Appendix J
Paleontological Assessment for Project NH C020-027, State Highway 50 – Baltimore to McCullough

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STATE OF COLORADO

DEPARTMENT OF TRANSPORTATION

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DATE: September 28, 2011

TO: Lisa Streisfeld

FROM: Steven M. Wallace

SUBJECT: Paleontological assessment for project NH C020-027, State Highway 50 – Baltimore to McCullough

INTRODUCTION

Project NH C020-027, State Highway 50 – Baltimore to McCullough, also known as the US 50 West Planning and Environmental Linkages (PEL) Study, is proposed for consideration of environmental and community issues early in the planning process, before the formal environmental clearance process begins, for a State Highway 50 corridor between mileposts 301.72 (SH 50/Swallows Road intersection) and 313.52 (SH 50/Baltimore Avenue intersection) on SH 50, within and west of the City of Pueblo. This corridor lies on and along the existing SH 50 alignment between a point [MP 301.72] at or very near the center of the NW¼ SE¼ NW¼ of section 36, T19S, R67W, Pueblo County, and a point [MP 313.52] in the NW¼ SW¼ SW¼ NE¼ of section 14, T20S, R65W, Pueblo County. Because of the preliminary overview nature of the PEL study, I did not conduct any on-the-ground reconnaissance for paleontological resources within the proposed project limits; I have based my conclusions on the results of published literature and museum fossil locality database searches.

CORRIDOR GEOLOGY AND PALEONTOLOGY

The geologic units mapped (Scott 1969; 1972) within the PEL study corridor limits are, from youngest to oldest:

Unit	Age
Piney Creek Alluvium	Holocene
unnamed colluvium	Holocene
Broadway Alluvium	late Pleistocene
Slocum Alluvium	middle Pleistocene
Pierre Shale, transition member	Late Cretaceous
Niobrara Formation, Smoky Hill Shale Member	Late Cretaceous
Niobrara Formation, Fort Hays Limestone Member	Late Cretaceous

The **Piney Creek Alluvium** and **unnamed colluvium unit** can produce prehistoric bone, shell, and/or plant material, but because the sediments are less than 10,000 radiocarbon years old, any

material found could be in an archaeological context and should be evaluated first by a qualified archaeologist.

The **Broadway Alluvium** has produced mammoth, bison, horse, camel, jackrabbit, and white-tailed prairie dog specimens in the Denver and Greeley areas (Hunt 1954; G. R. Scott, personal communication, 1985; unpublished University of Colorado Museum and Colorado Department of Transportation fossil locality data). Mammoth, camel, horse, bison, prairie dog, Richardson's ground squirrel, pocket gopher, field mouse, and rabbit specimens have been collected from the **Slocum Alluvium** south of Littleton and east of Byers (Scott 1963a:22-23; unpublished U. S. Geological Survey and University of Colorado Museum fossil locality data). Lewis (1970) described a horncore of the extinct bison, *Bison latifrons*, from the Slocum Alluvium near Canon City.

The **Pierre Shale** invertebrate fauna in Colorado and surrounding states is well-known and described (*e. g.*, Scott 1963b:99-104; Gill and Cobban 1966; Izett *et al.* 1971; Bishop 1985; Scott and Cobban 1965, 1986a, 1986b; Cobban et al. 1993; Landman and Cobban 2003). The known fauna is dominated by ammonites (extinct squid relatives) and inoceramid clams.

Carpenter (1996) reviewed the status of Pierre Shale plesiosaurs (large, extinct marine reptiles) in Colorado and surrounding states, while Martz *et al.* (1999) reported on the biostratigraphic and taxonomic status of mosasaurs (large, extinct marine lizards) in Colorado. The upper transition member of the Pierre Shale has not been particularly productive of vertebrate fossils in Colorado and Wyoming, and most finds have been fragmentary and not well-preserved. Part of a mosasaur skeleton was recovered from this unit near Flagler before the turn of the century (Lee 1897). Scott (1969:72, 76) reported the discovery of mosasaur and plesiosaur remains in the lower part of the Pierre Shale in the Pueblo area, east and north of the study corridor. Ikejiri and Lucas (1999) reported a partial skeleton of the mosasaur genus *Tylosaurus* from Trinidad, Colorado, a few miles south of a specimen of *Mososaurus* [sic] sp. reported over 80 years earlier (Lee 1917:130, plate 1). Sharks' teeth are known from the upper part of the Pierre Shale (Scott 1963b; Hayes 1967:130). The University of Colorado Museum has a small number of poorly to moderately-well preserved bony fish, shark, and marine reptile remains from Pierre Shale localities in Elbert, El Paso, Lincoln, Weld, and Yuma Counties.

The **Niobrara Formation** invertebrate fauna in Colorado and surrounding states is well-known and described (*e. g.*, Scott 1963b:97-99,1969:50-65; Scott and Cobban 1964). The known fauna is dominated by ammonites (extinct squid relatives) and inoceramid clams.

Invertebrate fossils from the Fort Hays Limestone include oysters, inoceramid clams, and very rare ammonites (Scott and Cobban 1964:L7); the fauna's taxonomic diversity is very limited. Species collected from a "productive" Fort Hays locality along State Highway 165 northwest of Rye (unpublished University of Colorado Museum fossil locality data) include:

Cremnoceramus aff. *C. erectus* [clam]
Cremnoceramus sp.
Durania aff. *D. austinensis* [clam]
Ostreida [oyster]

Baculites yokoyamai [ammonite]
Forresteria hobsoni [ammonite]

Inoceramid bivalves, oysters, and trace fossils are numerically abundant in the Smoky Hill Member, but taxonomic diversity is very limited (Rodriguez 1985: 36, 37). The inoceramids include:

Volviceramus grandis
V. involutus
Platyceramus platinus
Cladoceramus undulatoplicatus

The Smoky Hill Member in Kansas is (and had been known since the turn of the century as) a prolific producer of marine vertebrate fossils, including mosasaurs, plesiosaurs (extinct marine reptiles), pterosaurs (extinct flying reptiles), birds, teleost (bony) fish, and sharks (Hattin and Cobban 1977:193). Conversely, although Niobrara Formation shark, bony fish, and marine reptile remains are known (but evidently occur much less abundantly) in Colorado, no published faunal species lists and only one undoubted published specimen description (Martz 1996), that of the mosasaur *Platecarpus tympaniticus*, exist. Russell (1967:211) listed a specimen of the mosasaur *Tylosaurus proriger* from the "top of Niobrara very near Pierre contact" near Walsenburg, but Peter Robinson (personal communication 1988) of the University of Colorado Museum in Boulder believes the specimen was actually collected from the younger Sharon Springs Member of the Pierre Shale. The published (Russell 1967:211) legal location of the specimen is mapped (Johnson 1969) as Pierre Shale.

The following shark species are known to occur (Indeck and Wallace 1988:14-16) in both members of the Niobrara Formation:

Squalicorax falcatus
Cretolamna appendiculata
Cretoxyrhina mantelli
Scapanorhynchus sp.

CORRIDOR FOSSIL LOCALITIES

Scott (1969: plate 1) mapped 23 Smoky Hill Member of the Niobrara Formation fossil localities within one mile of the existing SH 50 alignment. I have compiled the published (Scott and Cobban 1964) fauna from 21 of these 23 localities in the attached table, "SH 50 Pueblo West USGS Niobrara Formation localities". Some of the taxonomic nomenclature in Scott and Cobban (1964) has been revised in the attached table to reflect subsequent literature revision of that nomenclature. Six of these USGS localities (D3481, 3482, 3488, 3489, 3501, and 3505) have been re-recorded in the Denver Museum of Nature and Science fossil locality database as DMNH localities 3113, 3668, 3115, 3116, 3117, and 3118, respectively, because of casts of specimens from those localities that Bill Cobban donated to the museum. A seventh DMNS locality within one mile of the existing SH 50 alignment, DMNH 3114, is identified as a duplicate record of USGS 3422, but because (1) the legal location of DMNH 3114 matches that

of USGS D3482, and (2) USGS 3422 does not lie within the progression of USGS numbers for fossil localities recorded along SH 50, I believe DMNH 3114 is actually equivalent to USGS 3482, not 3422.

Scott (1969: plate 1; 1972) mapped six Fort Hays Member of the Niobrara Formation fossil localities within the one mile of the existing SH 50 alignment, but the identifications of the fossils found there are not published in Scott and Cobban (1964). I know of no other published or unpublished fossil localities within the study corridor limits in any of the other geologic units mapped (Scott 1969; 1972) within the study corridor limits.

CONCLUSIONS

Given the known fossil productivity of the Niobrara Formation within a mile of the study corridor, it would appear likely that future construction within and immediately adjacent to the existing SH 50 right-of-way will impact potentially scientifically important fossils. The 21 fossil localities with an identified fauna are not especially scientifically important in that they represent the typical low-species diversity Niobrara Formation (and age-equivalent geologic unit elsewhere in Colorado) faunas recorded in Colorado previously. Only two of the 21 localities have more than four identified taxa.

Fifteen of 21 localities, however, have scientific significance from having produced fossils that are guide fossils to a chronologically-restricted stratigraphic interval. These fossils can be used to date isolated fossil localities and chronologically correlate isolated fossil localities (and the rocks in which they are contained) whose age relationships to each other might not be otherwise apparent. The fact that nearly 75 percent of the recorded localities include guide fossils to a chronologically-restricted stratigraphic interval probably indicates a bias toward formally recording fossil localities that can be reliably dated within a relatively short period of geologic time, but the fact that that so many have been recorded within a relatively small area adjacent to the study corridor suggests strong potential for finding similar localities within the study corridor if and when systematic on-the-ground reconnaissance for paleontological resources is conducted within the study corridor in the future.

The Pierre Shale has also shown strong potential for producing scientifically important fossils in the Pueblo area (and elsewhere in Colorado), but the Niobrara Formation underlies the vast majority of the study corridor, buried in places underneath a relatively thin layer of much younger surficial deposits, while the Pierre Shale is mapped (Scott 1969) only within the easternmost 0.25 mile of the study corridor. At most, the Pierre Shale lies shallowly buried underneath a relatively thin layer of much younger surficial deposits for another 0.3 mile to the west of its mapped (*ibid*) outcrop area within the study corridor.

The Pleistocene units mapped (Scott 1969; 1972) within the study corridor limits have demonstrated a much lower probability of having scientifically important fossils uncovered, damaged, and/or destroyed by future construction within the study corridor limits.

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