.422.7316 Mobile: 801.616.9419 Fax: 801.422.0267 Email: Brooks.Britt@gmail.com
BLM - Utah State Office Regional Utah BLM Lands	Scott Foss, Ph.D. Regional Paleontologist	P.O. Box 45155 Salt Lake City, Utah 84145 Phone: 801.539.4272 Mobile: 801.505.3356 Fax: 801.539.4074 Email: Scott_Foss@blm.gov
BLM Salt Lake Field Office	Larry Garahana Geologist	2370 South 2300 West Salt Lake City, Utah 84119 Phone: 801.977.4371 Email: Larry_Garahana@blm.gov
Wyoming BLM Lands	Brent H. Breithaupt, Ph. D. Paleontological Resource Assistant to the BLM Regional Paleontologist Wyoming BLM	Office phone 307-775-6052 BLM - Wyoming State Office P.O. Box 1828 Cheyenne, Wyoming 82003 Phone: 307.775.6052 Fax :307.775.6042 Email: Brent_Breithaupt@blm.gov

Table 5-1 Contact Information

Agency	Name	Contact Information
BLM Nevada State Office Nevada BLM Lands BLM Nevada Paleontology	Tom Burke Archaeologist	1340 Financial Blvd Reno, Nevada 89502 Phone: 775.861.6415 Fax: 775.861.6712 Email: Tom_Burke@blm.gov
BLM Elko District Tuscarora & Wells Field Offices	Bryan Hockett Bill Fawcett	3900 East Idaho Street Elko, Nevada 89801 Fax: 775.753.0255 Bryan_Hockett@blm.gov Phone: 775.753.0276 Bill_Fawcett@blm.gov Phone: 775.753.0200
BLM Winnemucca District Humboldt River Office	Samuel Potter Archaeologist	5100 East Winnemucca Blvd. Winnemucca, Nevada 89445 Phone: 775.623.1524 Fax: 775.623.1503 Samuel_Potter@blm.gov
BLM Surprise Field Office (covers northwestern Nevada)	Penni Borghi Archaeologist	602 Cressler St. Cedarville, California 96104 Phone: 530.279.2732 Email: Penni_Borghi@ca.blm.gov
BLM Oregon Prineville District	John Zancanella Paleontology Program Coordinator Archaeologist	3050 NE Third Prineville, OR 97754 Phone: 541.416.6735 Email: John_Zancanella@or.blm.gov

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_____. 2003b. *Spacial Digital Database for the Geologic Map of Oregon.* http://pubs.usgs.gov/of/2003/of03-67/. Accessed May 2008.

Utah Geological Survey. 2000. *Digital Geologic Map of Utah*. http://ugs.utah.gov/. Accessed May 2008.

Attachment A Geologic Units by Milepost and Paleontological Sensitive Areas with PFYC Rankings of 3–5

Table A-1 Geologic Units by Milepost and Paleontological Sensitive Areas with PFYC Rankings of 3–5

Start MP	End MP	Length (miles)	Map Unit	Rock Type	Formation	Paleo Sensitivity (PFYC) – 5 is the most sensitive	Summer 2008 Field Checked	Recommend for Post-trench Spot/Field Check
0.1	0.3	0.2	Tb	Volcanic and sedimentary	Bridger formation	5	Yes	Yes
0.3	0.4	0.1	Tgl	Lacustrine sedimentary	Green River formation: Laney member	5	Yes	Yes
0.4	0.6	0.2	Tw	Fluvial sedimentary	Wasatch formation, main body	5	Yes	Yes
1.4	1.8	0.4	Tgl	Lacustrine sedimentary	Green River formation: Laney member	5	Yes	Yes
1.8	6.1	4.4	Tb	Volcanic and sedimentary	Bridger formation	5	Yes	Yes
6.1	6.6	0.5	Tgl	Lacustrine sedimentary	Green River formation: Laney member	5	Yes	Yes
7.3	7.6	0.3	Tgl	Lacustrine sedimentary	Green River formation: Laney member	5	Yes	Yes
9.2	10.2	1	Tw	Fluvial sedimentary	Wasatch formation, main body	5	Yes	Yes
10.2	11.0	0.8	Tgw	Lacustrine sedimentary	Green River formation: Wilkins Peak member	5	Yes	Yes
11	11.7	0.7	Tgrw	Fluvial and lacustrine sedimentary	Green River and Wasatch formations	5	Yes	Yes
11.7	12.8	1.1	Tgw	Lacustrine sedimentary	Green River formation: Wilkins Peak member	5	Yes	Yes
12.8	13.3	0.5	Tgrw	Fluvial and lacustrine sedimentary	Green River and Wasatch formations	5	Yes	Yes
13.3	14.4	1.1	Kg	Marine sedimentary	Gannett group	3	Yes	Yes

Table A-1 Geologic Units by Milepost and Paleontological Sensitive Areas with PFYC Rankings of 3–5

Start MP	End MP	Length (miles)	Map Unit	Rock Type	Formation	Paleo Sensitivity (PFYC) – 5 is the most sensitive	Summer 2008 Field Checked	Recommend for Post-trench Spot/Field Check
14.4	15.1	0.7	Tw	Fluvial sedimentary	Wasatch formation, main body	5	Yes	Yes
15.1	16.4	1.3	Tgrw	Fluvial and lacustrine sedimentary	Green River and Wasatch formations	5	Yes	Yes
16.4	19.1	2.7	Ka	Marine sedimentary	Aspen shale	3	Yes	Yes
19.1	20.5	1.4	Kf	Marine sedimentary	Frontier formation	3	Yes	Yes
20.5	26.2	5.7	Kh	Marine sedimentary	Hilliard shale	3	Yes	Yes
26.2	27.6	1.4	Kf	Marine sedimentary	Frontier formation	3	Yes	Yes
27.6	27.7	0.1	TKe	Fluvial and marsh sedimentary	Evanston formation	3	Yes	Yes
27.7	28.1	0.3	Kf	Marine sedimentary	Frontier formation	3	Yes	Yes
28.1	28.9	0.8	TKe	Fluvial and marsh sedimentary	Evanston formation	3	Yes	Yes
28.9	40.7	11.8	Tgrw	Fluvial and lacustrine sedimentary	Green River and Wasatch formations	5	Yes	Yes
40.7	41.2	0.5	Tw	Fluvial sedimentary	Wasatch formation, main body	5	Yes	Yes
41.2	42.1	0.9	TKe	Fluvial and marsh sedimentary	Evanston formation	3	Yes	Yes
42.1	42.6	0.5	Kg	Marine sedimentary	Gannett group	3	Yes	Yes
42.6	43.2	0.6	Tf	Fluvial sedimentary	Fowkes formation (Pliocene and Eocene)	3	Yes	Yes

Table A-1 Geologic Units by Milepost and Paleontological Sensitive Areas with PFYC Rankings of 3–5

Start MP	End MP	Length (miles)	Map Unit	Rock Type	Formation	Paleo Sensitivity (PFYC) – 5 is the most sensitive	Summer 2008 Field Checked	Recommend for Post-trench Spot/Field Check
43.2	43.4	0.2	Kss	Marine sedimentary	Sage Junction, Quely, Cokeville, Thomas Fork, and Smiths Formations	3	Yes	Yes
43.4	46.2	2.8	TKe	Fluvial and marsh sedimentary	Evanston formation	3	Yes	Yes
46.2	47.7	1.5	Kss	Marine sedimentary	Sage Junction, Quely, Cokeville, Thomas Fork, and Smiths Formations	3	Yes	Yes
47.7	48.1	0.4	Tf	Fluvial sedimentary	Fowkes formation (Pliocene and Eocene)	3	Yes	Yes
48.1	48.1	0	Tf	Fluvial sedimentary	Fowkes formation (Pliocene and Eocene)	3	Yes	Yes
55.3	60.7	5.4	T1	Fluvial and lacustrine sedimentary	Wasatch, Cotton, Flagstaff, Claron, White Sage and other Fms	3	Yes	Yes
61.1	64.9	3.8	T1	Fluvial and lacustrine sedimentary	Wasatch, Cotton, Flagstaff, Claron, White Sage and other Fms	3	Yes	Yes
64.9	65.1	0.2	J1	Marine and eolian sedimentary	Summerville, Entrada, Carmel, Arapien, Twin Creek and other Fms	3	Yes	Yes
65.1	65.3	0.2	T1	Fluvial and lacustrine sedimentary	Wasatch, Cotton, Flagstaff, Claron, White Sage and other Fms	3	Yes	Yes

Table A-1 Geologic Units by Milepost and Paleontological Sensitive Areas with PFYC Rankings of 3–5

Start MP	End MP	Length (miles)	Map Unit	Rock Type	Formation	Paleo Sensitivity (PFYC) – 5 is the most sensitive	Summer 2008 Field Checked	Recommend for Post-trench Spot/Field Check
65.3	66.0	0.7	J1	Marine and eolian sedimentary	Summerville, Entrada, Carmel, Arapien, Twin Creek and other Fms	3	Yes	Yes
66	71.1	5.1	T1	Fluvial and lacustrine sedimentary	Wasatch, Cotton, Flagstaff, Claron, White Sage and other Fms	3	Yes	Yes
71.5	72.1	0.6	T1	Fluvial and lacustrine sedimentary	Wasatch, Cotton, Flagstaff, Claron, White Sage and other Fms	3	Yes	No
72.3	72.9	0.6	T1	Fluvial and lacustrine sedimentary	Wasatch, Cotton, Flagstaff, Claron, White Sage and other Fms	3	Yes	Yes
73.6	73.8	0.2	T1	Fluvial and lacustrine sedimentary	Wasatch, Cotton, Flagstaff, Claron, White Sage and other Fms	3	Yes	Yes
73.8	74.0	0.2	T1	Fluvial and lacustrine sedimentary	Wasatch, Cotton, Flagstaff, Claron, White Sage and other Fms	3	Yes	Yes
74.2	75.1	0.9	T1	Fluvial and lacustrine sedimentary	Wasatch, Cotton, Flagstaff, Claron, White Sage and other Fms	3	Yes	No
75.4	76.6	1.2	T1	Fluvial and lacustrine sedimentary	Wasatch, Cotton, Flagstaff, Claron, White Sage and other Fms	3	Yes	No

Table A-1 Geologic Units by Milepost and Paleontological Sensitive Areas with PFYC Rankings of 3–5

Start MP	End MP	Length (miles)	Map Unit	Rock Type	Formation	Paleo Sensitivity (PFYC) – 5 is the most sensitive	Summer 2008 Field Checked	Recommend for Post-trench Spot/Field Check
76.7	82.7	6	T1	Fluvial and lacustrine sedimentary	Wasatch, Cotton, Flagstaff, Claron, White Sage and other Fms	3	Yes	No
92.9	94.5	1.6	T4	Volcanic and sedimentary	Salt Lake Fm and other valley-filling alluvial, lacustrine, and volcanic units	3	Yes	No
95.2	98.8	3.6	T4	Volcanic and sedimentary	Salt Lake Fm and other valley-filling alluvial, lacustrine, and volcanic units	3	Yes	No
134.8	135.5	0.7	M3	Marine sedimentary	Chainman, Manning Canyon, Doughnut and other Fms	3	Yes	No
141.2	141.9	0.7	T4	Volcanic and sedimentary	Salt Lake Fm and other valley-filling alluvial, lacustrine, and volcanic units	3	Yes	Yes
143.2	143.5	0.3	T4	Volcanic and sedimentary	Salt Lake Fm and other valley-filling alluvial, lacustrine, and volcanic units	3	Yes	Yes
187.8	188.1	0.3	T4	Volcanic and sedimentary	Salt Lake Fm and other valley-filling alluvial, lacustrine, and volcanic units	3	Yes	Yes
189.4	189.8	0.4	P2	Lacustrine sedimentary	Kaibab, Toroweap, Park City and other Fms	3	Yes	Yes
192.6	192.9	0.3	T4	Volcanic and sedimentary	Salt Lake Fm and other valley-filling alluvial, lacustrine, and volcanic units	3	Yes	Yes

Table A-1 Geologic Units by Milepost and Paleontological Sensitive Areas with PFYC Rankings of 3–5

Start MP	End MP	Length (miles)	Map Unit	Rock Type	Formation	Paleo Sensitivity (PFYC) – 5 is the most sensitive	Summer 2008 Field Checked	Recommend for Post-trench Spot/Field Check
197.2	197.4	0.2	T4	Volcanic and sedimentary	Salt Lake Fm and other valley-filling alluvial, lacustrine, and volcanic units	3	Yes	Yes
213.5	214.0	0.5	T4	Volcanic and sedimentary	Salt Lake Fm and other valley-filling alluvial, lacustrine, and volcanic units	3	Yes	Yes
228.7	228.8	0.1	P1	Marine sedimentary	Cedar Mesa, Diamond Creek, Arcturus and other Fms	3	Yes	No
229.7	230.5	0.8	P1	Marine sedimentary	Cedar Mesa, Diamond Creek, Arcturus and other Fms	3	Yes	No
231.1	231.2	0.1	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
244.4	245.2	0.8	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
246.7	247.0	0.3	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
247.3	247.6	0.3	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
248.1	248.3	0.2	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
248.8	249.8	1	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
250.2	250.4	0.2	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
251.4	255.4	4	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
256.2	256.4	0.2	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No

Table A-1 Geologic Units by Milepost and Paleontological Sensitive Areas with PFYC Rankings of 3–5

Start MP	End MP	Length (miles)	Map Unit	Rock Type	Formation	Paleo Sensitivity (PFYC) – 5 is the most sensitive	Summer 2008 Field Checked	Recommend for Post-trench Spot/Field Check
257.2	259.8	2.6	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
262.1	262.5	0.4	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
263.1	264.7	1.6	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
265.2	266.4	1.2	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
272.4	272.9	0.5	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
275.9	280.2	4.3	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
283.7	292.9	9.2	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
295.2	299.3	3.4	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
300.3	301.6	1.3	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
302	304.5	2.5	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
306.8	307.4	0.6	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
309.2	310.3	1.1	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
311.2	315.4	4.2	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
324.7	327.7	3	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
328.2	328.3	0.1	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
329	333.5	4.6	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No
333.8	336.7	2.9	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No

Table A-1 Geologic Units by Milepost and Paleontological Sensitive Areas with PFYC Rankings of 3–5

Start MP	End MP	Length (miles)	Map Unit	Rock Type	Formation	Paleo Sensitivity (PFYC) – 5 is the most sensitive	Summer 2008 Field Checked	Recommend for Post-trench Spot/Field Check
352.7	353.6	0.9	Qa	Unconsolidated Sedimentary	Surficial alluvium and colluvium	2	Yes	Yes
363.5	368.0	4.5	Tts	Volcanic	Tuffaceous sedimentary rocks; tuffs; pumicites; and silcic flows (Miocene)	3	Yes	No
368.3	368.3	0.1	Qa	Unconsolidated Sedimentary	Surficial alluvium and colluvium	2	Yes	Yes
368.7	371.5	2.8	Tts	Volcanic	Tuffaceous sedimentary rocks; tuffs; pumicites; and silcic flows (Miocene)	3	Yes	No
374.4	374.6	0.2	Tts	Volcanic	Tuffaceous sedimentary rocks; tuffs; pumicites; and silcic flows (Miocene)	3	Yes	No
375.1	376.9	1.8	Tts	Volcanic	Tuffaceous sedimentary rocks; tuffs; pumicites; and silcic flows (Miocene)	3	Yes	No
376.9	382.1	5.2	Qa	Unconsolidated Sedimentary	Surficial alluvium and colluvium	2	Yes	Yes
382.1	382.5	0.4	Tts	Volcanic	Tuffaceous sedimentary rocks; tuffs; pumicites; and silcic flows (Miocene)	3	Yes	No
382.5	384.3	1.8	Qa	Unconsolidated Sedimentary	Surficial alluvium and colluvium	2	Yes	Yes
384.3	384.6	0.3	Tts	Volcanic	Tuffaceous sedimentary rocks; tuffs; pumicites; and silcic flows (Miocene)	3	Yes	No
384.6	385.4	0.8	Ts3	Volcanic	Tuffaceous sedimentary rocks	3	Yes	No

Table A-1 Geologic Units by Milepost and Paleontological Sensitive Areas with PFYC Rankings of 3–5

Start MP	End MP	Length (miles)	Map Unit	Rock Type	Formation	Paleo Sensitivity (PFYC) – 5 is the most sensitive	Summer 2008 Field Checked	Recommend for Post-trench Spot/Field Check
385.4	391.6	6	Qa	Unconsolidated Sedimentary	Surficial alluvium and colluvium	2	Yes	Yes
393.3	416.2	22.9	Qa	Unconsolidated Sedimentary	Surficial alluvium and colluvium	2	Yes	Yes
443.8	444.7	0.9	JTRs	Sedimentary	Sedimentary rocks (Jurassic and upper Triassic)	3	Yes	No
456.9	460.3	3.4	Qp	Unconsolidated sedimentary	Playa, marsh, and alluvial-flat deposits, locally eroded	3	August 2009	No
464.1	483.3	19.3	Qp	Unconsolidated sedimentary	Playa, marsh, and alluvial-flat deposits, locally eroded	3	August 2009	No
488.3	496.0	7.7	Qp	Unconsolidated sedimentary	Playa, marsh, and alluvial-flat deposits, locally eroded	3	August 2009	No
506.1	506.2	0.1	JTRs	Basalt	Tertiary	3	August 2009	No
510.4	511.0	0.6	JTRs	Sedimentary	Sedimentary rocks (Jurassic and upper Triassic)	3	August 2009	No
511.6	516.2	4.6	Tr2	Alluvial and lacustrine sedimentary	Age equivalent Chinle, Ankareh Fms	3	August 2009	Yes
517.5	517.8	0.3	Tr2	Alluvial and lacustrine sedimentary	Age equivalent Chinle, Ankareh Fms	3	August 2009	No
532.8	533.4	0.6	Tts	Volcanic	Tuffaceous sedimentary rocks; tuffs; pumicites; and silcic flows (Miocene)	3	No	Yes

Table A-1 Geologic Units by Milepost and Paleontological Sensitive Areas with PFYC Rankings of 3–5

Start MP	End MP	Length (miles)	Map Unit	Rock Type	Formation	Paleo Sensitivity (PFYC) – 5 is the most sensitive	Summer 2008 Field Checked	Recommend for Post-trench Spot/Field Check
533.7	533.9	0.2	Tts	Volcanic	Tuffaceous sedimentary rocks; tuffs; pumicites; and silcic flows (Miocene)	3	No	Yes
538.6	540.2	1.7	Tts	Volcanic	Tuffaceous sedimentary rocks; tuffs; pumicites; and silcic flows (Miocene)	3	No	Yes
551.7	552.0	0.3	Tts	Volcanic	Tuffaceous sedimentary rocks; tuffs; pumicites; and silcic flows (Miocene)	3	No	Yes
554.4	555.3	0.9	Tts	Volcanic	Tuffaceous sedimentary rocks; tuffs; pumicites; and silcic flows (Miocene)	3	No	Yes
555.7	556.0	0.3	Tts	Volcanic	Tuffaceous sedimentary rocks; tuffs; pumicites; and silcic flows (Miocene)	3	No	Yes
570.8	571.4	0.6	Qp	Unconsolidated sedimentary	Playa, marsh, and alluvial-flat deposits, locally eroded	3	No	No
597.5	600.2	2.7	Tts	Volcanic	Tuffaceous sedimentary rocks; tuffs; pumicites; and silcic flows (Miocene)	3	No	No
602.2	602.4	0.2	Tts	Volcanic	Tuffaceous sedimentary rocks; tuffs; pumicites; and silcic flows (Miocene)	3	No	No

Attachment B Supporting Bureau of Land Management Documentation

Guidelines for Assessment and Mitigation of Potential Impacts to Paleontological Resources

Contents:

Introduction

Surface disturbing federal actions on public and split-estate lands may cause direct adverse impacts to paleontological resources through the damage or destruction of fossils or the disturbance of the stratigraphic context in which they are located. Indirect adverse impacts may be created from increased accessibility to fossils leading to looting or vandalism activities. Land tenure adjustments may result in the loss of significant paleontological resources to the public if fossils pass from public ownership.

Under the Federal Land Policy and Management Act (FLPMA) and the National Environmental Policy Act (NEPA), federal actions and land tenure adjustments that may impact or result in a loss of paleontological resources on public or split-estate lands are evaluated, and necessary mitigation is identified.

I. ASSESSMENT OF POTENTIAL IMPACTS TO PALEONTOLOGICAL RESOURCES

The following sections outline general steps designed to assist in the analysis and assessment of possible impacts to paleontological resources from proposed actions. These sections are sequential in order and provide for termination of the assessment at various stages if the analysis indicates no impacts are likely to occur.

A. Scoping. Field Offices must assess all proposed federal actions to identify possible effects to significant paleontological resources (see Appendix A for definition) that are potentially recoverable and are likely to be within the zone of expected surface disturbance or relatively close to the surface. The direct effects of all surface activities and the indirect effects of increased public access and land tenure adjustments must be considered in any paleontological assessment. The assessment will determine whether further analysis will be necessary. The Paleontology Program Coordinator (Paleontology Coordinator – see Appendix A for definition) has primary responsibility for the scoping process for projects within the Field Office area, but the Paleontology Program Lead (Paleontology Lead – see Appendix A for definition) may be responsible for projects that span multiple Field or District Offices, and can support the Paleontology Coordinator as requested.

1. Surface only activities – If the proposed project will not disturb potentially fossil-yielding bedrock or alluvium, no additional work is necessary. The project file should be documented as appropriate. Examples of such projects include weed spraying, mechanical brush treatment, geophysical exploration, or surface disturbing activities such as road construction when the fossil resource is expected to be buried well below project compression or excavation depth or when surface fossil resources would be left undamaged.

2. Land Tenure Adjustments – If parcels are identified to pass from public ownership in a proposed land tenure adjustment action but contain no potential for recoverable, significant paleontological resources, no additional work is necessary. The project file should be documented as appropriate**,** and conclusions addressed in the environmental document. This situation may arise, for example, in areas consisting only of granitic bedrock where paleontological resources would not normally occur.

3. Young alluvial deposits or deep soils may cover and obscure sedimentary bedrock, and any fossils that may occur in that bedrock would be unidentifiable or irretrievable prior to disturbance actions. In most of these cases, the fossil resources cannot be quantified, but the potential for impacting paleontological resources should be mentioned in the evaluation of the proposal, i.e., the planned disturbance will pass through the soil layer and impact a bedrock unit which is known to contain significant fossils elsewhere.

If the initial scoping identifies the possibility for adversely affecting significant paleontological resources, further analysis is necessary. If there will be no impact or potential impact based on the action or the fossil resource may be impacted, but is too deep to be recovered, e.g., deep well bore passing through a fossil formation, the project file must be documented, and no additional assessment is necessary.

B. Analysis of Existing Data. If scoping suggests the possibility of disturbing fossil-yielding bedrock or alluvium that is near to the surface and that may contain significant paleontological resources that are potentially recoverable, more in-depth analysis is necessary. Geologic mapping reflecting the Potential Fossil Yield Classification (PFYC) should be consulted, along with any other easily accessible information, such as GIS-based locality data, other known paleontological locality information, and existing paleontological reports for the area, aerial photos, or soils maps.

1. Potential Fossil Yield Classification (PFYC) – This is a system for categorizing the probability of geologic units to contain scientifically significant paleontological resources or noteworthy fossil occurrences. It has five levels or Classes, with Class 1 applied to geologic units that are not likely to contain significant fossils through Class 5 for geologic formations that have a high potential to yield scientifically significant fossils on a regular basis (see IM No. 2008-009). This classification does not reflect rare or isolated occurrences of significant fossils or individual localities, only the relative occurrence on a formation- or member-wide basis. Any rare occurrences may require additional assessment and mitigation if they fall within the area of anticipated impacts.

2. If the results of the preliminary analysis determine that the proposed project will only affect geologic units not likely to contain significant fossils or that have a very low or low potential for significant fossils (PFYC Class 1or 2), and no scientifically important localities are known to occur in the area, the project file should be documented, and no additional paleontology assessment is necessary.

3. The results of an analysis of a proposed project may indicate the potential to disturb PFYC Class 3, 4, or 5 formations or potentially fossil-bearing alluvium, or known significant localities, which may then suggest the need for field surveys and/or other mitigation measures. The results may also identify areas where little or nothing is known of the fossil record so that additional attention may be given to these areas during field survey. The analysis should consider the likely impacts on the known or potential fossil resource and should be the basis for determining the need for or level of additional assessments.

C. Determining the Need for Field Surveys and Mitigation. The previously discussed procedures may result in the determination that the project may encounter bedrock or an alluvial zone that has a moderate or high potential to contain significant paleontological resources. However, it does not determine the appropriate action, such as a field survey, on-site monitoring, special stipulations, avoidance, or other mitigation.

1. If the need for further work is not clearly evident after the analysis, the Authorized Officer and/or Project Leader should be consulted for a final decision. The Paleontology Lead or Regional Paleontologist may also be consulted. A brief written report of findings should be prepared, including the rationale for supporting the decision not to require a field survey or additional monitoring. The report should be signed by the Authorized Officer and placed in the project file. For example, a seismic survey using vibroseis trucks may be proposed on areas of deep soils, or a temporary recreational event may be planned in an area of low fossil potential. These types of projects are not likely to have a reasonable potential to adversely affect important

paleontological resources. The file should be documented and a standard discovery stipulation attached to the permit proposal.

2. If the analysis in Sec. I.B indicates a reasonably high expectation of not just encountering a potential fossil-bearing zone and also causing adverse impacts to significant paleontological resources, the determination must be made as to (1) whether adverse effects cannot be avoided; (2) whether the adverse impacts can be avoided by altering the location or scope of the project; (3) whether the impacts can be mitigated through development of special stipulations such as requiring on-site monitoring; or (4) whether field surveys will be necessary to determine the presence or absence of significant paleontological resources.

3. In the case where it is known that significant paleontological resources will be adversely impacted, the preferred course of action is avoidance of the impact by moving or rerouting the site of construction, or eliminating or reducing the need for surface disturbance.

4. Application of specific stipulations may reduce or eliminate adverse impacts in many cases. A standard discovery stipulation should be included in any permit approval that is likely to affect significant paleontological resources. The stipulation should mandate an immediate work stoppage in the area of discovery, notification to the Authorized Officer, and protection of the material and geological context. Other stipulations may be appropriate on a case-by-case basis.

(a) A suggested standard discovery stipulation for a discretionary federal action is:

> The permittee shall immediately notify the BLM Authorized Officer of any paleontological resources discovered as a result of operations under this authorization. The permittee shall suspend all activities in the vicinity of such discovery until notified to proceed by the Authorized Officer and shall protect the discovery from damage or looting. The permittee may not be required to suspend all operations if activities can be adjusted to avoid further impacts to a discovered locality or be continued elsewhere. The Authorized Officer will evaluate, or will have evaluated, such discoveries as soon as possible, but not later than 10 working days after being notified. Appropriate measures to mitigate adverse effects to significant paleontological resources will be determined by the Authorized Officer after consulting with the operator. Within 10 days, the operator will be allowed to continue construction through the site, or will be given the choice of either (1) following the Authorized Officer's instructions for stabilizing the fossil resource in place and avoiding further disturbance to the fossil resource, or (2) following the Authorized Officer's instructions for mitigating impacts to the fossil resource prior to continuing construction through the project area.

Note: C.1 and C.2 above would be conducted at the permittee's expense. By regulation, after a 3809 plan of operations is approved or where there is no plan, the BLM is responsible for the cost of any investigation and recovery of fossil materials.

(b) Other stipulations may be developed to reduce potential impacts, preferably in consultation with the project proponent. These may include (1) techniques to reduce surface

disturbance, (2) briefings for all personnel about the potential for discovery, (3) requiring all finds be reported, and (3) using a "light touch" in sensitive areas. These should be made a formal part of the authorization for the project and discussed at a preconstruction meeting or an on-site meeting in the case of oil and gas operations.

(c) All proponents should be directed to share the current rules and regulations regarding fossil theft and the limitations to free use collecting of invertebrate and plant fossils on BLM-administered lands with all employees and subcontractors under their direction. Unlawful removal, damage, or vandalism of paleontological resources will be prosecuted by federal law enforcement. Theft or damage to government property by a proponent, a proponent's employee, or a subcontractor that is under a proponent's direction may lead to legal actions against the proponent.

5. If avoidance actions or stipulating measures are insufficient to protect known paleontological resources, a written assessment must be completed to determine the need for field survey or monitoring. This assessment must include the anticipated direct or indirect impacts associated with the project, the inadequacies of avoidance or special stipulations to protect the resource, existing paleontological information and known localities, relevant geologic information, and the potential for additional discoveries. The assessment must be completed by the Paleontology Coordinator.

(a) In some cases, bedrock will not be visible at the surface in the project area (for example, where thin soils or alluvium obscure all outcrops), but the proposed excavation will likely penetrate into bedrock with known significant paleontological resources. Because fossil material will not be visible at the ground surface in these cases, it may be appropriate to forego a field survey prior to excavation, but require on-site monitoring or spot-checks when bedrock is finally encountered. If construction monitoring is proposed, the written assessment must include a thorough justification for the recommendation.

(b) The State Office may require the Paleontology Coordinator to notify the Paleontology Lead that a field survey or monitoring is deemed appropriate prior to the final decision to require the survey or monitoring. The notification should minimally include the name of the project, the legal description of the location or other locational information, a brief summary of the proposed action, reason(s) for the decision to require a survey or monitoring, and any other relevant information. Concurrence of the Paleontology Lead or Regional Paleontologist may be required prior to the final decision for requiring a survey or monitoring.

(c) A standardized assessment document may be developed that can be applied to projects that are similar in nature, relatively small, and repetitive in approach for use within a Field Office or District. This written assessment is intended to simplify the documentation process for those projects that are likely to have minimal impacts, and may be structured as a programmatic assessment, a form, a checklist, or other document with standard items. This assessment must include the name of the project, the legal description of the location or other locational reference, a brief summary of the proposed action, reason(s) for the decision, and any other relevant information. The parameters in the assessment should be designed to identify the need for a field survey. For example, the parameters may indicate a field survey may be required

for road and well pad construction activities occurring on Class 4 or 5 formations where the formation is likely to be encountered during surface disturbing activities. The Field Manager, in consultation with the Paleontology Lead, must approve the use of a programmatic assessment prior to initial implementation.

6. The decision to require a field survey or monitoring must be made by the Authorized Officer and documented in the project file. If required, a copy of the decision must be furnished to the Paleontology Lead.

II. PROCEDURES FOR CONDUCTING A PALEONTOLOGICAL FIELD SURVEY

If the assessment of existing data indicates: (a) the presence or high probability of occurrence of vertebrate fossils or uncommon nonvertebrate fossils (PFYC Class 4 or 5), or that the probability is unknown (Class 3), in the area of a proposed federal action or transfer of title, and (b) a reasonable probability that those resources will be adversely affected by the proposed action, a paleontological field survey should be conducted.

A. Definition of Field Surveys. Field Surveys are pedestrian surveys to be performed in areas where significant fossils can be expected to occur within the boundary and immediate vicinity of the anticipated disturbance, or where the probability of encountering significant fossils is unknown.

1. Field surveys are performed prior to any surface disturbing activities. Before conducting field surveys, the project location should be as final as possible and any staking of the location should be complete.

2. Surveys are conducted by a BLM Regional Paleontologist, Paleontology Lead, Paleontology Coordinator, appropriately trained and supervised BLM staff, or by a BLM-permitted consulting paleontologist hired by the project proponent.

(a) At the Field Manager's discretion, other qualified BLM staff may conduct surveys on small projects. Performance of surveys by BLM staff must also be approved by the Regional Paleontologist, Paleontology Lead, or Paleontology Coordinator.

(b) Surveys that are complex in nature, constrained by construction schedules, or otherwise cannot be performed by BLM staff should be performed by a consulting paleontologist holding a valid BLM Paleontological Resources Use Permit. Submission of reports may be done directly by the paleontologist to the BLM. The project proponent is also responsible for all costs associated with the survey, including the consulting paleontologist's fees and charges, all survey costs, fossil preparation to the basic identification stage, analyses, reports, and curation costs directly related to mitigation of the project's anticipated impacts. Any required monitoring and mitigation costs are also the responsibility of the project proponent. These costs are to be negotiated between the project proponent and the consulting paleontologist prior to beginning any data gathering, analysis, or field work, and these negotiations do not require BLM

involvement or approval. Any new, additional, or modified curation agreements between the paleontologist and the official repository must be in place prior to starting field work.

(c) Authorization for an activity to proceed cannot be given by a consulting paleontologist. Performance of the survey, either by a consulting paleontologist or BLM staff, or submission of the report DOES NOT constitute approval for the activity to proceed. The BLM must review the report, including adequacy of the field methods and findings. The Authorized Officer must approve the findings and determine the need for monitoring prior to approval to proceed.

B. Conducting Field Surveys. Field surveys must be performed by the Principal Investigator or an approved Field Agent or Field Monitor (see section IV.C., Types of Field Personnel for descriptions of these individuals) as authorized under a Paleontological Resource Use Permit, or by a BLM Regional Paleontologist or qualified BLM designee. Field surveys and collections performed as a mitigation measure are not intended to be scientific research studies, but are meant to identify, avoid, or recover paleontological resources to prevent damage or destruction from project activities. However, proper scientific techniques and procedures must be utilized during all mitigation efforts. Safety should be an important consideration; therefore, surveys should not be attempted on cliff faces, in open, non-reinforced trenches deeper than five feet, or other unsafe areas.

1. The scope of the survey is dependent upon the scale of the project. Small projects are defined as less than 10 acres, or, if linear, less than five miles; large projects exceed those dimensions.

2. At the start of field work, the consulting paleontologist (paleontologist) must contact the Paleontology Coordinator in each affected Field Office who may require a visit to that office. After an initial visit each year, the paleontologist may contact the Field Office by telephone or email prior to subsequent field trips, at the discretion of the Field Office. Information about the survey schedule, additional personnel, emergency field contact information, and any other pertinent data should be provided to the Paleontology Coordinator. The Field Office will inform the paleontologist of any conditions that may impact the survey, such as fire danger or restrictions, drought restrictions, wildlife timing restrictions, management restrictions, road restrictions or construction, and any other relevant information.

3. During the field survey, the paleontologist surveys, locates, and documents all paleontological resources within 200 feet of the proposed project location or corridor, or less distance upon approval.

(a) Where significant paleontological resources are at risk, data collection alone does not constitute mitigation of damage. All significant fossils that may be damaged or destroyed during project activities must be collected, along with all relevant contextual and locational data. Specimens must be collected during the survey or prior to commencement of any surface-disturbing activities.

(b) In many cases, isolated gar scales, chelonid (turtle) carapace or plastron fragments, crocodile and fish teeth, and unidentifiable bone fragments do not need to be collected. The location must be recorded and a description of the fossil material noted in the field notes and on a BLM Locality Form as part of the report. The context of these types of fossils should be considered, as they may represent rare occurrences or unusual faunal associations, and thus may be scientifically important and must be documented and voucher specimens collected where appropriate.

(c) Occurrences of plant or invertebrate fossils should be recorded and representative examples or voucher specimens collected where appropriate. Additional mitigation measures may be appropriate in some cases for these types of localities.

(d) If a large specimen or a concentration of significant fossils is located during the field survey, the available time and/or personnel may not allow for full recovery during the survey. The specimen(s) and locality(ies) should be stabilized as needed, and a determination made as to whether avoidance is necessary or whether full recovery of the specimen is required at a later time prior to disturbance activities. The Authorized Officer and project proponent must be notified, the mitigation alternatives discussed including funding for recovery, and a decision reached as soon as possible. If avoidance or later recovery is selected for mitigation, the find should be stabilized, buried if needed to protect the fossils and context, and appropriate measures implemented to reduce adverse effects from natural or human causes.

4. During the survey, locations or areas that exhibit a lithology suggesting a high probability of subsurface fossil material must be recorded, and a recommendation for the need for on-site monitoring, spot-checking, or testing should be made in the report. This may include areas where no fossil material was found on the surface during the survey. The recommendation should consider the size and type of planned disturbance, such as the depth of a trenching operation or the acreage of surface disturbance.

5. Surveys must be performed only during times when the ground is visible and not frozen. This will often preclude surveys during winter months in many areas. Biological timing restrictions, such as critical nesting or birthing times, may confine or delay field activities. Project proponents should be informed of BLM's requirement for performing any field surveys as soon as possible and should be advised of the possibilities for delays in survey completion based on seasonal weather conditions or other management restrictions to allow for adequate scheduling of available time.

C. Report of Survey Findings. After completion of the field survey, the paleontologist must file a written report with the BLM and the designated repository. If required, a copy should also be filed with the project proponent. This report must summarize the results of the survey as well as appropriate geological and paleontological background information as described below. It should also include any recommendations for on-site monitoring or other mitigation. For small projects (less than 10 acres), the report must be filed within 30 days after completion of the survey unless specific approval for a different time frame has been received from the BLM. The time frame for submission of the report for large projects should be negotiated during project scoping. On a case-by-case basis, approval to begin project activities may be granted for those

portions of the project area noted to be less paleontologically sensitive prior to final approval of the report.

1. Reports of the general findings and the background information must be submitted to the BLM project manager or Authorized Officer (if appropriate), the Paleontology Lead or Regional Paleontologist, and each affected Field Office. Reports must include the following details, as applicable. Items (a) and (b) should appear at the beginning of the report and may be presented as a title page in multi-page reports. Some of these categories may be combined.

(a) Name, affiliation, address, date of report, and permit number (if consultant) of paleontologist doing the survey.
(b) Project name and number (if used), name of proponent, and general location of project.
(c) Date(s) of survey and names of any personnel assisting with the survey.
(d) Brief description of the proposed project, emphasizing potential impacts to paleontological resources.
(e) Description of background research conducted. (Include overview of known paleontological information, institutions consulted, previous surveys in the area, previous projects of similar nature in the area, and general description of survey techniques employed).
(f) Summary of regional and local geology. May reference earlier projects for relevant information.
(g) Summary of regional and local paleontology. May reference earlier projects for relevant information.
(h) Summary of the survey results.
(i) Significance of findings.
(j) Potential impacts to paleontological resources resulting from the project.
(k) Detailed mitigation recommendations that may lessen potential adverse impacts.
(l) Potential fossiliferous areas to allow for future assessment of sites if applicable.
(m) Cited and other pertinent references.
(n) Map of project area, indicating areas surveyed, known localities, and new discoveries.
(o) Relevant photos, diagrams, tables to aid in explaining, clarifying, or understanding the findings.
(p) Listing of collected material, including field numbers, field identifications, and elements, cross-referenced to locality field numbers. This list may be submitted in electronic format, preferably in spreadsheet format.
(q) BLM locality form (8270-3) or equivalent for each new locality (including localities where fossils were observed but not collected) with a 1:24000 scale map showing the localities (not reduced in scale during photocopying) (see items 2 and 3 below).

2. Exact locations of fossil localities contained in these reports are considered sensitive and must not be included in any public document. The BLM locality form (8270-3) or

equivalent, 1:24000 scale map showing the localities, and any other information containing specific fossil locations may be bound separately or placed in a separate section to allow for preservation of confidential locality data. A copy of this confidential section must be submitted to the Paleontology Lead (in some cases, two copies may be required). A copy for each affected Field Office may be required. Another copy must be submitted to the official repository with the collected materials.

3. BLM GPS recording and data standards must be used to report paleontological locality data. Existing USGS topographic maps are often based on the NAD27 standard, so locality data calculated from a map base must be converted before submission. Data must be recorded and reported with a mean error of +/- 12.5 meters or less, at a 95 percent confidence level. For small localities, data should be reported as point data. Larger polygonal localities should be reported using coordinates of a centroid and a description of the approximate size, or the key coordinate points of a bounding polygon. Linear features, such as roads or surveyed project boundaries, must be reported as line data. The 1:24000 scale map(s) accompanying the locality forms should graphically illustrate the locality, either as a point or an outline of the locality as appropriate, and be clearly labeled with the locality or field number.

D. Report Approval. The Authorized Officer will analyze the Survey Report for adequacy within 10 working days of receipt. Notification accepting the report, or explaining any identified deficiencies, will be sent to the consulting paleontologist and the project proponent with a copy placed in the project file. Any deficiencies must be corrected as soon as possible, usually initiated within five working days, and the report must be resubmitted for approval. Any resubmissions must be prompt, but consideration will be made for the amount of time needed for major corrections. Deficiencies directly affecting the survey, such as inadequate survey procedures or incomplete data, must be corrected before granting approval for the project to proceed. Deficiencies not directly affecting the survey, such as curation issues, will not prevent approval of the project, but must be corrected as soon as possible.

III. DETERMINATION OF FURTHER MITIGATION REQUIREMENTS

The need for additional mitigation to protect paleontological resources will be determined on a case-by-case basis. The Authorized Officer, in consultation with Regional Paleontologist or the Paleontology Lead, will analyze the Survey Report for survey findings and any mitigation recommendations. If no further mitigation is needed, the Authorized Officer will promptly notify the project proponent that there are no additional paleontological surveys or mitigation measures required, and the project may proceed pending any other approvals. The project file must be documented indicating acceptance of the survey report and identifying any additional mitigation requirements. If it is determined that additional mitigation efforts are needed to protect or preserve the paleontological resources, the project proponent will be notified as soon as possible. The Authorized Officer and/or the Paleontology Lead usually develop and approve the mitigation procedures or recommend a project be redesigned in consultation with the project proponent. Factors such as locality or specimen significance, economics, safety, and project urgency will be considered when developing mitigation measures. Additional mitigation

measures will be developed and implemented as timely as possible so as not to delay project actions.

A. Relocation. The preferred mitigation technique is to change the project location based on the results of the field survey. Relocation, however, may necessitate a field survey of the new area, as well as resurveys by other resource specialists. Anticipation of this contingency prior to or during the original survey may allow for survey of an expanded area at the same time. If relocation will eliminate impacts and is acceptable to all parties, then a report to the file, including a map showing the original and revised locations, must be completed documenting the change. Approval for the project to proceed in the revised location may then be granted by the Authorized Officer to the project proponent. When avoidance is not possible, appropriate mitigation may include excavation or collection (data recovery), stabilization, monitoring, protective barriers and signs, or other physical and administrative protection measures.

B. Deferred Fossil Collection. In some cases, fossil material may have been identified, but not completely collected during the initial field survey, such as a partial dinosaur or other large fossil assemblage. It may be possible to complete the recovery of this material and all related data prior to beginning construction activities, and thus mitigate the adverse impact. This may require a shift in the project schedule and must be coordinated with the project proponent. Approval by the Authorized Officer for the project to proceed will only be granted when recovery of the fossil material and field data is completed. A report to the file and the project proponent documenting the recovery and indicating that no further mitigation is required must be completed, and the report signed by the Authorized Officer. If the discovery cannot be fully collected within the available time frame, it may have to be avoided by relocating or redesigning the project.

IV. PROCEDURES FOR FIELD MONITORING

The purpose of on-site monitoring is to assess and collect any previously unknown fossil material uncovered during the project activities or soon after surface-disturbing actions. Based on the initial scoping, the field survey and recommendations, and the plan of operations, it may be necessary to require monitoring of surface-disturbing activities. Monitoring may be required as part of an overall mitigation for a project which was developed during the NEPA process, or upon the discovery of paleontological resources during project activities.

A. Monitoring Plan. A monitoring plan can be developed by a BLM paleontologist or a qualified paleontologist hired by the proponent. The plan must be appropriately scaled to the size and complexity of the anticipated monitoring. If developed by a third party, the appropriate Paleontology Lead or Regional Paleontologist shall review the plan for sufficiency prior to acceptance. Monitoring of the project may proceed when the monitoring plan is approved by the Authorized Officer. A monitoring plan indicates the treatments recommended for the area of the proposed disturbance and must minimally address the following:

1. The recommended approach to additional specimen collection, such as total or partial recovery or sampling; and

2. The specific locations and intensity of monitoring or sampling recommended for each geologic unit, stratigraphic layer, or area impacted.

Monitoring intensity is determined based on the analysis of existing data and/or field surveys and any previous monitoring efforts.

B. Types of Monitoring. There are two types of monitoring: 1) on-site, performed during ongoing operations, and 2) spot-checks, performed during or after disturbance, or at key times during the progress of the project.

1. On-site monitoring – In areas with a high probability for buried fossils, the presence of a monitor at the site of disturbance at all times that disturbance is occurring may be warranted. The need for a full-time monitor is based on the findings of the survey, the local geology, and the proposed actions. Efforts will be made to complete fossil recovery with minimal work stoppage. However, in some cases, an extended period of work stoppage may be required, so coordination with the project proponent or representative is important (see D below). Prior to beginning the monitoring work, the monitor, company supervisor, and machinery operators should agree on procedures for brief work stoppages to allow for examination of finds. It is critical that safety be of utmost concern because of the presence of heavy machinery and open trenches.

The monitor must assess any finds, collect loose fossil material and related data, and take appropriate steps to mitigate any current or potential damage. Consideration of the size of the expected fossils must also be considered; for example, microfossils may not be visible during excavation activities. It may be appropriate to collect samples of matrix for later recovery of microvertebrate fossils or other analyses. Activities planned to occur during night time should be assessed relative to the potential to uncover significant fossils. Fossils may not be visible at night in trenching or grading operations, so construction activities may need to be suspended during night time in sensitive areas.

2. Spot-checking – In areas with a moderate to high probability for unknown fossil material, it may be more appropriate to check only at key times rather than maintain continuous monitoring of operations. Key times for scheduling spot-checking are when the fossil-bearing bedrock is exposed to view or prior to placing spoil material back into the excavation. Examples of these key times may be when a pipeline trenching operation is complete but before pipe is placed and the trench backfilled or prior to redistribution of topsoil. Spot-checking requires close coordination with the project proponent and the paleontologist, and usually requires the paleontologist to be available on short notice. In some instances, it may be advantageous to allow rain and/or wind to erode away loose matrix and concentrate fossil material to increase visibility. The paleontologist will coordinate with the project proponent to allow sufficient time for this action to occur, as appropriate to conditions, expected fossil material, and construction schedules.

The paleontologist should report potentially fossiliferous areas in the final report to allow for future assessment of sites, even if no fossils were located during the project monitoring.

C. Types of Field Personnel. Depending on the complexity of the project, it may be necessary to employ a number of paleontology field personnel simultaneously. There may be a lack of fully qualified paleontologists to perform all the necessary monitoring during the scheduled times of construction. Use of additional personnel for field work is permissible, but Field Agents and Field Monitors (described below) must be requested by the Permittee and authorized by the BLM prior to field work.

1. **Principal Investigator** – The person listed as Permittee (Permit item 1a) on the Paleontological Resources Use Permit is the Principal Investigator (PI) and is responsible for all actions under the permit, for meeting all permit terms and conditions, and for the performance of all other personnel. This person is also the contact person for the project proponent and the BLM.

2. **Field Agent** – Other qualified paleontologists may perform field work independently of the PI under the conditions of this permit. Résumés must be submitted to BLM and must demonstrate qualifications equivalent to those of Permittees. Field Agents must be listed on the permit under "Name(s) of individual(s) responsible for planning, supervising, and carrying out fieldwork" (Permit item 8) or authorized in a separate letter from BLM. They must follow all the permit terms and conditions applicable to field work and must carry a copy of the permit, included terms and conditions, and separate authorizing letter (if used) while in the field. Field work results must be reported to the PI, who will then submit required reports.

3. **Field Monitor** – Field Monitors may be utilized for supplemental on-site monitoring of surface-disturbing activities when the PI or a Field Agent is performing field work elsewhere. Field Monitors must have sufficient field experience to demonstrate acceptable knowledge of fossil identification, collection methods, and paleontological techniques. The PI must supply a summary of each person's experience to the BLM prior to field work. Field Monitors must be approved by the BLM prior to performing field work and must carry a copy of the permit while in the field. The PI or Field Agent must be in communication with the Field Monitor using a portable communication device, such as a cell phone or two-way radio, and are required to be near enough to the Field Monitor to allow for prompt examination of all fossil discoveries (no more than two hours away) by the PI or Field Agent.

4. **Field Assistant** – Additional personnel not meeting the previously cited experience or knowledge levels may be utilized during field work, but must be under direct, on-site supervision of either the PI or a Field Agent as part of a supervised crew. Field assistants must have at least four to eight hours of training or experience received from a qualified paleontologist in identifying paleontological resources prior to performing field work or when first utilized in this capacity. A listing of all Field Assistants (including contact information) must be supplied prior to any field work. All discoveries made by a Field Assistant must be immediately reported to the PI or Field Agent on site. To ensure proper supervision, an appropriate ratio of Field Assistants per PI or Field Agent must be maintained. The complexity of the project, the area to be covered, and the experience of the assistants are some of the factors that should be considered in determining the proper ratio, but commonly five to seven assistants is the maximum number that can be supervised by one PI or Field Agent.

D. Work Stoppage. If significant fossil material is discovered during construction activities, the PI, Field Agents, and Field Monitors have the authority to temporarily halt surface disturbing actions until an assessment of the find is completed and appropriate protection measures taken. Efforts will be made to complete fossil recovery with minimal work stoppage. However, in some cases, an extended period of work stoppage may be required. If the paleontological resource can be avoided, mitigated, or collected within approximately two hours, work may resume after approval from the PI or Field Agent, and the Authorized Officer must be notified as soon as possible of the discovery and any mitigation efforts that were undertaken. If the find cannot be mitigated within a reasonable time (two hours), the concurrence of the Authorized Officer or official representative for a longer work stoppage must be obtained. Work may not resume until approval is granted from both the PI or Agent and the Authorized Officer.

V. FINAL PROJECT REPORT

Upon completion of all field work, including survey and monitoring, the PI must submit within 30 days, a written final report to the Authorized Officer, Paleontology Lead, and the designated repository. A copy of the report may be provided to the project proponent if required**,** but without the BLM Locality forms. Reports must include the following details. Items 1 and 2 should appear at the beginning of the report, and may be presented as a title page in multi-page reports.

1. Name, affiliation, address, date of report, and permit number (if consultant) of the paleontologist doing the survey.
2. Project name and number (if used), name of proponent, and general location of project.
3. Date(s) of the survey and names of any personnel assisting with the survey.
4. Brief description of project and expected impacts to paleontological resources.
5. A summary of mitigation performed.
6. A summary of findings, including important discoveries.
7. A description of potentially fossiliferous areas to allow for future assessment of sites, even if no fossils were located during the project monitoring.
8. A completed BLM locality form 8270-3 or equivalent for each new locality using Universal Transverse Mercator (UTM) NAD 83 coordinates, and 1:24000 scale maps with new localities plotted using points or polygons as appropriate. Locality forms, maps, and any other information containing specific fossil locations should be bound separately or assembled as a separate section to allow for preservation of confidential locality data.
9. List of specimen field numbers and field identifications of collected material, cross-referenced to the locality field number. This list may be submitted in electronic format, preferably in a spreadsheet format.

If the survey was performed by BLM, a report similar in contents must be written and filed in the project file, and the project proponent notified as soon as possible upon completion.

VI. COMPLETION OF MITIGATION RESPONSIBILITY

When the final report with the specimen inventory and the signed receipt of confirmation of museum deposition are accepted by the BLM, mitigation for paleontological resources related to the project will be considered completed. The project proponent will be notified in writing as soon as possible by the Authorized Officer after consulting with the Paleontology Lead or Regional Paleontologist and a copy of the notification placed in the project file.

The responsibility of the project proponent ends when appropriate mitigation related directly to the project is completed and final approval is received from the Authorized Officer. Any additional field collection, quarrying, final specimen preparation, etc. will be considered to be research, and will be the responsibility of the consulting paleontologist or another approved party. The project proponent will not be held responsible for completion of any research project. However, the project proponent can choose to sponsor further research. A separate research permit will be required for additional research activities.

VII. COLLECTIONS RESULTING FROM ASSESSMENT AND MITIGATION

Fossil specimens and related data collected from public lands during field surveys and mitigation remain the property of the Federal government. They must be placed in the approved repository(s) identified on the Paleontological Resource Use Permit held by the consulting paleontologist as soon as practical and receipt(s) of collections submitted to the BLM, but no later than 60 days after all field work is completed. Written approval from the Paleontology Lead or Regional Paleontologist is required if additional time is needed for transfer of all specimens and field data.

VIII. RESOURCE MANAGEMENT UPDATES

Based on findings resulting from any of the above steps, the project file, locality and specimen information, and other BLM data should be updated to reflect any new or modified information. Paleontology permit files should be checked and updated, as well as any other administrative information.

The PFYC Class assignments can be assessed based on the analysis, survey, and monitoring results. New information may indicate a change in the PFYC Class is appropriate for one or several geologic units. Other applications of the PFYC system should be considered, such as the use for impact analyses in planning documents or for survey and mitigation determinations for other projects. Any changes in classification must be made in consultation with the Paleontology Lead or Regional Paleontologist to maintain consistency across Field Office boundaries.

APPENDIX A – DEFINITIONS

(As applicable to BLM management of paleontological resources)

Alluvium – A general term for clay, silt, sand, gravel, or similar unconsolidated detrital material [fragments of rock or mineral material derived from older rocks] deposited during relatively recent geologic time by a stream or other body of running water as a sorted or semi-sorted sediment in the bed of the stream or its flood plain or delta, or as a cone or fan at the base of a mountain slope; especially, such a deposit of fine-grained texture (silt or silty clay) deposited during a time of flood (*from* American Geological Institute (AGI), Glossary of Geology, 1972 ed.)

Alluvium may contain paleontological resources in older alluvial deposits. The location on the landscape often will provide clues to the potential for paleontological resources within alluvial deposits. As an example, alluvium developed near major river courses or lake margins has a much higher potential to contain significant paleontological resources than alluvium (colluvium) formed from slope wash.

Approved Repository – Meets the Department of the Interior 411 Departmental Manual (DM) provisions for museum property, including capability for providing adequate long-term curatorial services, such as a physically secure environment, and maintaining professional staff qualified to catalog, care for, preserve, retrieve, and loan, where appropriate, these materials and associated records.

Bedrock – A general term for the rock, usually solid, that underlies soil or other unconsolidated, surficial material (*from* American Geological Institute (AGI), Glossary of Geology, 1972 ed.) For paleontological purposes, bedrock generally excludes alluvium, colluvium, sand dunes, and loess (fine-grained blanket deposit of marl or loam). In certain situations, bedrock may contain recent soils/sediments with fossils.

Colluvium – A general term applied to any loose, heterogeneous, and incoherent mass of soil material or rock fragments deposited chiefly by mass-wasting, usually at the base of a steep slope or cliff; e.g., talus, cliff debris, and avalanche material. Also, alluvium deposited by unconcentrated surface run-off or sheet erosion, usually at the base of a slope (*from* American Geological Institute (AGI), Glossary of Geology, 1972 ed.)

Field Agent – Other qualified paleontologists may perform field work independently of the PI under the conditions of this permit. Résumés must be submitted to BLM and must demonstrate qualifications equivalent to those of Permittees. Field Agents must be listed on the permit under "Name(s) of individual(s) responsible for planning, supervising, and carrying out fieldwork" (Permit item 8) or authorized in a separate letter from BLM. They must follow all the permit terms and conditions applicable to field work and must carry a copy of the permit, included terms and conditions, and separate authorizing letter (if used) while in the field. Field work results must be reported to the PI, who will then submit required reports.

Field Assistant – Additional personnel not meeting the previously cited experience or knowledge levels may be utilized during field work, but must be under direct, on-site supervision

of either the PI or a Field Agent as part of a supervised crew. Field assistants must have at least 4 to 8 hours of training or experience received from a qualified paleontologist in identifying paleontological resources prior to performing field work or when first utilized in this capacity. A listing of all Field Assistants (including contact information) must be supplied prior to any field work. All discoveries made by a Field Assistant must be immediately reported to the PI or Field Agent on site. To ensure proper supervision, an appropriate ratio of Field Assistants per PI or Field Agent must be maintained. The complexity of the project, the area to be covered, and the experience of the assistants are some of the factors that should be considered in determining the proper ratio, but commonly five to seven assistants is the maximum number that can be supervised by one PI or Field Agent.

Field Monitor – Field Monitors may be utilized for supplemental on-site monitoring of surface-disturbing activities when the PI or a Field Agent is performing field work elsewhere. Field Monitors must have sufficient field experience to demonstrate acceptable knowledge of fossil identification, collection methods, and paleontological techniques. The PI must supply a summary of each person's experience to the BLM prior to field work. Field Monitors must be approved by BLM prior to performing field work and must carry a copy of the permit while in the field. The PI or Field Agent must be in communication with the Field Monitor using a portable communication device, such as a cell phone or two-way radio, and are required to be near enough to the Field Monitor to allow for prompt examination of all fossil discoveries (no more than two hours) by the PI or Field Agent.

Field Survey – Pedestrian (walking) surveys performed in areas where significant fossils are expected to occur within the boundary or immediate vicinity of an anticipated disturbance. Surveys are performed by a qualified paleontologist or BLM Regional Paleontologist or other officially appointed BLM employee prior to any surface disturbing activities. Survey activities also include concurrent collection of significant fossils.

Land Tenure Adjustments/Change in Title – Changes in ownership or administration of surface or mineral estates, typically exchanges or sales, which may result in a change in ownership or control of paleontological resources.

Monitoring – a) On-site observation during all surface disturbing activities to assess and collect any previously-unknown fossil material uncovered by the project activities. b) Examination of excavation or spoil piles at key times during project activities. Monitoring must be performed by a permitted paleontologist, field agent, or field monitor (see section ***IV.C***.), Regional Paleontologist, or other officially appointed BLM employee, and occurs during or soon after surface disturbing actions.

Paleontological Locality (Locality) – A geographic point or area where a fossil or associated fossils are found in a related geological context. A paleontological locality is confined to a discrete stratigraphic layer, structural feature, or physiographic area.

Paleontology Program Coordinator (Paleontology Coordinator) – The employee designated by the local BLM Office Manager to manage paleontological resource issues, including planning, mitigation, budget, and other administrative duties. The local point of contact for

paleontological resource use permittees, the State Office Paleontology Program Lead, and the Regional Paleontologist. The employee is usually a geologist or archaeologist.

(a) In some offices, additional employees may be designated by the supervisor to determine the need for field surveys and monitoring for some projects, or other duties in support of the paleontology program. The scope of duties for these additional employees must be approved by the Paleontology Program Lead and closely coordinated with the Paleontology Coordinator.

(b) A few current BLM employees may meet the same professional qualifications that are required for a BLM Paleontological Resources Use Permit applicant. BLM-approved training and field experience may also allow employees to gain sufficient background to achieve competency in the field. With the approval of the Regional Paleontologist and the Office Manager or Deputy State Director, these employees may be designated as qualified to perform field surveys or monitoring. The current availability of these employees must also be approved by the unit manager or Deputy State Director, typically on a project-by-project basis or within a defined time period. Depending on official duties, local roles and responsibilities, and management preferences, these employees may or may not be the Paleontology Coordinator.

Paleontology Program Lead (Paleontology Lead) – Any one of the following: the Regional Paleontologist in the states with an identified position; the paleontologist at Grand Staircase-Escalante National Monument; or the State Office Archeologist in the states without a Regional Paleontologist.

Principal Investigator – The person listed as Permittee (Permit item 1a) on the Paleontological Resources Use Permit is the Principal Investigator (PI) and is responsible for all actions under the permit, for meeting all permit terms and conditions, and for the performance of all other personnel. This person is also the contact person for the project proponent and the BLM.

Regional Paleontologist – The BLM paleontologist that provides professional expertise in paleontology, and is responsible for interpreting relevant laws, authorities, and policy for the administration of the BLM paleontology program for all States in his/her respective region, and as the program interface between Field and/or District Offices, State Offices, and the Washington Office. In some cases, the Regional Paleontologist also serves as the State Office Paleontologist.

Significant Paleontological Resource (syn. **Significant Fossil Resource**) – Any paleontological resource that is considered to be of scientific interest, including most vertebrate fossil remains and traces, and certain rare or unusual invertebrate and plant fossils. A significant paleontological resource is considered to be scientifically important because it is a rare or previously unknown species, it is of high quality and well-preserved, it preserves a previously unknown anatomical or other characteristic, provides new information about the history of life on earth, or has identified educational or recreational value. Paleontological resources that may be considered to not have paleontological significance include those that lack provenience or context, lack physical integrity because of decay or natural erosion, or that are overly redundant or are otherwise not useful for research.

Vertebrate fossil remains and traces include bone, scales, scutes, skin impressions, burrows, tracks, tail drag marks, vertebrate coprolites (feces), gastroliths (stomach stones), or other physical evidence of past vertebrate life or activities.

Soil – The natural medium for growth of land plants (*from* American Geological Institute (AGI), Glossary of Geology, 1972 ed.) Generally, well-developed soils do not contain paleontological resources. However, the C horizon (the substratum above bedrock that is little affected by soil forming processes) may occasionally contain Pleistocene-aged fossils.

Stipulations – Written conditions that may restrict or impose limits on approved activities, or require that certain procedures be followed. The general usage herein encompasses several formal terms specific to other use authorizations such as Mitigation, Terms and Conditions, Conditions of Approval, and Standard Stipulations.

Surface disturbance – Disruption of the ground surface and subsurface. Disruption may damage or destroy significant paleontological resources and their geological context.

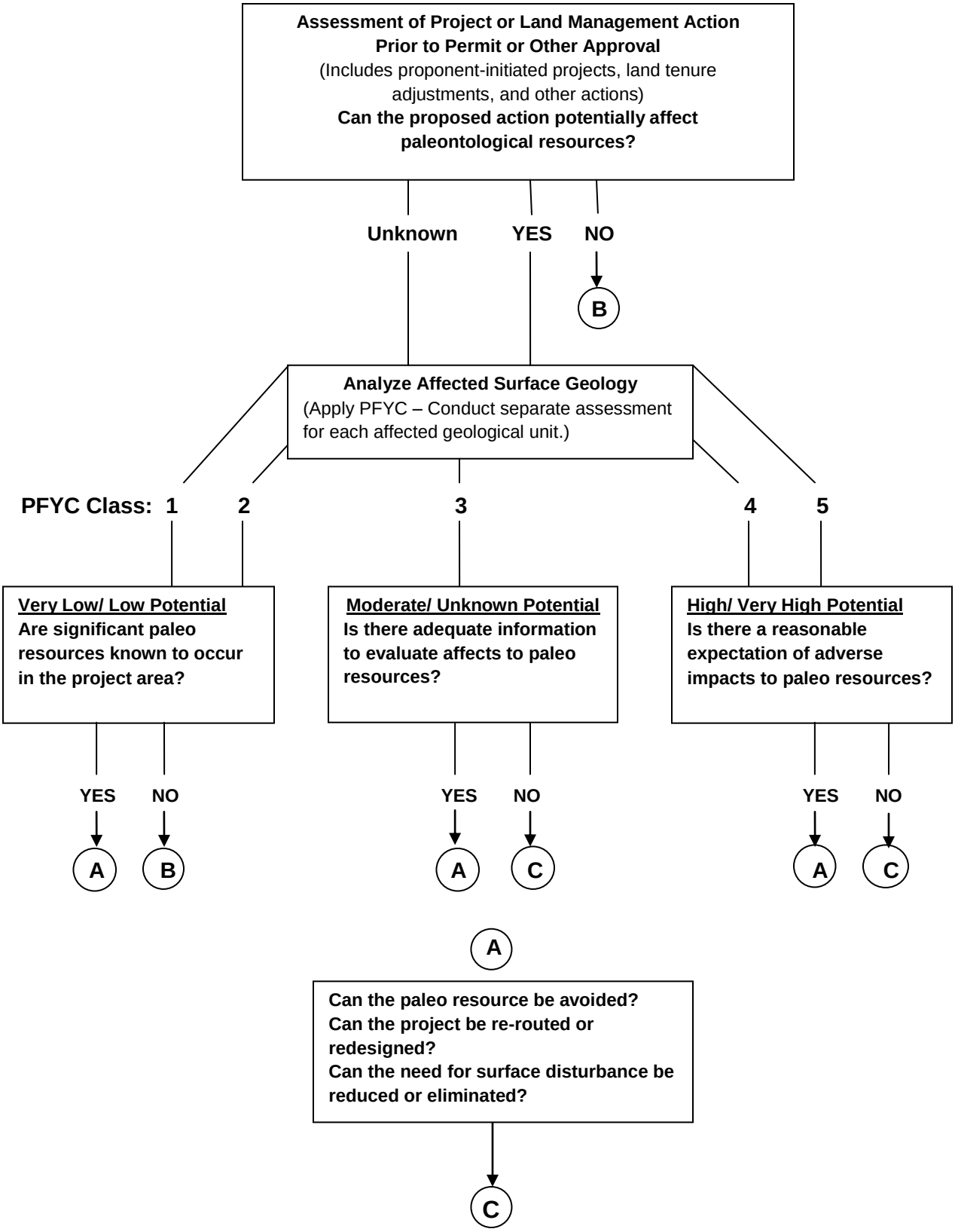
– Generally excludes: fire (but not fire activities, see below), vegetation mowing, weed spraying, grazing, natural erosion, fence building

– Some activities that may impact the ground surface and must be assessed on a case-by-case basis are:

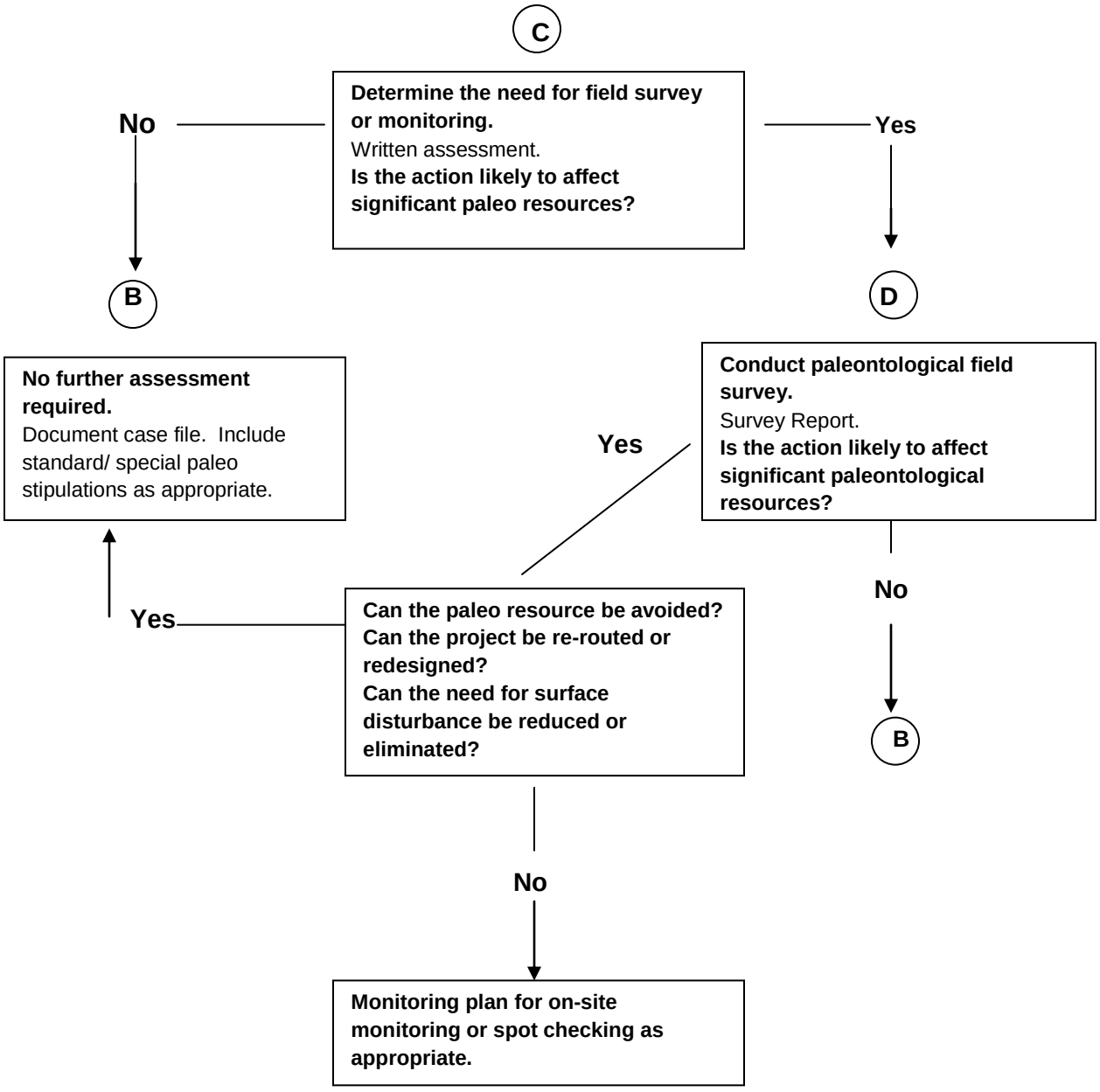
* Mechanized vegetative treatments – chaining, sagebrush chopping, etc
* Seismic activities – vibroseis techniques, cross-country travel
* Fire management activities – line building, brush removal and thinning using mechanized equipment
* Recreational activities – OHV, rock collecting, mountain biking, public events

Voucher Specimen – A representative sample that verifies the kind of fossil material found during a field survey, and is collected and curated in an approved repository along with its associated field data.

Paleontological Resources Assessment Flowchart



Paleontological Actions



Attachment C Ruby Supplemental Paleontological Report for the Winnemucca Field Office

Supplemental Paleontological Report for the BLM Winnemucca Field Office

Table of Contents

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List of Abbreviations and Acronyms

BLM	Bureau of Land Management
E & E	Ecology and Environment, Inc.
GIS	Geographical Information System
MP	milepost
PFYC	potential fossil yield classifications
ROW	right-of-way
Ruby	Ruby Pipeline, L.L.C.

1.0 Introduction

The Bureau of Land Management (BLM) Winnemucca Field Office requested additional information regarding potential paleontologic resources traversed by the Ruby Pipeline Project (Project), proposed by Ruby Pipeline, LLC (Ruby), within the Winnemucca District. The requested information is presented below. It includes past paleontologic work completed in the Winnemucca District, a discussion of the geologic formations and potential yields (including findings of non-significance and the justification for defining the potential fossil yield classifications [PFYC] formation rankings), methodologies, and references.

2.0 Background and Previous Work

Northwestern Nevada has produced an array of fossils, but it is best known for spectacular Cenozoic floras, including the Eocene Cedarville flora (LaMotte 1936), the Miocene Virgin Valley flora (Bertram et al. 1997) (Tidwell and Parker 1990), and the Lund Petrified Forest (Erwin 2005). Plant fossils range from palynomorphs (Bertram et. al. 1997) to wood petrifactions, including opalized wood (Crabtree 1983), leaf compressions (Tidwell 1998) and the earliest known Joshua tree relative (Tidwell and Parker 1989). Dramatic shifts in fossil floras preserved in the Great Basin document the onset of the Eocene-Oligocene cooling/drying shift and changes in the paleoaltitude of the region (Axelrod and Schorn 1994; Wolfe et. al. 1997). For a summary of papers dealing with fossil floras in northwestern Nevada, see Call (1988).

As with fossil plants, Cenozoic vertebrate fossils (primarily mammals) from the region have also been used to document climatic shifts in North America (Kohn and Fremd 2008). Nevada is well known for its Miocene faunas, and Merriam's 1910 and 1911 papers were milestones in the study of northwestern Nevada's vertebrate fossils from Virgin Valley and Thousand Creek. Recently, Davis and Pyenson (2007) presented an overview of the state's Miocene mammalian fauna. Younger mammals, primarily Quaternary-aged, are also present in the region, but most finds consist of isolated teeth and/or fragmentary bones (BLM Winnemucca District preliminary Geographical Information System (GIS) files). Vertebrate finds closest to the right-of-way (ROW) consist of bone fragments associated with freshwater unionid clams found in Lahontan shoreline deposits at the tip of the Slumbering Hills. Well-preserved, nearly complete skeletons, such as the DeLong mammoth from the Black Rock Desert (Livingston 1992), have also been recovered from Quaternary deposits.

Mesozoic vertebrates occur in the region, and all are marine. These include a number of ichthyosaurs and other marine reptiles, nothosaurs, and possibly thalattosaurs, along with fish. They have been recovered primarily from the mid-Triassic Prida and Favret formations some 60 miles south of the ROW in the southern Humboldt Range and New Pass Range areas (Sander et al. 1994). Perhaps the most spectacular find was the skull of *Augustasaurus hagdorni.*

Although there are well over 200 fossil localities recorded by the Winnemucca District BLM office alone, only three are within seven miles of the route ROW. From east to west, the closest localities are: (1) PaNV-02-052 – angiosperm plant compressions and fragmentary fish, about one mile south of ROW milepost (MP) 469; (2) PaNV-02-134 – *Sequoia*

petrifactions about five miles north of ROW MP 495; and (3) the Wall Creek paleobotany site – angiosperm petrifactions primarily consisting of three genera, *Thuja*, *Robinia*, and *Quercu* (Call 1988), about seven miles north of ROW MP 624. All three of these localities are in Miocene-aged strata.

With the occasional exceptions of Pliocene and Pleistocene strata, most post-Oligocene fossil assemblages in the area are preserved in lacustrine or fluvial sediments rich in volcanic ash-rich (tuffaceous) units. These reworked tuffs are preserved primarily in depocenters (Bonham 1969; Crabtree 1983; Livingston 1992, Bertram et. al. 1997; Call 2008) related to extensional tectonics (Colgan et. al 2006) or calderas (Waggoner and Poteet 1996). Sources of the ashes are primarily from regional calderas (Perkins 1998).

3.0 Geologic Formations crossed by the Right-of-Way and Potential Fossil Yield Classifications Rankings

This section includes an overview of the four main classes of geologic formations encountered in the district, along with rankings of the paleontological sensitivity.

3.1 Igneous

The Project crosses approximately 135 miles of lands within the BLM Winnemucca District. Of those miles, over 15 pertain to igneous rocks, largely rhyolite and rhyolitic tuffs or basalt. Igneous rocks rarely preserve fossils and are defined as PFYC 1, a ranking that does not require preconstruction survey or construction phase monitoring.

3.2 Mesozoic Marginal Marine Strata

Seven segments totaling about 11 miles of the ROW are on Triassic or undifferentiated Triassic/Jurassic strata that represent marine to marginal marine, primarily deltaic, strata. Some of the maps referred to lacustrine strata equivalent in age to the Chinle and Ankareh Formation, but these are likely marine to marginal marine, fluvial to deltaic deposits, possibly related to the Osobb Formation, which is part of the Chinle paleo river system that originated in Texas and flowed to the shoreline in what is now northwestern Nevada (Riggs et. al 1996; Dickinson and Gehrels 2008).

No marine vertebrate finds have been reported near the ROW, but such fossils could be found in the Mesozoic strata. In keeping with BLM recommendations, the Mesozoic marine strata along the ROW are considered PFYC 2, and the deltaic/marginal marine deposits here are ranked as PFYC 3 because these have moderate paleontological potential. Paleontological field surveys of over 7.5 miles of the proposed ROW along strata mapped as Triassic and Jurassic were conducted by E & E's contract paleontologists and geologists in August of 2009. Most of the rocks were mildly metamorphosed and consisted of quartzite, or quartz-cemented sandstones, with uncommon occurrences of phyllitic shales. No fossils were found.

3.3 Pleistocene Alluvium and Colluvium

Within the district, the bulk of the ROW, approximately 105 miles, crosses unconsolidated alluvium/colluvium of indeterminate, but most probably Quaternary, age. Such strata are usually assigned a PFYC rank of 2 because they are typically devoid of fossils; occasionally,

however, significant fossils are found. For example, a large number of Pleistocene vertebrates have been found in Utah (Nelson and Madsen 1987; Gillette and Miller 1999), but despite the wide aerial extent of Quaternary deposits, such fossils are uncommon, and their occurrence cannot be accurately predicted. A comment from Ken Loda of the Winnemucca BLM District on an early draft of the Federal Energy Regulatory Commission Resource Report No. 6, Geologic Resources, requested that eight miles of Pleistocene Lake Lahontan sediments between MP 488 to 496 be changed to PFYC 5, because megafauna remains, including *Mammuthus*, *Smilodon*, and others (Grayson 2006), had been recovered approximately 20 miles south of the Project. Since the draft of Resource Report No. 6, the Project route and MP designations have changed. As a consequence of this request, Pleistocene sediments between MPs 466–485 and 490–498 were assigned PFYC 3 (increased from PFYC 2) because the Pleistocene units have moderate potential to contain significant fossils and will be spot checked. Fossiliferous horizons of terrestrial vertebrates are notoriously limited in aerial extent, usually being limited to exposed and eroded margins of paleo basins, as was the case with the DeLong Black Rock Desert sites, located along the margins of the playas where lacustrine sediments interfinger with shoreline and fluvial deposits (Livingston 1992).

To determine whether the playa deposits along the Project ROW within the Winnemucca district were fossiliferous, Ecology and Environment, Inc. (E & E) paleontologists and geologists spot checked exposures between MP 466–476 and MP 491–497 on August 17, 2009. Particular attention was given to gravels near the margins of the playas. No fossils were found. Based on E & E's experience in other areas and after field surveying the ROW, E & E feels that the chances of finding significant vertebrate fossils in the area's playa deposits are relatively low. Consequently, E & E ranks these deposits as PFYC 3 rather than PFYC 5. If megavertebrate remains are present along the Project route, they are likely buried, and the best opportunity to discover them is during the construction phase.

3.4 Waterlain Tuffaceous Units

Sedimentary rocks consisting primarily of reworked tuffaceous (ash-rich) materials occur along about four miles of the ROW and are ranked as PFYC 3 because they may contain significant fossils, particularly paleobotanical or vertebrate remains. Because rotary trenching machines reduce rock to powder and would obliterate fossils, it is recommended that several locations along these units be excavated with track hoes to permit inspection of excavated rock fragments by paleontologists. In response to the Winnemucca BLM District's sensitivity to potential fossils in waterlain tuffs, Ruby will conduct a detailed paleontological surface survey of such deposits along about four miles of the ROW between MPs 532.8–533.4, MPs 533.7–533.9, MPs 538.6–540.2, MP 551.7–552.0, MPs 554.4–555.3, and MPs 555.7–556.0.

4.0 Field Methodology

Paleontological localities in and near the Winnemucca BLM District were obtained from: (1) the University of California at Berkeley Museum of Paleontology database, (2) the Winnemucca District Office of the BLM GIS files provided by Samuel Potter, (3) literature searches, and (4) personal communication with W.D. Tidwell, paleobotanist.

Because Nevada has not implemented a statewide PFYC ranking, Ruby Ruby's permitted contract paleontologist developed a PFYC ranking for affected geological formations based on the existing ranking system in place for the Las Vegas area and the PFYC system in place for Utah and Idaho. No geologic formations along the Project route in Nevada were ranked higher than PFYC 3. Most known, pre-Pleistocene vertebrate and paleobotanical localities in northern Nevada occur in waterlain tuffaceous units. Because no significant fossils have been reported from such tuffaceous units along the Project route, however, these units were assigned to PFYC 3 to indicate that their potential remains to be determined.

In the summer of 2008, all PFYC 3 units along the Project route from the Utah-Nevada border westward to its intersection with Highway 225, northwest of Elko, were field surveyed by the permitted paleontologist and employees under his supervision. The survey was conducted by driving or hiking to outcrops along the ROW ranked PFYC 3 and walking out to examine the exposures. Principal fossils observed during the survey consisted of fragments of fossil wood replaced by common opal carbonate root casts. No significant fossils were found. Based on the field survey, the permitted paleontologist determined that further surveys west of Highway 225 were not warranted because geologic maps indicated that westward of Highway 225 similar strata would be encountered, and the percentage of volcanic rock increased. However, based on a BLM request, Ruby conducted pre-construction surveys in August of 2009 of PFYC 3 units between MPs 445 and 518, where sedimentary units classified as PFYC 3 are shown to outcrop and where playas are present. Particular attention was given to Mesozoic strata. No significant fossils were found.

Ruby's archaeology surveys revealed five paleontological finds in Nevada that are listed in Table C-1 (EPG 2009). Ruby NV Paleo site #1 contained a single piece of fossilized bone found more than 630 feet north of MP 346 in a lag deposit. Ruby NV Paleo Site #2 located about 166 feet south of MP 247 was described by EPG as lithified soil containing flora and fauna including four pieces of fossilized bones (EPG 2009). It is possible that Ruby NV Paleo Site #2 is located in an ash tuffaceous or mudstone deposit. This may be the same

location where Ruby's 2008 paleontology field survey identified root casts in mudstone. These root casts could be mistaken for fossils if not inventoried correctly. Ruby Paleo site #3 is reported to contain over 1000 pieces of fossilized bone, including possible paracamelus and equid long bones with terminal joints. Ruby Paleo site #3 is located about 273 feet south of MP 386.5 in calcareous mud deposit, or tuffaceous ash deposit. Ruby NV Paleo site #4 is described as Pleistocene Lake Lahontan shoreline that trends northwest to southeast and is reported to contain many fossil bivalves and gastropods. The northern exposure of the ancient shoreline is located about 3470 feet north of MP 463.6. The southern exposure of Ruby Paleo Site #4 is located about 255 feet north of MP 463.6. Ruby NV Paleo site #5 consists of a single fossilized bone located about 714 feet north of MP 539.7.

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Exhibit A
Paleontological Finds Identified in Nevada

Table C-1 Paleontological Finds Identified in Nevada

Paleo Site #	Distance from the Centerline (ft)	Geological Context		DMS North	DMS WEST
Ruby NV Paleo #1	638	Early-Tertiary Deposits Mapped Tt1/TC/Ta1 Lag associated with deflated/reduced conglomerates.	One piece of fossilized bone, longbone diaphysis; camel-sized.	41° 12' 37.600"	116° 04' 07.866"
Ruby NV Paleo #2	166	Permian-aged Deposits Mapped Pph/Pbl/Ppcg. Associated with lithified soil contained in sequence of limestones and tuffaceous mudstones exposed in canyon wall.	Four fossilized bones, unknown taxa; fossil roots and worm tracks in lithified soil; possible animal tracks exposed in profile at unit's contact with overlying tuffaceous mudstone.	41° 27' 16.635"	114° 16' 43.581"
Ruby NV Paleo #3	273	Mid-Tertiary Deposits Mapped Ts2/Tb2 Associated with calcareous mud deposit (spring?) at contact between Oligocene tuff and Miocene basalt.	1000+ fragments of fossilized bone, including paracamelus, equid, possible carnivore/omnivore.	41° 12' 34.370"	116° 48' 32.616"
Ruby NV Paleo #4	3470	Mid- to Late-Pleistocene Mapped Qal Marl/tuffa associated with lower Lahontan shoreline deposits.	Bivalves (Unionidae, probably Anodonta c.) and gastropods embedded in marl. A few pieces of re-worked fossilized longbone contained in the shoreline terrace gravels.	41°24'25.930"	117°59'56.420"

Table C-1 Paleontological Finds Identified in Nevada

Paleo Site #	Distance from the Centerline (ft)	Geological Context		DMS North	DMS WEST
Ruby NV Paleo #5	714	UNKNOWN	One piece of fossilized bone	41° 34' 42.318" N	119° 20' 56.933" W