FISH AND WILDLIFE SERVICE
Ecological Services
Nebraska Field Office
203 West Second Street
Grand Island, Nebraska 68801

September 23, 2011

FWS-NE: 2010-377

K. Nicole Gibson, Ph.D.
Endangered Species Act Lead, Keystone XL Project
U.S. Department of State
OES/ENV Room 2657
Washington, D.C. 20520

Subject: Transmittal of the U.S. Fish and Wildlife Service's Biological Opinion on the Effects to Threatened and Endangered Species from the Issuance of a Presidential Permit to TransCanada Keystone Pipeline, LP (Keystone) by the U.S. Department of State for the proposed construction, connection, operation, and maintenance of the Keystone XL pipeline and associated facilities at the border of the United States for importation of crude oil from Canada.

Dear Dr. Gibson:

This document transmits the United States Fish and Wildlife Service's (Service or, in cite, USFWS) Biological Opinion regarding potential impacts of the proposed Keystone XL pipeline (Project) to the federally endangered American burying beetle (ABB; *Nicrophorus americanus*). This consultation document has been prepared pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act) (16 United States Code [U.S.C.] 1531 et seq.) and 50 Code of Federal Regulations [CFR] §402 of our interagency regulations governing section 7 of the Act.

Section 7(a)(2) of the Act requires Federal agencies to consult with the Service to ensure that any action authorized, funded, or carried out is not likely to jeopardize the continued existence of any federally listed species nor destroy or adversely modify critical habitat. The proposed Project in this case is the construction and operation of a 36-inch diameter oil transport pipeline between Hardisty, Alberta, Canada and multiple destinations in Oklahoma and Texas.

Keystone has applied to U.S. Department of State (DOS) for a Presidential Permit for the proposed construction, connection, operation, and maintenance of the Keystone XL pipeline and associated facilities at the border of the United States for importation of crude oil from Canada. DOS receives and considers such applications for Presidential Permits for energy production and transmission projects pursuant to the President's constitutional authority, which authority the President has delegated to DOS in Executive Order (EO) 13337, as amended (69 Federal Register [FR] 25299). Under EO 13337, the Secretary of State may issue a Presidential Permit for a border crossing facility if she finds that issuing such a permit would be in the "national interest." EO 13337 also specifies a process for DOS to seek input from certain other agencies on determination of the national interest. It was determined in consultation with other agencies

(including BLM and the USACE) that the DOS is the lead Federal agency for the NEPA environmental review of the proposed Keystone XL project. Consequently, DOS is also the lead agency consulting with the Service pursuant to section 7 of the ESA.

Several Federal agencies are cooperating agencies with DOS, and involved in some capacity with this pipeline Project. The Project would affect numerous rivers and wetlands, so the Army Corp of Engineers would be issuing Section 404 permits, as necessary. Because the Project would cross both public and private lands, the Bureau of Land Management (BLM) would evaluate the Project and decide whether to grant TransCanada Keystone Pipeline, LP (Keystone) a Right-of-Way (ROW) across Federal lands pursuant to Rights-of-Way under the Mineral Leasing Act (43 CFR 2880). These Federal lands principally include 43 miles of pipeline ROW in Montana, but the pipeline would also cross or go under Bureau of Reclamation facilities in Montana (2), South Dakota (2) and Nebraska (1). This Biological Opinion evaluates all impacts to threatened and endangered species, regardless of land ownership. Western Area Power Administration (WAPA) would own a small section of an 230 kV transmission line in southern South Dakota that is being planned to upgrade load capacity and support voltage requirements for pump stations 20 and 21 (in Tripp County, South Dakota) in the future in the event that the pipeline is operating at full capacity. Finally, the Rural Utilities Service (RUS) of the Department of Agriculture would be providing grants to help fund construction of some of the power distribution lines that may be built to provide power to the pipeline pump stations.

This Biological Opinion is based on the best available scientific and commercial data including E-mail and telephone correspondence, Service files, pertinent scientific literature, discussions with recognized species authorities, and other scientific sources. Further, this Biological Opinion uses information from the May 19, 2011, Biological Assessment (BA) submitted to the Service by DOS. An in-depth description of the Project components (i.e., Project centerline ROW and above ground facilities) and their effects was developed by DOS's designated applicant (discussed below), Keystone, and its subcontractors (Trow Engineering on behalf of Keystone; and Cardno ENTRIX, on behalf of DOS).

CONSULTATION HISTORY

The Service Nebraska Field Office in Grand Island, Nebraska, was delegated the lead Service office to conduct the consultation with DOS. However, other Service Ecological Services field offices in the six states crossed by the proposed Project were actively involved in review of the Project in their respective states during informal consultation beginning in 2008, and provided input on draft consultation documents throughout the consultation. The DOS appointed Keystone and its subcontractors to act as its designated non-federal representatives for the section 7 consultation.

Keystone compiled lists of species and habitats potentially affected by the Project using information from the Service, BLM, and state natural resource agencies. Keystone then developed target survey areas, field survey protocols, and survey schedules with Federal and state agency input in 2008. Keystone filed documentation of agency correspondence associated with the review and approval process with the DOS in November 2008, July 2009, June 2010, and November 2010.

The Project representatives initiated biological field surveys within the Project footprint (e.g., pipeline ROW), pump stations, access roads, pipe yards, contractor yards, extra workspace, etc.)

during the Spring of 2008. Contractors surveyed the area along the proposed Project centerline and Keystone filed an Environmental Report with the DOS in November of 2008. Additional field surveys along the ROW continued through the summer of 2011, to accommodate route alignment modifications, access permissions by private landowners, and additional agency requests for surveys.

The Service, DOS, Keystone, and Cardno ENTRIX on behalf of DOS conducted extensive informal consultations on the effects of the proposed Project. Prior to initiation of formal consultation on May 19, 2011, informal consultation occurred between Keystone and the Service field offices in Montana, South Dakota, Nebraska, Kansas, Oklahoma and Texas. Informal consultation included various letter/information exchanges, E-mails, phone calls, and site visits beginning in 2008 (see consultation history, below). The following bulleted items provide a summary of Keystone and agency correspondence, species specific survey information, and continued informal consultation with the Service regarding coordination of biological surveys and determination of biological impacts from the proposed Project. Supporting meeting summaries, consultation letters, and other communications are included in the BA (Keystone 2011), in files at the Service's Nebraska Ecological Services Field Office located in Grand Island, Nebraska and other Service Ecological Services field offices in Montana, South Dakota, Kansas, Oklahoma and Texas.

- April 2008. Keystone sent initial consultation letters for the Steele City Segment (Montana, South Dakota, and Nebraska) to the Service, BLM, state wildlife agencies, and state natural heritage programs to request their input on identifying prominent terrestrial and aquatic resource issues or concerns that may occur within or adjacent to the ROW, focusing on species that are either sensitive (e.g., federal or state listed), have high economic value (e.g., big game, waterfowl), or are considered important resources (e.g., raptors, fish). The consultation letters included state-specific special status species tables compiled from data received from each state, the Service, and BLM with brief descriptions of species habitat, miles of potential habitat crossed by the Project, and approximate mileposts where potential habitat was identified along the ROW.

- April 10, 2008. Project representatives met with the Service's Texas Ecological Services Field Office in Arlington, Texas. The goals of the meeting were to introduce the Project, discuss the list of species that may occur in the Project area, define the survey approach and discuss survey protocols for the Project, and discuss any agency concerns, issues, or questions.

- April 16, 2008. Project representatives met with the Service Oklahoma Field Office in Tulsa, Oklahoma. The goals of the meeting were to introduce the Project, discuss the list of species that may occur in the Project area, define the survey approach and discuss survey protocols for the Project, and discuss any agency concerns, issues, or questions.

- April 29, 2008. Project representatives met with the Service Clear Lake Ecological Services Field Office in Houston, Texas. The goals of the meeting were to introduce the Project, discuss the list of species that may occur in the Project area, define the survey approach and discuss survey protocols for the Project, and discuss any agency concerns, issues, or questions.

- May 5, 2008. Keystone met with the Nebraska Game and Parks Commission (NGPC) and the Service at the NGPC office in Lincoln, Nebraska, to discuss issues pertaining to wildlife, special status species, and sensitive habitat that could potentially occur in the Project area. The goal of the meeting was to gather input on agency recommendations based on the information sent to them in April 2008 for species occurrence, habitat assessments, and future field surveys. Keystone incorporated comments from the meeting into survey protocols and best management practices (BMPs) documents for future agency verification.

- May 8, 2008. Keystone met with the Service and the Montana Fish, Wildlife, and Parks (MFWP) at the MFWP office in Helena, Montana, to discuss issues pertaining to wildlife, special status species, and sensitive habitat that could potentially occur in the Project area. The goal of the meeting was to gather input on agency recommendations based on the information sent to them in April 2008 for species occurrence, habitat assessments, and future field surveys. Keystone incorporated comments from the meeting into survey protocol and BMPs documents for future agency verification. MFWP requested a follow-up meeting with additional technical staff from MFWP (Regions 6 and 7).

- May 23, 2008. Project representatives met with the Texas Parks and Wildlife Department (TPWD) in Dickinson, Texas, at the Justin Hurst Wildlife Management Area. The goals of the meeting were to introduce the Project, discuss the list of species that may occur in the Project area, define the survey approach and discuss survey protocols for the Project, and discuss any agency concerns, issues, or questions.

- June 3, 2008. Project representatives met with the personnel at the Service East Texas Ecological Services Sub-office in Lufkin, Texas. The goal of the meeting was to meet with a Service biologist who had specialized experience in reviews for potential habitat and distribution of the red-cockaded woodpecker and Louisiana pine snake, as well as public and private land issues.

- June 10, 2008. Keystone met with staff from Service and South Dakota Department of Game, Fish, and Parks (SDGFP), at the SDGFP office in Pierre, South Dakota, to discuss issues pertaining to wildlife, special status species, and sensitive habitat that could potentially occur in the Project area. The goal of the meeting was to gather input on agency recommendations based on the information sent to them in April 2008 for species occurrence, habitat assessments, and future field surveys. Keystone incorporated comments from the meeting into survey protocol and BMPs documents for future agency verification.

- July 1, 2008. Project representatives met with the Oklahoma Department of Wildlife Conservation (ODWC) in Oklahoma City, Oklahoma. Goals of the meeting were to introduce the Project, discuss list of species that may occur in the Project area, define survey approaches and discuss survey protocols for the Project, and discuss agency concerns or questions.

- July 29, 2008. Keystone met with staff from the BLM Glasgow Field Office and MFWP Region 6 and 7 at the MFWP office in Glasgow, Montana, to discuss issues pertaining to wildlife, special status species, and sensitive habitat that could potentially occur in the

Project area. The goal of the meeting was to discuss agency recommendations based on the information sent to them in April 2008 for species occurrence, habitat assessments, and future field surveys. Keystone incorporated input from the meeting into survey protocol and BMPs documents for future agency verification.

- September 4, 2008. Keystone sent informal consultation letters to the Service field offices in Arlington, Texas; Lufkin, Texas, and Tulsa, Oklahoma, describing the proposed threatened and endangered species biological survey program and the list of species for which species-specific surveys would occur. The consultation letters included a compact disc containing electronic files of the ROW, and requested input on the species lists.

- September 12, 2008. Keystone received a consultation letter from the Service Ecological Services Field Office in Arlington, Texas, regarding recommendations for the proposed list of threatened and endangered species-specific surveys. The letter also identified habitats that are a high priority of conservation, and provided recommendations for content of mitigation plan for fish and wildlife resources.

- November 12, 2008. Keystone received a consultation letter from the Service Ecological Services Field Office in Clear Lake, Texas, regarding recommendations for the proposed list of threatened and endangered species-specific surveys, habitat descriptions and field evaluations, lighting at above-ground facilities, pipeline monitoring criteria, utility corridors, and other areas of concern.

- December 3, 2008. Keystone received a consultation letter from the Service Ecological Services Field Office in Tulsa, Oklahoma, regarding recommendations for the proposed list of threatened and endangered species-specific surveys, habitats of special concern, and BMPs for projects affecting rivers, streams, and tributaries. The Service requested formal consultation with DOS to address take of the American Burying Beetle.

- January / February, 2009. Keystone sent the wildlife resource agency offices in the Steele City Segment (i.e., Service, BLM, and state wildlife agencies in Montana, South Dakota, and Nebraska) an information package that included state-specific special status species survey protocol and BMPs documents for the species identified as potentially occurring during the 2008 meetings. A summary of the findings from the 2008 biological field surveys were included in the correspondence.

- January 6, 2009. Project representatives met with the Service Clear Lake Ecological Services Field Office in Houston, Texas. The goals of the meeting were to discuss updated Project details and schedule, provide a status on the current environmental data gathering, discuss current list of species of concern, and discuss any unresolved concerns, issues, or questions.

- January 14, 2009. Project representatives met with the Service Ecological Services Field Office in Arlington, Texas. The goals of the meeting were to discuss updated Project details and schedule, provide a status on the current environmental data gathering, discuss current list of species of concern, and discuss any unresolved concerns, issues, or questions.

- January 20, 2009. Project representatives met with the Service Oklahoma Field Office in Tulsa, Oklahoma. The goals of the meeting were to discuss updated project details and schedule, provide a status on the current environmental data gathering, discuss current list of species of concern, and discuss any unresolved concerns, issues, or questions.

- January 27, 2009. Keystone met with staff from the Service and SDGFP at the SDGFP office in Pierre, South Dakota, to discuss issues pertaining to special status species surveys. The goals of the meeting were to verify Keystone's survey approach, BMPs, discuss required field surveys, and review the information that was sent to the Service in the January / February informal consultation package. The Service and SDGFP provided additional recommendations to Keystone's sensitive species mitigation approach to be updated prior to final agency concurrence.

- February 3, 2009. Keystone met with staff from the BLM Glasgow Field Office and MFWP Regions 6 and 7 at the MFWP office in Glasgow, Montana, to discuss issues pertaining to special status species surveys. The goals of the meeting were to verify Keystone's survey approach, BMPs, discuss required field surveys, and review the information that was sent to the in the January/February consultation package. The BLM and MFWP provided additional recommendations to Keystone's sensitive species mitigation approach to be updated prior to final agency concurrence.

- February 5, 2009. Keystone held a conference call with staff from the BLM Glasgow, Malta, and Miles City field offices to discuss issues pertaining to special status species surveys. The goals of the meeting were to verify Keystone's survey approach, BMPs, discuss required field surveys, and review the information that was sent to the Service in the January / February informal consultation package. The BLM provided additional recommendations to Keystone's sensitive species mitigation approach to be updated prior to final agency concurrence.

- February 19, 2009. Keystone met with staff from the Service Nebraska Ecological Field Office and NGPC at the NGPC office in Lincoln, Nebraska, to discuss issues pertaining to special status species surveys. The goals of the meeting were to verify Keystone's survey approach, BMPs, discuss required field surveys, and review the information that was sent to the Service in the January/February informal consultation package. The Service and NGPC provided additional recommendations to Keystone's sensitive species mitigation approach to be updated prior to final agency concurrence.

- April 3, 2009. Keystone sent E-mail correspondence to the Service Clear Lake Ecological Services Field Office in Texas regarding survey protocols for the Texas prairie dawn-flower. Comments and concurrence were received on the survey locations and methodology on April 7, 2009, and surveys were initiated following receipt of approval.

- May 19, 2009. Keystone sent E-mail correspondence to the Service Tulsa Ecological Services Field Office in Oklahoma regarding survey protocols for the interior least tern. Comments and concurrence were received on the survey locations and methodology on June 17, 2009, and surveys were initiated following receipt of approval.

- June 16, 2009. Keystone held a conference call with staff from the Service Ecological Services Field Office in Tulsa, Oklahoma, to discuss issues pertaining to the American burying beetle. The goals of the meeting were to determine the next steps in the consultation process for the American burying beetle and verify that the Service was receiving the information they required. The Service provided guidance for the information that should be included in the BA.

- June 25, 2009. Keystone called Service personnel in the South Dakota Field Office, Pierre, South Dakota, regarding geotech activity clearance. The Service discussed need for formal consultation with DOS to address take of the American burying beetle in South Dakota.

- June 30, 2009. Keystone sent informal consultation letters to the Service field offices in Arlington, Clear Lake, and Lufkin, Texas; and Tulsa, Oklahoma; and to the Oklahoma Department of Wildlife Conservation (ODWC), and Texas Parks and Wildlife Department (TPWD). The purpose of the letters was to confirm the final list of species-specific surveys that were required for the Project, to summarize for the agencies the results of surveys that had been completed to date, and to confirm that any species not included in the summary are not likely to be adversely affected by the Project.

- July 29, 2009. E-mail was sent from Angela Brown of Service to Kendra Bauer at the University of Texas to acknowledge the review of the Lamar County, Texas, survey for the American burying beetle, and acceptance of the survey results.

- September 25, 2009. Keystone received a consultation letter from TPWD in response to the letter dated June 30, 2009, that provided recommendations to protect fish and wildlife resources and information on known occurrence of fish and wildlife resources near the Project area. TPWD also attached the April 13, 2009 letter that had been submitted to Elizabeth Orlando at DOS.

- November 2, 2009. DOS received concurrence from National Oceanic and Atmospheric Administration (NOAA) Fisheries and Service Southeast Regional Office regarding sea turtle occurrence and the no effect finding for protected sea turtles because the Project would not cross estuarine or marine habitats.

- January 15, 2010. Keystone called and sent an E-mail to the Service Oklahoma Field Office in Tulsa, seeking concurrence on proposed survey windows for raptors/rookeries and bald eagles to be completed in 2010.

- March 2, 2010. Project personnel held a conference call with Service on Endangered Species Act (ESA) and Migratory Bird Treaty Act (MBTA) Surveys. The goal of the call was to discuss helicopter survey timing windows (potential times for surveys) for raptors/rookeries and bald eagles in 2010. The need for conducting additional pedestrian surveys for piping plovers was also discussed.

- April 12, 2010. Keystone sent the proposed interior least tern survey protocol to the Service Oklahoma Field Office in Tulsa, for concurrence on the approach and resumes of personnel scheduled to conduct the surveys.

- May 4, 2010. Keystone received suggested edits to the interior least tern survey protocol from Service Oklahoma Field Office in Tulsa. Edits were incorporated and the protocol document finalized.

- May 5, 2010. Keystone contacted the Service East Texas Field Office in Lufkin regarding a landowner report of a red-cockaded woodpecker (RCW) sighting on his property located in Polk County, Texas. The property in question would be affected by the proposed route and the issue was originally reported to the U.S. Army Corps of Engineers (USACE) Galveston District by the landowner. The Service Lufkin office recommended that Keystone contact the Service Clear Lake office in Texas to discuss further necessary actions.

- May 19, 2010. Service Clear Lake Ecological Services Field Office in Texas, contacted Keystone and reported that Service personnel visited the property in Polk County where the potential RCW sighting occurred and observed no RCWs or potential habitat at the site.

- June 1, 2010. Service provided DOS comments on the Draft Biological Assessment of impacts of the proposed Project to threatened and endangered species. Comments from Service field offices in Nebraska, South Dakota, Oklahoma and Texas were included.

- June 3, 2010. Service provided the Director of the Office of Environmental Compliance, Department of the Interior combined comments from Region 6 (Denver) and Region 2 (Albuquerque) on the Draft Environmental Impact Statement for the proposed Project.

- June 22, 2010. Keystone contacted the Service Arlington Ecological Services Field Office in Texas to determine the steps necessary to modify a subcontractor's (Dr. Wyatt Hoback) Endangered Species Research Permit to include Texas. The permit modification was necessary to support ABB surveys required in Lamar County, Texas.

- September 3, 2010. Keystone met with Service, Keystone, DOS, and Cardno ENTRIX, regarding the requirements for formal consultation on the effects of the Keystone XL Pipeline Project.

- September 16, 2010. Keystone contacted the Service Clear Lake Ecological Services Field Office regarding potential Texas trailing phlox habitat crossed by the project in Hardin and Polk counties, Texas. Service provided a link to Habitat Prediction for Texas Trailing Phlox Using Landsat Thematic Mapper and Ancillary Biophysical Data (Schwelling et al. 2000). Service requested that Keystone review this information and provided additional information pertaining to potential habitat crossed by the project.

- October 12, 2010. Continuation of meetings between Service, Keystone, Nebraska Game Fish and Parks, and Cardno ENTRIX regarding needs for the Keystone XL Pipeline formal consultation on anticipated Project impacts to the American burying beetle.

- December 30, 2010. Service provided comments to Keystone and Cardno ENTRIX on the November 2010 preliminary final Biological Assessment (BA) of impacts to threatened and endangered species from the proposed Keystone XL pipeline.

- December 30, 2010. Service provided comments on the November 29, 2010, revision of the American Burying Beetle Survey Report to Keystone and Cardno ENTRIX.

- January 7, 2011. Meeting between Service, Keystone, and Cardno ENTRIX (for DOS) to discuss Service comments on the preliminary final BA.

- January 12, 2011. Personnel from Service, Keystone, Nebraska Game Fish and Parks, and Cardno ENTRIX (for DOS) met to continue discussions about the BA needed for section 7 formal consultation on effects of the Keystone XL Pipeline Project to the American burying beetle.

- February 2, 2011. Personnel from Service, Keystone, DOS, and Cardno ENTRIX (for DOS) met to continue discussions about the BA needed for section 7 formal consultation on effects of the Keystone XL Pipeline Project to the ABB.

- February 17, 2011. Personnel from Service, DOS, and Cardno ENTRIX (for DOS) met to continue discussions about the BA needed for section 7 formal consultation on effects of the Keystone XL Pipeline Project to the ABB.

- March 24, 2011. Personnel from Service, DOS, Keystone, Nebraska Game Fish and Parks, and Cardno ENTRIX (for DOS) met to continue discussions about the BA needed for section 7 formal consultation on effects of the Keystone XL Pipeline Project to the ABB.

- April 21, 2011. Personnel from Service, Keystone, DOS, and Cardno ENTRIX (for DOS) met to continue discussions about the BA needed for section 7 formal consultation on effects of the Keystone XL Pipeline Project to the ABB. Discussion included potential impacts to wooded areas in Oklahoma.

- April 21, 2011. Personnel from Keystone and DOS met to continue discussions about the BA needed for section 7 formal consultation on effects of the Keystone XL Pipeline Project to the ABB. Discussion included monitoring and habitat restoration bonding.

- April 27, 2011. Personnel from Service and DOS met to continue discussions about the BA needed for section 7 formal consultation on effects of the Keystone XL Pipeline Project to the ABB. Discussion included monitoring and habitat restoration bonding.

- May 19, 2011. DOS submitted Final BA to the Service with a letter requesting initiation of formal consultation.

- August 26, 2011. DOS issued the Final EIS to cooperating agencies and the public.

The BA analyzed the anticipated effects from the proposed Project to numerous species protected under the Act (Keystone 2011). Table 1 lists the species and the effect determinations reached in the BA by the DOS (Keystone 2011).

Table 1. Species included in Biological Assessment analyses for the proposed Action and effect determinations.

Common Name	Scientific Name	Federal Status	Conclusion[1]	Rationale
Mammals				
Black-footed ferret	*Mustela nigripes*	Endangered/Prop. Experimental Pop.	NLAA/ NLAA	No potential reintroduction sites present
Louisiana black bear/ American black bear	*Ursus americanus luteolus/ Ursus americanus*	Threatened/ Threatened – Sim. of Appearance	No Effect/ No Effect	Mobility of species precludes effect
Red wolf	*Canis rufus*	Endangered	No Effect	Not present
Birds				
Eskimo curlew	*Numenius borealis*	Endangered	No Effect	Not present
Interior least tern	*Sternula antillarum*	Endangered	NLAA	Conservation measures adequate
Mountain plover	*Charadrius montanus*	Was Proposed Threatened; Proposed Listing withdrawn in 2011	No Effect	Not applicable
Piping plover	*Charadrius melodus*	Threatened	NLAA	Conservation measures adequate
Red-cockaded woodpecker	*Picoides borealis*	Endangered	No Effect	Not present
Whooping crane	*Grus americana*	Endangered	NLAA	Conservation measures adequate
Fish				
Arkansas River shiner	*Notropis girardi*	Threatened	NLAA	Conservation measures adequate
AR shiner designated critical habitat			NLAA	Conservation measures adequate
Pallid sturgeon	*Scaphirhynchus albus*	Endangered	NLAA	Conservation measures adequate
Topeka shiner	*Notropis topeka*	Endangered	No Effect	Habitat not affected
Amphibians				
Houston toad	*Bufo houstonensis*	Endangered	No Effect	Habitat not affected
Reptiles				
Green sea turtle	*Chelonia mydas*	Threatened	No Effect	Habitat not affected
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	No Effect	Habitat not affected
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	No Effect	Habitat not affected
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	No Effect	Habitat not affected
Loggerhead sea turtle	*Caretta caretta*	Threatened	No Effect	Habitat not affected

Table 1. Species included in Biological Assessment analyses for the proposed Action and effect determinations.

Common Name	Scientific Name	Federal Status	Conclusion[1]	Rationale
Invertebrates				
American burying beetle	*Nicrophorus americanus*	Endangered	MALAA	Habitat and individuals adversely affected
Ouachita rock pocketbook	*Arkansia wheeleri*	Endangered	No Effect	Habitat in known range not affected
Plants				
Blowout penstemon	*Penstemon haydenii*	Endangered	NLAA	Habitat would be avoided
Texas prairie dawn-flower	*Hymenoxys texana*	Endangered	NLAA	Conservation measures adequate
Texas trailing phlox	*Phlox nivalis texensis*	Endangered	No Effect	Not present; Habitat not affected
Western prairie fringed orchid	*Platanthera praeclara*	Threatened	NLAA	Conservation measures adequate

[1] NLAA – May affect, not likely to adversely affect
MALAA – May affect, likely to adversely affect.

The Service concurs with the DOS determinations that the proposed Project may affect but is not likely to adversely affect the endangered black-footed ferret, Interior least tern, red-cockaded woodpecker, whooping crane, pallid sturgeon, blowout penstemon, and the Texas prairie dawn-flower; and the threatened piping plover, Arkansas River shiner, and the western prairie fringed orchid. When effects to critical habitat are not likely to occur, as is the case for the Arkansas River shiner, the determination is "may affect, not likely to adversely affect" the critical habitat; the Service concurs with a NLAA determination. Additionally, the correct effects determination for the mountain plover is "no effect," because the species no longer has status under the ESA. The Service withdrew its proposed listing rule for the mountain plover on May 12, 2011 (75 FR 37353), and consultation is not required. A detailed discussion of factors contributing to the Service's concurrence with the above NLAA effects determinations is on file at the Service's Nebraska Field Office in Grand Island, Nebraska.

The Service acknowledges the "no effect" determinations by DOS, and no further consultation is required for these species. Finally, the Service concurs with the determination that the Project may affect and is likely to adversely affect the ABB. Therefore, this Biological Opinion would analyze the effects of the proposed Project along with the effects of interrelated and interdependent activities on ABB, because the Keystone XL pipeline may affect and is likely to adversely affect this species. No critical habitat has been designated for the ABB, so the action would not modify critical habitat for this species.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The Federal Action under consideration is the potential issuance by DOS of a so-called "Presidential Permit" to authorize the crossing of the United States-Canada border by a crude oil transmission system that Keystone proposes to construct and operate between an oil supply hub near Hardisty, Alberta, Canada, and multiple destinations in the United States. The Project would have the nominal capacity to deliver up to 830,000 barrels per day of crude oil (Keystone 2011). Direct and indirect effects of the Federal Action are analyzed to ensure they are not likely to jeopardize the continued existence of federally listed or proposed endangered or threatened species. Indirect effects of the Federal Action include, "…activities that are caused by or result from the Action, are later in time and are reasonably certain to occur…" (USFWS and NMFS 2003). The primary indirect effect of the potential issuance of the Presidential Permit by DOS is the proposed Keystone XL pipeline (Project), including all preconstruction, construction, operation and reclamation activities associated therewith. Therefore, the focus of this Biological Opinion would be the effects of the Keystone XL pipeline project.

Keystone has applied to U.S. Department of State (DOS) for a Presidential Permit for the proposed construction, connection, operation, and maintenance of the proposed Keystone XL pipeline and associated facilities at the border of the United States for importation of crude oil from Canada. DOS receives and considers such applications for Presidential Permits for energy production and transmission projects pursuant to the President's constitutional authority, which authority the President has delegated to DOS in Executive Order (EO) 13337, as amended (69 Federal Register [FR] 25299). Under EO 13337, the Secretary of State may issue a Presidential Permit for a border crossing facility if she finds that issuing such a permit would be in the "national interest." EO 13337 also specifies a process for DOS to seek input from certain other agencies on determination of the national interest. It was determined in consultation with other agencies (including BLM and the USACE) that the DOS would be the lead Federal agency for the NEPA environmental review of the proposed Keystone XL project. Consequently, DOS is also the lead agency consulting with the Service pursuant to section 7 of the ESA.

Several Federal agencies are cooperating agencies with DOS, and involved in some capacity with this pipeline Project. Authorizations and approvals from agencies other than DOS would be required should the Keystone XL pipeline be permitted by DOS. The Project would affect numerous rivers and wetlands, so the Army Corp of Engineers would be issuing Section 404 permits, as necessary. Because the Project would cross both public and private lands, the Bureau of Land Management (BLM) would evaluate the Project and decide whether to grant TransCanada Keystone Pipeline, LP (Keystone) a Right-of-Way (ROW) across Federal lands pursuant to Rights-of-Way under the Mineral Leasing Act (43 CFR 2880). These Federal lands principally include 43 miles of pipeline ROW in Montana, but the pipeline would also cross or go under Bureau of Reclamation facilities in Montana (2), South Dakota (2) and Nebraska (1). This Biological Opinion evaluates all impacts to threatened and endangered species, regardless of land ownership. Western Area Power Administration (WAPA), part of the Department of Energy, in coordination with the Rural Utilities Service (RUS) would own a small section of an 230 kV transmission line in southern South Dakota that is being planned to upgrade load capacity and support voltage requirements in the area around Tripp County, South Dakota, which may be required in the future in the event that the pipeline increases to full capacity. Finally, the RUS of the Department of Agriculture would be providing grants to help fund construction of

some of the power distribution lines that may bebuilt to provide power to the pipeline pump stations.

Figure 1 in Appendix A of this Biological Opinion illustrates the general location of the entire Project (see also Keystone 2011, Figure 2.1-1). Figures 1 to 7 in Appendix A illustrate the more detailed pipeline route and locations of aboveground facilities in each state (see also Keystone 2011, Figures 2.1-2 to 2.1-7). Pipeline aerial photos and U.S. Geologic Survey topographic map route sheets for the currently proposed Keystone XL Project, power line routes to the pipeline pump stations, and site specific river Horizontal Directional Drilling crossing plans are available on the U.S. Department of State's Keystone XL Pipeline Project web site under Project Documents, Supplemental Filing (May 19, 2010; Keystone 2010).

The proposed Project consists of three segments: the Steele City Segment, the Gulf Coast Segment, and the Houston Lateral (Appendix A, Figures 1 through 7). From north to south, the Steele City Segment extends from the U.S./Canada border near Morgan, Montana, southeast to Steele City, Nebraska. The Gulf Coast Segment extends from Cushing, Oklahoma, south to Nederland, in Jefferson County, Texas. The Houston Lateral extends from the Gulf Coast Segment in Liberty County, Texas, southwest to Moore Junction, Harris County, Texas, and includes the 74-acre Cushing Tank Farm. In total, the proposed Project consists of approximately 1,711 miles of new, 36-inch diameter pipeline, with 327 miles in Canada and 1,384 miles in the United States. The new pipeline would connect with the northern and southern termini of the previously approved 298-mile-long, 36-inch diameter Keystone Cushing Extension segment of the Keystone Pipeline Project (Keystone 2011). Keystone XL pipeline facilities are summarized by state and segment in Table 2.

Table 2. Description of proposed Project facilities by pipeline segment and state (Keystone 2011: Table 2.1-1)

Segment/State	Miles of New Pipeline Construction	Ancillary Facilities
Steele City Segment		
Montana	282.7	6 new pump stations, 14 main line valves (MLVs), 50 access roads
South Dakota	314.2	7 new pump stations, 9 MLVs, 18 access roads
Nebraska	254.7	5 new pump stations, 13 MLVs, 12 access roads
Keystone Cushing Extension		
Kansas	0	2 new pump stations and 1 access road
Gulf Coast Segment		
Oklahoma	155.7	4 new pump stations, 11 MLVs, 76 access roads, Cushing Tank Farm
Texas	328.1	6 new pump stations, 22 MLVs, 1 delivery site, 157 access roads
Houston Lateral		
Texas	48.6	7 MLVs, 1 delivery site, 31 access roads
TOTAL	**1383.9**	

In the United States, construction of the proposed Project would begin as soon as possible following receipt of all required permits, but likely not prior to early 2012. Based on the current permitting schedule, the proposed project is planned to be placed into service in 2013, with the actual date dependent on dates of receipt of all necessary permits, approvals, and authorizations (Keystone 2011).

Multiple activities would occur during Project pre-construction, construction, operation, maintenance and restoration of the Project lands. For details of construction methods, characteristics of the ROW and auxiliary facilities, and Project operation and maintenance, and restoration of Project lands, refer to the BA (Keystone 2011). The Project Construction Mitigation and Reclamation Plan, the Pipeline Risk Assessment and Environmental Consequence Analysis, and results of species-specific fields surveys, can be found in various appendices to the BA (Keystone 2011).

Pre-construction Activities

Pre-construction activities by Keystone include the survey and staking of Project ROW and ancillary facilities.

Keystone conducted presence/absence surveys through a contractor in 2009 and 2010 and confirmed ABB on Project lands. Methods and results of the surveys are discussed in Appendix D of the BA and in this Biological Opinion. Following that confirmation, Keystone included several conservation measures to the Project to avoid, reduce or minimize adverse impacts to ABB. The conservation measures include:

- Trapping and relocating of adult ABB would be done in Nebraska to avoid and/or minimize mortality of the species due to pipeline construction activities. This trapping and relocating would be conducted prior to the beetles retreat underground for the winter, and the ABB would be moved to areas of occupied, good or prime ABB habitat at least 5 miles from the trap sites. Immediately following ABB relocation, areas to be disturbed would be mowed to reduce soil moisture content, and carrion would be removed from the areas until September 1, as per the ABB Trapping Protocol and Conservation Measures for Use in Nebraska (Appendix B). The mowing and carrion removal would make the Project areas unattractive to the beetles for overwintering and substantially reduce the potential for ABB to be directly affected by construction activities.

- After the ABB trapping and relocating efforts are completed, the ROW would be disturbed (graded) prior to the next June ABB active period in Nebraska (e.g., trap and relocation efforts take place during the August active period, and the ROW disturbance would take place prior to the following June active period).

- In areas where the ROW could not be disturbed (graded) before the next activity period, ABB trapping and relocating efforts would be repeated in Nebraska (e.g., in the example above, trapping and relocation efforts would be repeated during the June active period, and the ROW would be disturbed before the following active period [in this case, August]).

The pre-construction ABB trapping and relocating effort to be accomplished in August of 2011 is unprecedented in scope. The trapping effort is designed to clear, to the extent possible, the

nearly 100 miles of pipeline ROW (mile point (MP) 597 to 695) and associated project lands of ABB. Six, three-person crews supervised by Dr. W.W. Hoback from the University of Nebraksa-Kearney (under contract with Keystone), would trap half of the area at a time, covering the entire area in 23 days. Traps would be placed at each MP, using all-terrain-vehicles for transportation to and from the remote trap sites. Following the trapping effort, the ROW would be mowed (within safety constraints in the hilly terrain) to less than eight inches, and carrion would be removed to make the area unattractive for return of ABB until the ABB retreat underground for the winter. If vegetation removal and grading can be implemented on the cleared areas in Nebraska prior to ABB emergence in the spring of 2012, then the number of adult ABB killed by construction activities would be minimized. However, if construction is delayed until after ABB emergence in spring of 2012, then the trapping and relocating of adult ABB would need to be repeated prior to construction in 2012.

Construction Activities

The construction segments consist of multiple mainline spreads which would be built concurrently as follows:

- 36-inch diameter Steele City Segment, approximately 852 miles in length, from the US/Canada Border at Morgan, Montana, to Steele City, Nebraska, which would be constructed with 10 mainline spreads, varying in length between approximately 80 and 94 miles each.

- 36-inch diameter Gulf Coast Segment, approximately 484 miles in length, from Cushing, Oklahoma, to Nederland, in Jefferson County, Texas, which would be constructed with 6 mainline spreads, varying in lengths from 47 to 99 miles each.

- 36-inch diameter Houston Lateral, approximately 49 miles in length, from Liberty County, Texas, to Moore Junction in Harris County, Texas, which would be constructed with one main spread (Keystone 2011).

ROW construction activities include vegetation clearing, grading to achieve a relatively level work zone, topsoil stripping; trench excavation and padding of trench bottom; pipe stringing, bending, line-up, welding, check, repair and coating procedures; pipe inspection, coating, lowering and pipe tie-ins; hydrostatic testing of the pipe and final tie-in; cleanup and restoration of the ROW.

Temporary and permanent access roads would be built or upgraded where necessary; most of these would be temporary access roads and restored following Project construction, although one permanent access road through ABB habitat is being constructed in Oklahoma. Approximately 858,402 cubic yards of borrow material (for entire Project) would be needed for road work, trench padding, and construction of ancillary sites (DOS 2011b).

Table 3. Summary of land areas affected by various facilities necessary for the construction and operation of the Keystone XL pipeline. This table is limited to those states with ABB occurring in the action area of the Project. However, some acres reported are not ABB habitat and ABB do not occur on all of the acres identified (Source: Keystone 2011, Table 2.1-2)

Facility	Land Affected During Construction[1] (acres)	Land Affected During Operation[2] (acres)
Steele City Segment		
South Dakota		
Pipeline ROW	4,178.9	1,904.0
Additional TWAs[6]	309.3	0.0
Pipe Stockpile Sites, Rail Sidings, and Contractor Yards	581.2	0.0
Construction Camps	160.2	0.0
Pump Stations/Delivery Facilities	59.4	59.4
Access Roads[7]	144.8	9.1
South Dakota Subtotal[3,5]	5,433.7	1,972.5
Nebraska		
Pipeline ROW	3,384.8	1,543.8
Additional TWAs[6]	349.5	0.0
Pipe Stockpile Sites, Rail Sidings, and Contractor Yards	515.6	0.0
Pump Stations/Delivery Facilities	42.2	42.2
Access Roads[7]	53.3	0.0
Nebraska Subtotal[3,5]	4,345.3	1,586.1
Gulf Coast Segment		
Oklahoma		
Pipeline ROW	2,033.5	943.8
Additional TWAs[6]	179.1	0.0
Pipe Stockpile Sites, Rail Sidings, and Contractor Yards	701.3	0.0
Tank Farm/Pump Stations/Delivery Facilities	74.1	74.1
Access Roads[7]	118.6	15.1
Oklahoma Subtotal[3, 5]	3,106.6	1,033.1

[1] Disturbance is based on a total of 110-foot-wide construction ROW, except in certain wetlands, cultural sites, shelterbelts, residential areas, and commercial/industrial areas where an 85-foot-wide construction ROW would be used, or in areas requiring extra width for workspace necessitated by site conditions. Disturbance also includes pipe stockpile sites, contractor yards, rail yards, and construction camps

[2] Operational acreage was estimated based on a 50-foot-wide permanent ROW in all areas. All pigging facilities would be located within either pump stations or delivery facility sites. Intermediate MLVs and densitometers would be constructed within the construction ROW and operated within the permanently maintained 50-foot-wide ROW. Other MLVs, check valves and block valves, and meters would be located within the area associated with a pump station, delivery site or permanent ROW. Consequently, the acres of disturbance for these aboveground facilities are captured within the Pipeline ROW and Pump Station/Delivery Facilities categories within the table.

[3] Discrepancies in total acreages are due to rounding.

[5] Includes disturbances associated with construction of the Steele City Segment, the Gulf Coast Segment, and the Houston Lateral. This total includes 125 acres associated with construction and operation of new pump stations along the Keystone Cushing Extension.

[6] Includes staging areas at approximately 5 acres.

[7] Access road temporary and permanent disturbance is based on 30-foot width; all non-public roads are conservatively estimated to require upgrades and maintenance during construction. Temporary access road acreages are summarized under the *Land Affected During Construction* column and permanent access road acreages are summarized under the *Land Affected During Operation* column.

The typical pipeline construction right-of-way (ROW) is 110 feet wide, although the width varies somewhat depending on local terrain, soils and other characteristics. For example, the width of the construction ROW crossing wetlands or minor roads is anticipated to be 85 feet, whereas the ROW in areas of steep terrain or unstable soils (such as the Sandhills in South Dakota and Nebraska) would be greater than 110 feet wide. In addition to the pipeline ROW construction, the Project would disturb multiple areas used for ancillary facilities, such as additional temporary workspace areas (TWAs), pipe stockpile sites, rail sidings, contractor yards, construction camps, pump stations, delivery facilities and access roads. Mainline valves are contained within the Project ROW. The 74-acre Cushing Tank Farm near Cushing, OK, and storage facilities at the termini of the pipeline in Texas are also part of the Project. Movement of heavy equipment during the construction process would compact soil in the ROW and all ancillary Project areas. The number of acres disturbed by these Project facilities is described in Table 3.

Most construction activities would take place during daylight hours and construction areas would not generally use artificial lighting at those times. However, construction activities that could potentially require lighting would include critical pipeline tie-ins, Horizontal Directional Drilling (HDD) crossings, and certain work required after sunset due to weather, safety or other project requirements. For example, HDD crossings would require 24-hour operation until the crossing is completed (Keystone 2011.

During construction, construction equipment would be refueled on site, at least 100 feet from any wetland and at least 150 feet from any groundwater well. Maintenance of equipment would take place at construction yards (DOS 2011).

Keystone would incorporate numerous species-specific conservation measures into the Project to minimize or avoid adverse Project impacts to various threatened or endangered species. These are detailed in Chapter 3 of the BA (Keystone 2011) along with potential effects of other aspects of the Project. Conservation measures to avoid, minimize, or mitigate adverse effects of the Project to ABB are summarized below.

Conservation Measures During Construction

- During construction in the ABB range in Nebraska, a biologist would travel the ROW every couple of days during the June activity period to remove any carcasses that may be present within the ROW (DOS 2011b).

- Keystone would train all workers operating in ABB habitat and would include discussion of American burying beetle habitat, biology, reasons for their decline, and responsibilities of all workers for the protection of the ABB (including removing food wastes from the ROW each day, reporting any ABB sightings to an Environmental Inspector, and avoiding bringing dogs and cats to the ROW). Keystone would produce a full color Endangered Species Card with a picture of the ABB and all of this information summarized on the card. The card would be handed out to all construction workers operating in ABB habitat (DOS 2011b).

- Signs would be posted at all access points to the ROW highlighting the areas as ABB habitat and reminding workers to follow special restrictions in the area (DOS 2011b).

- Keystone would down-shield lighting at ancillary facilities within areas occupied by the American burying beetle to avoid attracting ABBs to the construction or operation of the sites (DOS 2011b).

Operation and Maintenance Activities

Keystone would develop and implement an annual Pipeline Maintenance Program (PMP) to ensure the integrity of the pipeline. The PMP would include valve maintenance, periodic inline inspections, and cathodic protection readings to ensure facilities are reliable and in service. Data collected in each year of the program would be fed back into the decision-making process for the development of the following year's program (DOS 2011b).

The Project Operation Control Center (OCC) would be manned by experienced and highly trained personnel 24 hours per day, every day of the year in Calgary. In addition, a fully redundant backup OCC would be constructed, operated, and maintained, also in Canada. Primary and backup communications systems would provide real-time information from the pump stations to field personnel (DOS 2011b). The control center would have highly sophisticated pipeline monitoring systems including a leak detection system capable of identifying abnormal conditions and initiating visual and audible alarms. Automatic shut-down systems would be initiated if a valve starts to shut and all pumps upstream would turn off automatically. All other pipeline situations would require human response (DOS 2011b).

The proposed Project would include a supervisory control and data acquisition (SCADA) system to constantly monitor the pipeline system (DOS 2011b). The SCADA system would be installed and operated in accordance with the requirements of 49 CFR 195 and Pipeline Hazardous Material Safety Administration (PHMAS) Project-specific special conditions 24 through 31 (see also Appendix U of the EIS). SCADA facilities would be located in the OCC and along the pipeline system, and all pump stations and delivery facilities would have communication software that sends data back to the OCC (DOS 2011b). The pipeline SCADA system would allow the OCC to remotely read intermediate MLV positions, tank levels, and delivery flow and total volume. The OCC personnel would also be able to start and stop pump stations and open and close MLVs. The above-ground pump stations along the pipeline would contain at least one light for safety and security (DOS 2011b).

The pipeline ROW would be inspected via aerial and ground surveillance to provide prompt identification of possible encroachments or nearby construction activities, ROW erosion, exposed pipe, or any other conditions that could result in damage to the pipeline. The aerial surveillance of the pipeline ROW would be carried out at least 26 times per year at intervals not to exceed 3 weeks as required by 49 CFR 195.412. Landowners would be encouraged to report any pipeline integrity concerns to Keystone or to PHMSA. Intermediate MLVs and MLVs at pump stations would also be inspected. As required by 49 CFR 195.420(b), they would be inspected at intervals not to exceed 7.5 months but at least twice each calendar year (DOS 2011b).

Woody vegetation along the permanent easement would be cleared periodically in order to maintain accessibility for pipeline integrity surveys. Mechanical mowing or cutting would be carried out from time to time as needed along the permanent easement for normal vegetation maintenance (DOS 2011b). Cultivated crops would be allowed to grow in the permanent

easement, but trees would be removed from the permanent ROW in all areas. In areas constructed using the HDD method, trees would be cleared as required on a site specific basis (DOS 2011b).

Permanent erosion control devices would be monitored to identify any areas requiring repair. The remainder of the ROW would be monitored to identify areas where additional erosion control devices would be necessary to prevent future degradation. The ROW would be monitored to identify any areas where soil productivity has been degraded as a result of pipeline construction. In these areas, reclamation measures would be implemented to rectify the problems (DOS 2011b).

Reclamation and Post-construction Activities and Conservation Measures

Alleviating Soil Compaction

Vegetation on the Project ROW and at all ancillary Project sites would be restored to the type and condition of adjacent vegetation after construction is completed. During the process of reclamation, soil compaction within the range of ABB caused by a variety of construction activities would be ameliorated on areas in the construction ROW and other areas temporarily affected by pipeline construction through the use of the following techniques, as described in Keystone (2011):

- All compacted agricultural lands, (cropland, haylands, and rangelands) shall be ripped a minimum of 3 passes at least 18 inches deep, and all pasture shall be ripped or chiseled a minimum of three passes at least 12 inches deep, before replacing topsoil.

- Areas of the construction ROW that were stripped for topsoil salvage shall be ripped a minimum of 3 passes (in cross patterns, as practical) prior to topsoil replacement. The approximate depth of ripping shall be 18 inches (or a lesser depth if damage may occur to existing drain tile systems). After ripping, the subsoil surface shall be graded smooth and any subsoil clumps broken up (disc and harrow) in an effort to avoid topsoil mixing.

- The de-compacted construction right-of-way shall be tested by the Contractor at regular intervals for compaction in agricultural lands (cropland, haylands and rangelands) areas. Tests shall be conducted on the same soil type under similar moisture conditions in undisturbed areas immediately adjacent to the right-of-way to approximate pre-construction conditions. Penetrometers or other appropriate devices shall be used to conduct tests.

- Topsoil shall be replaced to pre-existing depths once ripping and discing of subsoil is complete.

- During reclamation sub-soil and soil would be de-compacted and vegetation cover would be re-established within both the temporary and permanent ROW. Native vegetation seed would generally be used, unless otherwise directed by the landowner. As stated in the Project Construction, Mitigation, and Reclamation Plan (Keystone 2011: Appendix A) the objectives of reclamation and revegetation are to return the disturbed areas to approximate pre-construction use and capability (Keystone 2011). However, in the sensitive grasslands of the South Dakota and Nebraska Sandhills, Keystone has also

agreed to restore native vegetation in native grassland areas using a seed mix approved by the NGPC and local ecotype seed to the extent practicable.

Revegetaion of Project Lands

In the first year after construction, Keystone would inspect the ROW to identify areas of erosion or settling. Subsequently, Keystone would monitor erosion and settling through aerial patrols, which are part of Keystone's Integrity Management Plan, and through landowner reporting. DOS has the responsibility to monitor Project lands following construction to document the adequacy of the restoration of Project lands. If and only if DOS determines to issue a Presidential Permit, DOS would retain a third-party contractor to develop and implement an American burying beetle monitoring program to assure that the provisions of the this Biological Opinion are met through monitoring and habitat reclamation activities (Appendix C). Additional measures to improve success of revegetation include:

- Certificates of seed analysis are required for all seed mixes to limit the introduction of noxious weeds.

- Seed not utilized within 12 months of seed testing shall be approved by Keystone prior to use. Seeding shall follow cleanup and topsoil replacement as closely as possible. Seed shall be applied to all disturbed surfaces (i.e., except cultivated fields unless requested by the landowner).

- Seeding of permanent cover would occur at the time of year which would facilitate greatest potential for seed germination and plant establishment.

- Temporary cover would be seeded in a timely manner to minimize site erosion from water and/or wind.

- Weather conditions, construction right-of-way constraints, site access, topography and soil type shall influence the seeding method used (i.e., drill seeding versus broadcast seeding).

- Seed would be planted at depths consistent with the local or regional agricultural practices.

- Hydro-seeding may be used on a limited basis where the slope is too steep or soil conditions do not warrant conventional seeding methods.

- Keystone shall work with landowners to discourage intensive livestock grazing of the construction right-of-way during the first growing season by using temporary fencing or deferred grazing, or increased grazing rotation frequency.

In wetlands, topsoil would be replaced and original contours restored with no crown over the trench, as much as is practicable. Any excess spoil shall be removed from the wetland. The contractor would stabilize wetland edges and adjacent upland areas by establishing permanent erosion control measures and revegetating upland sites disturbed by construction.

High diversity native grassland occurs along the entire pipeline route through the Sandhills in Nebraska and South Dakota. Keystone would use a restoration seed mix approved by the appropriate agencies, including the Natural Resources Conservation Service, and would work with botanists in the Nebraska Game and Parks Commission (NGPC), and in South Dakota to develop the seed mix most appropriate for sandhills prairie restoration and ABB conservation. The seed must be a local, ecotype (Zaret 2005), diverse prairie mix compatible with habitat requirements of ABB.

Conservation and Mitigation Measures

During formal consultation three proposed executing agreements (described below) were developed and would go into effect if and only if the DOS determines to issue a permit for the proposed Keystone XL pipeline and prior to construction in the states of South Dakota, Nebraska, and Oklahoma. These proposed executing agreements concern: (1) the monitoring of American burying beetle habitat mitigation and reclamation of lands affected by the Keystone XL Pipeline; (2) the establishment of an American Burying Beetle Habitat Conservation Trust; and (3) the establishment of a Reclamation Performance Bond (see Appendices C, D, and E, respectively).

Monitoring Program

Funding would be provided by Keystone for compliance monitoring of ABB habitat reclamation. The Monitoring Program is an additional measure beyond the environmental quality control plan and actions that Keystone would put in place for the proposed project. The U.S. Department of State (DOS) would retain a third-party contractor to develop and implement an American burying beetle monitoring program to assure that the provisions of the USFWS's Keystone XL Pipeline Biological Opinion under section 7 of the Endangered Species Act (ESA) (16 U.S.C. § 1536(a)(2)) are met through monitoring and habitat reclamation activities. This monitoring program would be approved and overseen by DOS in consultation with USFWS. Keystone would fund the Monitoring Program prior to construction of the proposed Project in the states of South Dakota, Nebraska, and Oklahoma (Appendix C).

ABB Habitat Conservation Trust

A Habitat Conservation Trust (Trust) would be established in each state where impacts to ABB are likely to occur, including: south of Highway 18 in Tripp County, South Dakota; Keya Paha, Rock, Holt, Garfield, and Wheeler counties in Nebraska; and Hughes, Coal, Atoka, and Bryan counties in Oklahoma. The purpose of the Trusts is to offset the impacts to ABB habitat from construction and operation of the Keystone XL pipeline and promote conservation of the ABB. The amount of the Trusts would be computed based on the number of acres affected, quality of the acres impacted and average land values. Compensation would be based on total acres impacted and would be modified by habitat quality rating multipliers with prime habitat compensation at 3 times the total impact acres, good habitat at 2 times the total impact acres, fair habitat at 1 times the total impact acres, and marginal habitat at 0.5 times the total impact acres. No compensation would be required for poor habitat. These calculations are included in Appendix D. Compensation required for temporary habitat impacts would be scaled for the period of time anticipated for recovery of vegetation cover at 4 years over the 50-year life of the proposed Project or 8 percent of total calculated impacts. All compensation would be based on

habitat ratings consistent with discussions during consultation among DOS, USFWS, and Keystone.

Trust monies computed as above would be deposited in each state by Keystone within 6 months of approval of the Presidential Permit with an organization or entity familiar with managing funds for the benefit of public trust resources. Management fees would also be paid by Keystone to the funds' management entity. Distribution of monies from the funds management entity for appropriate conservation projects would be at the direction of a designated Joint Venture Management Board(s) currently found in each state. See the website for the Rainwater Basin Joint Venture in Nebraska for more information at: http://www.rwbjv.org/. Projects and potential acquisitions of property by easement or fee title to benefit ABB would be identified and recommended to the Management Board by a technical group made up of experts and experienced state and federal agency personnel familiar with habitat management for ABB. The Management Board in each state would make the decisions regarding which projects to implement for the benefit of the ABB in that state.

A portion of the funds for ABB habitat mitigation, not to exceed 10 percent, may be dedicated at the discretion of the Management Board in each state, to an endowment for the purpose of endangered species and species of special concern management and restoration. These endowment funds would be in recognition of the high risk of managing species of concern and would create a fund for sustaining into the future practices implemented under the mitigation requirements.

Reclamation Performance Bond

Native prairie affected by the Project in Nebraska and South Dakota would be restored to the quality of the natural communities adjacent to the Project lands. Land planted with the appropriate seed mixture as described above may not re-vegetate appropriately due to lack of adequate rainfall other factors beyond the control of Keystone. Nevertheless, the initial disturbance of ABB habitat is due to Keystone's activities, and the responsibility for adequate restoration of disturbed ABB habitat also rests with Keystone.

The Reclamation Performance Bond for ABB habitat would be an additional measure to supplement monitoring and reclamation efforts that Keystone would put in place to ensure restoration of disturbed areas within ABB habitat. Keystone would establish and post a performance bond prior to construction that includes the stipulated requirements in Appendix E. As part of its written conditions, this performance bond would be accessible and executed by DOS (or a third party under the direction of DOS) in the case that land in the ABB habitat area, as defined by the Biological Assessment, should fail to revegetate as outlined in Appendix E and Keystone fails to take corrective action. Release of the bond would be solely at the discretion of DOS after soliciting recommendations from USFWS and NGPC. If restoration of temporarily affected lands is not successful (i.e., to the diversity of grassland vegetation in adjacent areas as stipulated in the Reclamation Performance Bond), then such lands shall be considered permanently lost. Keystone, through its Construction, Mitigation and Reclamation Plan, and DOS, through its monitoring responsibilities, would identify all Project acres not meeting restoration criteria as defined in the Reclamation Performance Bond (Appendix E). Additionally, to the extent that funds are not available under the Performance Reclamation Bond, Keystone would supplement the ABB Habitat Conservation Trust (described above and in Appendix D) to reflect that these grassland habitat areas are treated as permanent loss as opposed

to temporary loss, if they are not restored to grassland of the same quality as adjacent, off-Project lands. Supplemental amounts owed by Keystone, if any, would be calculated on the same basis as the original compensatory mitigation amounts.

Interrelated and Interdependent Actions

DOS identified four actions that are not part of the Presidential Permit application submitted by Keystone and not part of the proposed Project, but are considered connected actions for the purposes of review under the National Environmental Policy Act (NEPA) as defined by 40 CFR 1508.25(a)1. (DOS 2011a, 2011b).

The four actions are:

- electrical substations and power distribution lines providing electricity to pipeline pump stations;
- the Big Bend to Witten 230-kilovolt (kV) transmission line (formerly the Lower Brule to Witten 230-kV transmission line, necessary in southern South Dakota for future increase in pipeline through-put ;
- the Bakken Marketlink Project near Baker, Montana; and
- the Cushing Marketlink Project at Cushing Oklahoma.

Electrical Substations and Power Distribution Lines to Pump stations

Multiple private power companies or cooperatives would construct distribution lines to deliver power to 30 pump stations located along the United States length of the pipeline. But for the proposed Project (i.e., Federal Action), these power lines would not be necessary. The private power companies providing the distribution lines are responsible for obtaining the necessary permits, approvals, or authorizations from Federal, state or local governments. Distribution line projects that would be funded in part by grants from the RUS would undergo additional environmental review by that agency in consultation with the Service. Some of these power lines have no Federal nexus; those that have not yet been built are included in the *Cumulative Effects* section of this Biological Opinion. Otherwise, effects of these interrelated power distribution lines and substations are discussed in the *Effects of the Action* section of this Biological Opinion.

These distribution lines range in length from about 0.1-mile to 62 miles in length, average about 13 miles long, and extend about 384 miles, combined. Each substation needed for the distribution lines would cover about 1 to 1.5 acres. The distribution lines to service pipeline pump stations would range in capacity from 69 kV to 240 kV, but the majority would have a capacity of 115 kV (DOS 2011b). Most of the lines would be strung on single pole and/or H-frame wood poles, and would typically be about 60 to 80 feet high with wire span distances from approximately 250 to 400 feet. Locations, length, kilovolt (kV) capacity, and power providers for individual distribution lines are identified in Table 2.5.1-1 in the EIS (DOS 2011b).

Big Bend to Witten Transmission Line

After receiving information on the power requirements of the pump stations in South Dakota, WAPA conducted an engineering study to determine system reliability under the proposed loads at full Project electrical energy consumption (2011 b). The study determined that a 230 kV

transmission line would be needed between the Fort Thompson/Big Bend area and the existing Witten substation to support voltage requirements for pump stations 20 and 21 when the Project is running at full capacity.

If a Presidential Permit is issued, WAPA plans to construct approximately 2.1 miles of new double-circuit transmission line from the Big Bend Dam, near the Town of Ft. Thompson, south to a new substation, tentatively named Big Bend Substation, which would also be constructed by WAPA. The new 2.1-mile 230-kV transmission line would be constructed, owned and operated by WAPA, but the Big Bend Substation would be transferred after construction to the Basin Electric Power Cooperative (BEPC) which would then own and operate it (DOS 2011b). BEPC proposes to construct, own and operate a new, 70-mile-long, 230-kV transmission line from the proposed new Big Bend Substation to the existing Witten Substation, near the Town of Witten in Tripp County. The new Big Bend Substation and approximately 70-mile-long 230-kV transmission line would assure future electric power requirements at pump stations 20 and 21 are met without degrading system reliability if and when the proposed Project is operating at maximum capacity.

The RUS is the lead agency, with WAPA cooperating for a separate environmental review of the Big Bend to Witten line under NEPA and the ESA as details of route alternatives become available; an EA with scoping is being prepared (76 FR 20311). While there is some uncertainty whether this action is an interdependent action (i.e., the transmission line would have some utility outside the proposed Project), potential effects of this transmission line are described in general in the BA and the EIS, and are addressed in the *Effects of the Action* section in this document.

Bakken Marketlink Project

Keystone WOULDMarketlink, LLC (Keystone Marketlink), a wholly owned subsidiary of TransCanada Pipelines Limited, is proposing to construct and operate the Bakken Marketlink Project (DOS 2011b). The project would include construction of facilities to provide crude oil transportation service from near Baker, Montana to Cushing, Oklahoma via the proposed Project and from Cushing to delivery points at Nederland and Moore Junction (east of Houston), Texas, via the proposed Project. Baker is near many existing and proposed crude oil gathering systems, pipelines, and crude oil storage tanks, and the project could deliver up to 100,000 bpd to the proposed Project depending on ultimate shipper commitments (DOS 2011b). The Bakken Marketlink Project would provide the first direct link between the prolific Bakken crude oil producing region and key U.S. markets near Cushing and the in the Gulf Coast area, which is the largest refining market in North America (DOS 2011b). The announced target in-service date for the Bakken Marketlink Project is the first quarter of 2013.

The project would consist of piping, booster pumps, meter manifolds and two tank terminals; one terminal would be near Plevna and Baker, Montana, and the second would be at the proposed Cushing tank farm (DOS 2011b). The Bakken Marketlink facilities would include two, 250,000-barrel tanks that would be used to accumulate crude from connecting third-party pipelines and terminals and a 100,000-barrel tank that would be used for operational purposes (see also Figure 2.5.3-1 in the EIS for a schematic diagram of the facilities near Baker, Montana) (DOS 2011b). The facilities would also include a proposed 5 mile long pipeline from an existing Montana tank farm facility in Township 7N Range 58E Section 4 (DOS 2011b) to the terminal near Plevna and

Baker, Montana. The project is still in the preliminary stages of evaluating the options regarding the routing of this proposed pipeline (DOS 2011b).

The Bakken Marketlink project facilities at the Cushing tank farm would include two, 250,000-barrel tanks that would be used for batch deliveries from the Baker facilities (DOS 2011b). Figure 2.5.3-3 in the EIS is a plot plan for the tank farm near Cushing that includes the Bakken Marketlink tanks, the Cushing Marketlink tanks, and two portions of the proposed Keystone XL Project (the Cushing tank farm and pump station 32) (DOS 2011b). Crude oil in the Bakken Marketlink storage tanks at the Cushing tank farm would either be pumped to the Keystone XL pipeline, or to other pipelines and tank farms near Cushing. The Cushing tank farm would be near many pipelines, storage facilities, and refineries; the Cushing area is a major crude oil marketing, refining, and pipeline hub that provides shippers with many delivery options and market access (DOS 2011b). Potential effects of Bakken Market Link project are described in general in the BA and the EIS, and are addressed in the *Effects of the Action* section in this document.

Cushing Marketlink Project

Keystone Marketlink also plans to construct and operate the Cushing Marketlink Project, which would include construction and operation of facilities within the boundaries of the proposed Keystone XL Cushing tank farm. This location is adjacent to the Cushing Oil Terminal, a key pipeline transportation and crude oil storage hub with over 50 million barrels of storage capacity. As a result, the Cushing Marketlink Project would be near many pipelines and storage facilities that could ship crude oil to the Cushing Marketlink facilities (DOS 2011b). The Cushing Marketlink Project is expected to alleviate current pipeline constraints from the Cushing area and provide shippers with a new transportation option from the Cushing market to the U.S. Gulf Coast near Nederland TX and Moore Junction (east of Houston) via the proposed Keystone XL pipeline (DOS 2011b).

The Cushing Marketlink project would include construction and operation of receipt custody transfer metering systems and batch accumulation tankage consisting of two, 350,000 barrel tanks, with one tank dedicated for light sweet crude (DOS 2011b). The tanks would be located within the proposed Project's Cushing tank farm property, which also would house pump station 32 of the proposed Project (see also Figure 2.5.3-3 of the EIS) and the storage tanks for the planned Bakken Marketlink storage tanks. The announced target in-service date for the Cushing Marketlink project is the first quarter of 2013 (DOS 2011b). Potential effects of Cushing Marketlink project are described in general in the BA and the EIS, and are addressed in the *Effects of the Action* section in this document.

RANGE-WIDE STATUS OF THE AMERICAN BURYING BEETLE

Status and Distribution

Status: The ABB was proposed for federal-listing in October of 1988 (53 FR 39617) and was designated as endangered on July 13, 1989, (54 FR 29652) and retains this status. Critical habitat has not been designated for the ABB. The Final Recovery Plan was signed on September 27, 1991. At that time (1991), only two, disjunct, natural populations occurred at the extremities of the species' historic range of 35 states, i.e., four counties in Oklahoma and one small island

off the coast of Rhode Island (USFWS 2008a). Due to the severity of the species decline, and uncertainty about the causes for that decline, the focus was on recovery actions targeted to significant near-term improvement in the status of the species, rather than addressing the range of objectives and criteria to bring about full recovery. Therefore, criteria were developed for downlisting, but not for recovery (USFWS 1991, 2008a). The recovery objectives in the 1991 recovery plan, and the bulleted criteria for achieving them follow.

(1) Reduce the immediacy of the threat of extinction…,

- Protect and maintain the two extant populations (i.e., in 1991),
- Re-establish (or locate and protect) at least two additional self-sustaining wild populations of 500 or more animals each, one in the eastern and one in the western part of the species historic range

(2) Improve status of ABB so that it can be reclassified from endangered to threatened.

- Re-establish three populations of the species (or discover additional populations) within each of four broad geographical areas of its historical range: the Northeast, the Southeast, the Midwest and the Great Lakes States…;
- Each population should contain a minimum of 500 adults as estimated by capture rates per trap night and black lighting effort; and
- Each population is to be demonstrably self-sustaining for at least five consecutive years (or is sustainable with established long-term management programs).

Several new populations have been discovered since 1991 and Objective 1 in the ABB Recovery Plan has been achieved. However, a five-year review of the ABB's listing status was completed by the Service on June 16, 2008. The review found that, based on the information available, the ABB remains endangered throughout its current range due to lack of populations in the Southeast and Great Lakes States and remaining threats to the populations (USFWS 2008a).

Distribution: Historically, the geographic range of the ABB included over 150 counties in 35 states, covering most of temperate eastern North America and the southern borders of three eastern Canadian provinces (USFWS 1991; Peck and Kaulbars 1987) (Figure 1). Documentation of records is not uniform throughout this broad historical range. More records exist from the Midwest into Canada and in the northeastern United States than from the southern Atlantic and Gulf of Mexico region (USFWS 1991). During the 20th century, the ABB disappeared from over 90 percent of its historical range (Ratcliffe 1995). The last ABB specimens along the mainland of the Atlantic seaboard, from New England to Florida, were collected in the 1940s (USFWS 1991). At the time of listing, known populations were limited to one on Block Island, Rhode Island; and one in Latimer County, Oklahoma. After the species was listed in 1988, survey efforts increased and the ABB was discovered in more locations, particularly in South Dakota, Nebraska and Oklahoma (Figure 1).

Currently, the ABB is known to occur in eight states (Figure 1): on Block Island off the coast of Rhode Island, Nantucket Island off the coast of Massachusetts, eastern Oklahoma, western Arkansas (Carlton and Rothwein 1998), Loess Hills in south-central Nebraska and Sandhills in north-central Nebraska (Ratcliffe 1996, Bedick et al. 1999), Chautauqua Hills region of southeastern Kansas (Sikes and Raithel 2002), south-central South Dakota (Backlund and Marrone 1995, 1997; Ratcliffe 1996), and northeast Texas (Godwin 2003). Most populations are located on private land. Populations known to exist on public land include: Ouachita National Forest, Arkansas / Oklahoma; Ozark-St. Francis National Forests, Arkansas; Camp Gruber,

Oklahoma; Fort Chaffee, Arkansas; Sequoyah National Wildlife Refuge, Oklahoma; Block Island National Wildlife Refuge, Rhode Island; Valentine National Wildlife Refuge, Nebraska; and Camp Maxey, Texas.

In South Dakota, there are seven records of ABB specimens deposited at the South Dakota State University insect collection. These collections suggest that the species may have ranged from Brookings and Union counties in the east to Haakon County in the west. The last known collection dates were in 1945. From 1990 to 1995, numerous surveys were conducted in South Dakota to locate ABB, but all were unsuccessful. However, ABB have been found in three South Dakota counties: Todd, Tripp, and Gregory (Backlund and Marrone 1997). Recently one ABB was found in Bennett County on the border of South Dakota and Nebraska.

In Nebraska, recent sampling indicates there are two disjunct populations of ABB in Nebraska (Figure 2). Habitats between the two populations are dissimilar, with the northern population occurring in the Nebraska Sandhills, while the southwest population occurs in the remote and heavily dissected Loess Hills. The northern population likely includes the ABBs in the adjacent sandhills of southern Tripp County, South Dakota.

ABB were found in two new counties in 2010, as predicted by the habitat model. For the Sandhills population, this model based on moisture and land use appears to generally describe areas of potential ABB occurrence. A descriptive map with 5 mile buffers was placed around trap data from previous studies (1995 to 2010 in Nebraska) shows occurrence of ABB in the northern Nebraska Sandhills and the southern Nebraska Loess Hills (Jurzenski and Hoback 2010) (Figure 2).

In Oklahoma, counties with recently confirmed ABB sightings since 1992 (i.e., current range) are Atoka, Bryan, Cherokee, Choctaw, Coal, Craig, Haskell, Hughes, Johnston, Latimer, LeFlore, McCurtain, McIntosh, Muskogee, Okfuskee, Osage, Pittsburg, Pushmataha, Rogers, Sequoyah, Tulsa, and Wagoner (22 counties). Additional counties with historic ABB sightings in eastern Oklahoma (historic range) include Creek, Mayes, Nowata, Okmulgee, Ottawa, and Washington (6 counties). Counties likely within the current ABB range, but where no recent or historic sightings have been recorded (i.e., potential range) include Marshall, Pawnee, an Pontotoc (3 counties). Unconfirmed recent ABB sightings since 1992 (i.e., also potential range) have been recorded in Adair and Delaware counties (USFWS, unpublished data, Oklahoma Field Office, Tulsa, Oklahoma). The 22 confirmed counties represent approximately 40-50 percent of the current occupied range of the ABB.

Figure 1. Historic and current range of the American burying beetle.

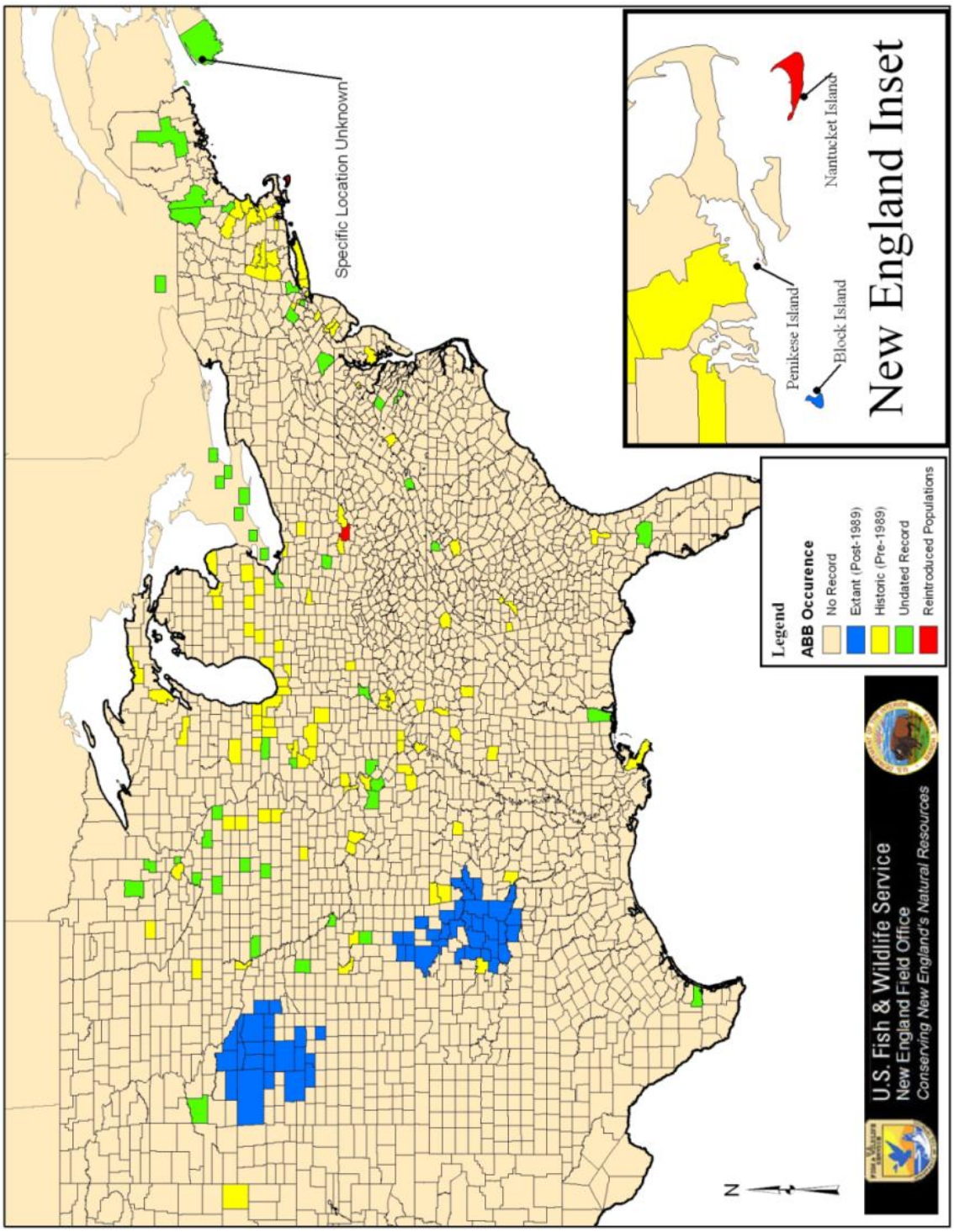
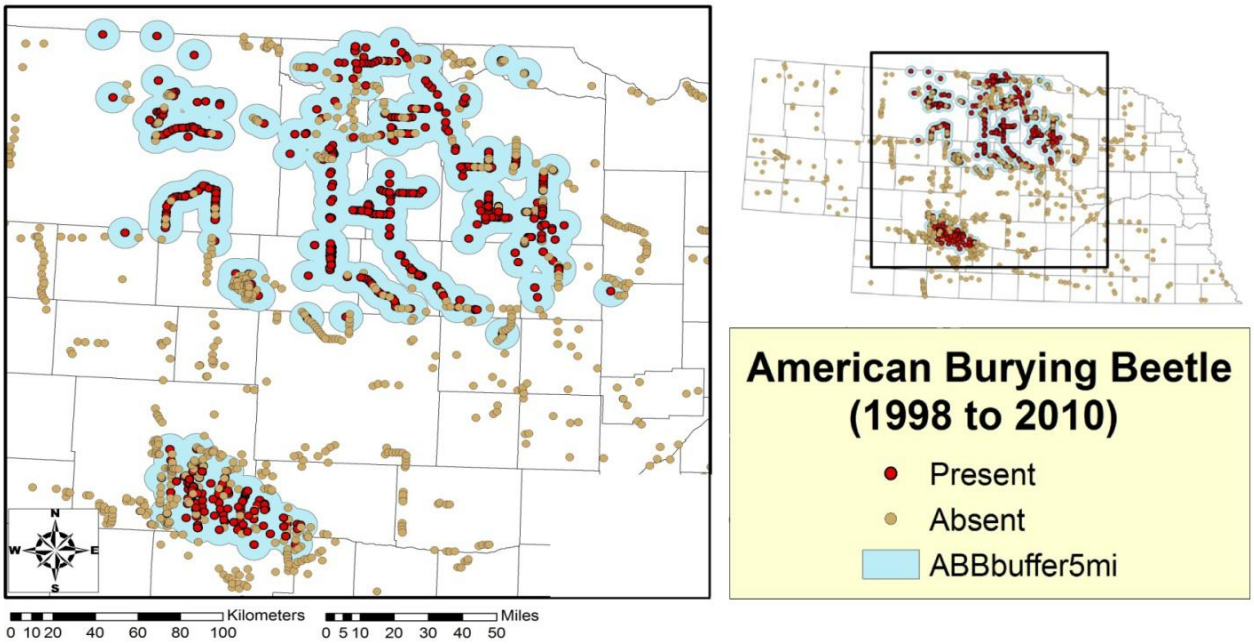


Figure 2. Presence and absence of ABB in Nebraska based on surveys conducted from 1998 to 2010 (Source: Jurzenski and Hoback 2010; Keystone 2011, Figure 3.1-3).



Numerous ABB surveys have been conducted throughout eastern Oklahoma. The majority of these surveys are undertaken to protect ABBs from specific soil disturbance actions associated with development projects. Most survey data are collected sporadically and without systematic or complete coverage across Oklahoma. Consequently, the number of trap nights varies among counties and years, ranging from 24 trap nights in Tulsa County to 17,388 trap nights in Muskogee County. Presently, eastern Oklahoma contains one large concentration of ABBs within their historic range, at Camp Gruber in Muskogee County. In 2007, a total of 676 ABBs were captured in 1,305 trap nights at Camp Gruber. Smaller concentrations of ABBs within their historic range in Oklahoma include the McAlester Army Ammunitions Plant (MCAAP) in Pittsburg County and the four-county area of Atoka, Coal, Hughes, and Pittsburg counties. There is also a large population in Osage County at The Nature Conservancy's Tallgrass Prairie Preserve, which is outside of the ABB known historic range.

Structured survey data are collected annually or biennially from MCAAP, Camp Gruber, Ouachita National Forest, Connors State College, and Weyerhaeuser lands in Oklahoma. These surveys provide trend data for the ABB. Surveys for the ABB have been conducted annually at Camp Gruber since 1992, accounting for the high number of trap nights (17,388) in Muskogee County. The MCAAP has conducted surveys biennially since 1995. Ouachita National Forest conducted annual surveys based on proposed soil disturbance activities from 1991 to 2005. Beginning in 2006, the Ouachita National Forest implemented standard transects to survey annually. Connors State College has an ABB conservation area where ABBs are surveyed biennially. Weyerhaeuser has land in McCurtain County and has conducted surveys since 1997. ABB captures at these locations typically fluctuate on an annual or biennial basis, but in general, ABB numbers appear stable or increasing, with the exception of the Weyerhaeuser lands where the trend appears to be declining. All of these areas, except for Weyerhaeuser lands, provide large tracts of relatively natural habitat for the ABB.

Reasons for decline: The ABB's uneven distribution and density, and their vulnerability to extinction are likely due to the species having specialized resource requirements with carrion being a finite resource widely scattered in space and time (Karr 1982, Pimm et al.1988, Peck and Kaulbars 1987). Data available for the ABB on Block Island, Rhode Island supports the contention that the primary mechanism for the species' rangewide declines lies in its dependence on carrion of a larger size class relative to that used by all other North American burying beetles, and that the optimum-sized carrion resource base has been reduced throughout the species' range (USFWS 1991).

Since the middle of the 19th century, certain animal species in the favored weight range for ABBs have either been eliminated from North America or significantly reduced over their historic range (USFWS 1991), including the passenger pigeon (*Ectopistes migratorius),* greater prairie chicken (*Tympanchus cupido)* and wild turkey *(Meleagris gallopavo).* The passenger pigeon was estimated at one time to have been the most common bird in the world, numbering 3 to 5 billion (Ellsworth and McComb 2003). There were once as many passenger pigeons within the approximate historic range of the ABB as there are numbers of birds of all species overwintering in the United States today. Wild turkeys, for example, occurred throughout the range of the ABB, and until recently, were extirpated from much of their former range. Black-tailed prairie dogs (*Cynomys ludovicianus)* which occur in the northern portion of the ABB's range have drastically declined (Miller et al. 1990) and previously dense populations of these black-tailed prairie dogs mammals may also have supported ABBs (USFWS 2008a).

During the westward expansion of settlement in North America, the removal of top-level carnivores such as the grey wolf (*Canis lupis)* and eastern cougar (*Puma concolor)* occurred simultaneously with land use changes that fragmented native forest and grasslands and created more edge habitats (such as the edge between forest and grassland, or grassland and cropland). These two processes resulted in meso-carnivores becoming more abundant. Mid-sized carnivores prey on small mammals and birds and directly compete with carrion beetles for carrion.

Fragmentation of large contiguous habitats into smaller pieces or patches of habitat may increase species richness, but the species composition usually changes. Fragmentation of forests and grasslands cause a decrease of indigenous species and an increase in meso-carnivores that thrive in areas disturbed by humans such as: American crow (*Corvus brachyrhynchos),* raccoon (*Procyon lotor),* red fox (*Vulpus fulva),* opossum (*Didelphis virginiana),* striped skunk (*Mephitis mephitis),* rats (*Neotoma* spp.) and (*Sigmodon* spp.), coyotes (*Canis latrans),* feral cats, and other opportunistic predators (Wilcove et al. 1986). In this way, historically large expanses of natural habitat that once supported high densities of indigenous species are now fragmented, supporting fewer or lower densities of indigenous species that once supported ABB populations, and also facilitating increased competition for limited carrion resources among the "new" predator/scavenger community. A number of these species, especially the raccoon and striped skunk, have undergone dramatic population increases over the last century (Garrott et al. 1993), and the coyote and opossum have expanded their range. These scavengers may extend hundreds of feet from edges into forest in eastern North America. Matthews (1995) experimentally placed 64 carcasses in various habitats in Oklahoma where ABBs and the roundneck sexton beetle (*N. orbicollis,* another type of burying beetle) had been previously documented, then tracked the organisms that scavenged them. Of the carcasses, 83 percent were claimed by ants, flies, and vertebrate scavengers; about 11 percent were claimed by the roundneck sexton beetle, and only one was claimed by ABBs.

Although much of the evidence suggesting the reduction of carrion resources as a primary mechanism of decline is circumstantial, this hypothesis fits the temporal and geographical pattern of the disappearance of ABBs, and is sufficient to explain why ABBs declined while related species did not. ABBs are the largest species of burying beetle in the New World (Western Hemisphere) and require carcasses of 3.5 to 7.0 ounces (99.22 to 198.45 g, Kozol et al. 1988) to maximize its fecundity, whereas all other burying beetles can breed abundantly on much smaller carcasses, with the smaller species using carcasses of 0.11 to 0.18 ounces (3.12 to 5.10 g, Trumbo 1992). In a fragmented ecosystem, larger species have been shown to be negatively affected before smaller species, a phenomenon which has been well-documented with carrion and dung beetles in South America (Klein 1989).

Population Estimate: Although ABB are relatively easy to capture, population estimates of ABB are problematic. The standard mark and re-capture technique used to estimate population size assumes that marked and unmarked individuals are equally likely to be captured, and that a substantial number of the animals would be recaptured from one trapping period to the next. However, due to ability of the ABBs to range widely and their reproductive strategy that includes retreating underground for several weeks, these assumptions may not apply. This may be less of a problem for the insular population on Block Island, Rhode Island where, because of the relatively small size of the island (2,614 ha), a significant proportion of the population can be monitored. Elsewhere, however, precise estimates of absolute or even relative densities remain a challenge (USFWS 2008a).

Because the ABB is an annual species (living for only one year) each year's population levels are largely dependent on the reproductive success of the previous year. Therefore, populations may be cyclic, with high numbers and abundance in one year, followed by a decline in numbers the succeeding year. Schnell et al. (1997-2003, 1997-2005) reported that areas of high concentration appeared to shift annually throughout Fort Chaffee, Arkansas and Camp Gruber, Oklahoma, even though land use within each area stayed relatively stable (USFWS 2008b).

False negatives are possible outcomes of ABB surveys. Standard transects on Camp Gruber that resulted in ABB captures in one year failed to capture ABBs in another year. Surveys conducted in a given area have resulted in ABB captures during one survey effort but surveys conducted in the same area within the same active season have resulted in negative ABB captures. During a 10 – 12 night period in the summer, no ABBs were recaptured after 6 nights. This indicates a relatively rapid turnover rate in the trappable ABB population due to factors such as natural mortality, dispersal, and burrowing underground and attending carrion/broods (Creighton and Schnell 1998).

Species Description

The ABB is the largest silphid (carrion beetle) in North America, reaching 1 to 1.8 inches (Wilson 1971, Anderson 1982, Backlund and Marrone 1997). Pronotal width is highly correlated with weight (Kozol et al. 1988). Size (pronotal width) of ABBs ranged from 0.344 – 0.500 inches in a laboratory study and 0.314 – 0.497 inches at Block Island. The beetles are black with orange-red markings. The hardened elytra (wing coverings) are smooth, shiny black, and each elytron has two scallop shaped orange-red markings. The pronotum (hard back plate of the front portion of the thorax of insects) over the mid-section between the head and wings, is circular in shape with flattened margins and a raised central portion. The most diagnostic feature

of the ABB is the large orange-red marking on the raised portion of the pronotum, a feature shared with no other members of the genus in North America (USFWS 1991). The ABB also has orange-red frons (the upper, anterior part of the head), and a single orange-red marking on the clypeus, which is the lower face located just above the mandibles. Antennae are large, with notable orange club-shaped tips.

Gender can be determined from markings on the clypeus; males have a large, rectangular, red marking and females have a smaller, triangular, red marking. Age of adults is determined by intensity of appearance. The markings of teneral ABBs (young beetles emerging during late summer) are brighter and appear more uniform in color while the exoskeleton is softer and in general more translucent. The pronotum of a mature, early summer adult tends to be darker than the markings on its elytra, with the former appearing dark orange to red and the latter appearing orange. The senescent (mature, post-breeding) ABB has pale elytral markings and are more scarred. They often have pieces missing from the margin of the pronotum or elytra, have cracks in the exoskeleton, and/or are missing appendages such as tarsi, legs, or antennae (USFWS 2008a).

Life History

The life history of the ABB is similar to that of other burying beetles (Kozol et al. 1988; Pukowski 1933; Scott and Traniello 1987; Wilson and Fudge 1984). The ABB is a nocturnal species that lives only for one year. The beetles are active in the summer months and bury themselves in the soil for the duration of the winter. The young tenerals emerge in late summer, over-winter as adults, and comprise the breeding population the following summer (Kozol 1990b). Both adults and larvae are dependent on carrion for food and reproduction. They must compete for carrion with other invertebrate species, as well as vertebrate species.

Winter Inactive Period: When the nighttime ambient air temperature is consistently below 60°F (15.5°C), ABBs bury into the soil and become inactive (USFWS 1991). In Nebraska, this typically occurs between early September to early June (W.W. Hoback, University of Nebraska-Kearney, personal communication); in Oklahoma, from late September and until mid-May (USFWS 2008b), approximately 8 to 9 months. However, the length of the inactive period can fluctuate depending on temperature. Recent studies indicate that ABBs bury to depths ranging from 0 to 8 inches in Arkansas (Schnell et al. 2007). Habitat structure (i.e., woodland vs. grassland) does not appear to be an influencing factor in over-winter survival rate in Oklahoma (Holloway and Schnell 1997).

During the winter months in the northern portion of ABBs distribution, soil commonly freezes to several feet below the surface. In the Nebraska Sandhills, for example, extreme penetration of frost was estimated between four feet and five feet (Floyd 1978), and water pipes to cattle tanks are still typically buried five feet to avoid freezing (K. Graham, USFWS, personal communication). Since these depths exceed ABB burial depths, the species likely uses a survival strategy in Nebraska and South Dakota that permits lowering of body temperature to freezing or near-freezing during the coldest portions of the winter (W.W. Hoback, University of Nebraska-Kearney, personal communication). The lowering of body temperature slows metabolism and helps ensure fat reserves are sufficient to last until emergence in late May or early June (W.W. Hoback, personal communication).

Preliminary data suggest that over-wintering results in significant mortality (Bedick et al. 1999). Winter mortality may range from 25 percent to about 70 percent depending on year, location, and availability of carrion in the fall (Schnell et al 2007; Raithel 1996-2002, unpubl. data, as cited in USFWS 2008b). Over-wintering ABBs with access to a whole vertebrate carcass in the fall had a survival rate of 77 percent versus a 45 percent survival rate for those ABBs not provisioned with a carcasses (Schnell et al. 2007).

Summer Active Period: The ABB is active in the summer months, emerging from their winter inactive period when ambient nocturnal air temperatures consistently exceed 60º F. They are most active from two to four hours after sunset, with no captures recorded immediately after dawn (Walker and Hoback 2007, Bedick et al. 1999). During the daytime, ABBs are believed to bury under the vegetation litter. The ABB begin rearing broods soon after emergence from over-wintering. During late May and early June ABBs secure a mate and carcass for reproduction. The reproductive process takes approximately 48-69 days.

In Nebraska, Bedick et al. (1999) found that ABB activity was highest when temperatures were between 59º F (15º C) and 68º F (20º C). ABB activity exhibited a weakly negative relationship with temperature, and ABB may delay nocturnal activity when temperatures are greater than 75º F (24º C). Other burying beetles were captured at 55º F (12.7º C), but activity was reduced when temperatures were below 59º F (15º C). In Oklahoma, ABBs are typically active from mid-May to late-September when nighttime ambient temperatures are consistently above 60º F. In Nebraska, ABBs become active in mid-May (Bedick et al. 1999). Peyton (1996) captured ABBs on May 20 in Nebraska. Weather, such as rain and strong winds, result in reduced ABB activity (Bedick et al. 1999). However, on Block Island, Rhode Island, burying beetles were trapped repeatedly and successfully on both rainy and windy nights provided the temperature was above 59º F (15º C, Kozol et al. 1988).

Capture rates for ABBs are highest from mid-June to early-July and again in mid-August (Kozol et al. 1988, Bedick et al. 2004, USFWS 1991) with a decrease in pitfall captures in late July (Kozol et al. 1988). The USFWS (1991) reported that during late July ABBs were easy to attract to carrion bait but were difficult to capture in pitfall traps.

Movement

ABBs are nocturnal and have been reported moving distances ranging from 0.10 to 2.6 miles in various parts of their range. Creighton and Schnell (1998) conducted a study on movement patterns of ABBs at Camp Gruber and Fort Chaffee in 1992 and 1993. They recaptured 68 ABBs over a 12 night period; of those 68, 23 (29.5 percent) were recaptured at a site different than the original site of capture. The mean distance moved of the 23 recaptured ABBs over the 12 night sampling period was 1.21 miles for each ABB (0.10 miles per night per ABB). The minimum and maximum distance moved by an individual recaptured ABB was 0.16 mile in one night and 4.3 miles in five nights, respectively. Six ABBs were recaptured two or three times. The mean movement for these six ABBs was 6.2 miles over six nights, 1.03 miles per night over the entire sampling period. The maximum distance moved by one of these six was 0.76 miles in one night (USFWS 2008b).

Bedick et al (2004) reported average nightly movements of 0.62 mile, with 85 percent of recaptures moving distances of 0.31 miles per night. Schnell et al. (1997-2003) annually determined the average nightly movements of the ABB to be 0.62 miles, using marked

individuals over a nine-year period at Camp Gruber. The smallest average nightly movement for any given active season over that same period was 0.52 miles. Schnell et al. (1997-2006) reported a one day movement of 2.6 miles; previously the greatest distance moved was 1.78 miles (Creighton and Schnell 1998). Considering the ABB's mobility, small size, recorded movement distances, and distance from which they can detect carrion, the USFWS considers presence/absence surveys to be conservatively effective over a distance of 5 miles.

Feeding

When not involved with brood rearing, carrion selection by adult ABBs for food can include an array of available carrion species and size (Trumbo 1992); ABBs also capture and consume live insects. Burying beetles are capable of finding a carcass between one and 48 hours after death at a distance up to 2 miles (3.22 km, Ratcliffe 1996). Success in finding carrion depends upon many factors including availability of optimal habitats for small vertebrates (Lomolino and Creighton 1996), density of competing invertebrate and vertebrate scavengers, individual searching ability, reproductive condition, and temperature (Ratcliffe 1996). Kozol et al. (1988) found no significant difference in the ABBs preference for avian verses mammalian carcasses. At Fort Chaffee, Holloway and Schnell (1997) found that ABBs numbers were higher in areas with high densities of small mammals (USFWS 2008b).

Habitat

Feeding Habitat: ABBs are considered feeding habitat generalists and have been successfully live-trapped in several vegetation types including native grasslands, grazed pasture, riparian zones, coniferous forests, mature forest, and oak-hickory forest, as well as on a variety of various soil types (Creighton et al. 1993; Lomolino and Creighton 1996; Lomolino et al. 1995; USFWS 1991). Ecosystems supporting ABB populations are diverse and include primary forest, scrub forest, forest edge, grassland prairie, riparian areas, mountain slopes, and maritime scrub communities (Ratcliffe 1996; USFWS 1991). The ABB readily moves between different habitats (Creighton and Schnell 1998, Lomolino et al. 1995) (USFWS 2008b).

Walker (1957) captured nine ABBs in a deciduous forest located on the floodplain of a small creek in Tennessee. The site was described as being 'park-like' with little undergrowth. This is not unlike the understory conditions found in Oklahoma upland forests. Bottomland sites in Oklahoma, by contrast, tended to have fairly dense undergrowth of small trees and shrubs. Studies by Creighton et al. (1993) at the Cherokee Wildlife Management Area in eastern Oklahoma found relatively more ABBs in oak-hickory forest than grasslands or bottomland forests (USFWS 2008b).

Lomonlino et al. (1995) examined the niche breadth of burying beetles at Fort Chaffe and Camp Gruber. Habitat was evaluated in terms of forest development and shrub cover. Niche breadth of ABBs ranged from 0.844-0.925, at Fort Chaffe and Camp Gruber, respectively. Although not as high as the ABB, *N. tomentosus* exhibited a high niche breadth of 0.903. In comparison, *N. marginatus*, and *N. orbicollis*, exhibited 0.402, and 0.512-0.707, respectively (*N. orbicollis* was found at both sites). No significant differences were found in habitat affinities between ABB sexes during this study (USFWS 2008b).

Lomolino and Creighton (1996) evaluated niche breadth of burying beetles at east central and southeast Oklahoma (regional level) and at the Tiak Ranger District (local level) of the Ouachita

National Forest in southeast Oklahoma. At the regional level, ABBs were found in sites characterized with moderate to well-developed forest with moderate to deep soils and an understory with moderate cover of small shrubs. They also found that *N. tomentosus* has the largest niche breadth, 0.89, followed by the ABB, 0.78. However, this may be a result of *N. tomemtosus* having the tendency to bury carcasses just beneath the litter, but not under the soil. The niche breadth for *N. marginatus*, *N. orbicollis*, and *N. pustulatus* was 0.36, 0.71, and 0.53, respectively (USFWS 2008b).

In contrast to the results of the regional study, ABBs at the Tiak Ranger District had the most restrictive niche breadth, at 0.53, whereas *N. tomentosus* and *N. orbicollis* were 0.80 and 0.84. However, the local and regional studies evaluated different habitat types. The local Tiak District study examined mature forests, second-growth forests, and clearcuts. Results indicated that ABBs avoided clear-cuts and preferred mature forests and provide insight into underlying mechanisms of how deforestation, or fragmentation in general, could contribute to the decline of ABBs. Interpretations of this study's results are limited because baited pitfall traps were used, which document the locations where ABBs feed, but not necessarily where they would be able to successfully reproduce. It is unlikely that the ABB would reproduce successfully in such a broad range of habitat conditions (USFWS 2008b).

Similarly, Kozol et al. (1988) reported that ABB is broadly distributed across available habitats on Block Island, Rhode Island (from shrub thickets to grazed fields). However, the apparent generalist nature of ABB on Block Island may be an artifact of this insular environment (Crowell 1983). Insular populations often exhibit ecological release, occurring in a broad variety of habitats considered atypical for populations on the mainland because of the low diversity of predators and competitors on islands (Crowell 1983, Grant 1971, Case 1975, Cox and Ricklefs 1977, Lomolino 1984) (USFWS 2008b).

The oak-hickory habitats preferred by ABBs in Oklahoma contrast sharply with the type of habitat used in Rhode Island. On Block Island, ABB is most common in areas with deep soil and light agricultural activity. However, these habitats are not natural. The natural vegetation of Block Island has been altered during the past 200 years from hardwood forest to post-agricultural maritime scrub, mowed fields, and grazed pastures (USFWS 1991). Holloway and Schnell (1997), using baited pitfall traps, found significant correlation between the number of ABBs captured and the biomass of mammals (0-200 g), and combined mammals and birds at Fort Chaffee. The geographic distribution of ABBs and the biomass of mammals exhibited notable concordance, except for the far northwest section of Fort Chaffee where ABB numbers were lower. This lower number of ABBs could be a result of this section of Fort Chaffee being a peninsula extending from the main portion of the installation, thereby having increased edge effect (USFWS 2008b).

Soil conditions for suitable ABB habitat must be conducive to excavation by ABBs (Anderson 1982; Lomolino and Creighton 1996). In Arkansas and Oklahoma, ABBs are found within a mixture of vegetation types from oak-hickory and coniferous forests on lowlands, slopes, and ridgetops to deciduous riparian corridors and pasturelands in the valleys (USFWS 1991; Creighton et al. 1993). Soils in the vicinity of captures are all well drained and include sandy loam and silt loam, with a clay component noted at most sites. Level topography and a well formed detritus layer at the ground surface are common (USFWS 1991). In 1996, more than 300 ABBs were captured in Nebraska habitats consisting of grassland prairie, forest edge, and

scrubland (Ratcliffe 1996). These surveys have found certain soil types such as very xeric (dry), saturated, or loose, sandy soils to be unsuitable for carcass burial and thus are unlikely habitats.

Reproduction Habitat: While studies indicate that the ABB is a habitat generalist in terms of feeding, it is likely more restricted when selecting burial sites for breeding. Anderson (1982) postulated that paired ABBs placed on carcasses would be more reproductively successful in forested habitats due to the rich, loose soils conducive to digging. Lomolino and Creighton (1996) found reproductive success was higher in forest verses grassland habitat, because more carcasses were buried in the forested habitat than the grassland. Carcasses may be more difficult to secure in grassland due to the near absence of a litter layer and may be more difficult to bury due to the tendency of grassland soils to be more compact than those in forest. However, of the carcasses buried, habitat characteristics did not significantly influence brood size. Holloway and Schnell (1997) found significant correlations between the numbers of ABBs caught in traps and the biomass of mammals and birds, irrespective of the predominant vegetation (USFWS 2008b).

Reproduction

Reproductive activity begins in mid-May and is completed in mid-August in Oklahoma and Arkansas. Parental care in this genus is elaborate and unique because both parents participate in the rearing of young (Bartlett 1987, Fetherston et al. 1990, Scott 1990, and Trumbo 1990), with care by at least one parent, usually the female, being critical for larval survival (Ratcliffe 1996). This is a rare and highly developed behavior in insects, previously known only among bees, ants, wasps, termites, and a few scarab beetles. In Nebraska, Bedick et al (1999) found that ABBs reproduce only once per year. However, in a laboratory setting, Lomonlino and Creighton (1993) found that five of eight ABB pairs succeeded in producing a second brood. In Nebraska, breeding has been recorded as beginning on June 4, using 60 days as the minimum development time.

Immediately upon emergence from their winter hibernation, ABBs begin searching for a proper carcass for reproduction. ABBs are able to locate carcasses using chemoreceptors on their antennae. Once a carcass has been found, inter-specific as well as intra-specific competition occurs until usually only a single dominant male and female burying beetle remain (Scott and Traniello 1989). Bedick et al. (1999) commonly found burying beetles with multiple appendages missing. Kozol (1991) reported that the ABB typically out-competes other burying beetles as a result of its larger size. However, the authors did not evaluate competition between the ABB and *N. marginatus*, which is a diurnal burying beetle (Bedick et al. 1999).

Male and female ABBs typically cooperatively bury a carcass, but individuals of either sex are capable of burying a carcass alone (Kozol et al. 1988). Once underground, both parents shave off the carcass fur or feathers, roll it into a ball, and treat it with anal and oral secretions that retard the growth of mold and bacteria. The female ABB lays eggs in the soil near the carcass. Brood sizes of ABBs can sometimes exceed 35 larvae, but 12-18 is more typical (Kozol 1990a). Altricial (helpless at birth), lightly hardened larvae hatch in about 12-14 days. The parents move these first instar larvae to the carcass. The developing larvae solicit feeding by stroking the mandibles of the parents. Both male and female parents regurgitated meat to the larvae. The larvae are soon capable of feeding directly from the carcass. In about 10-14 days large, third instar larvae burrow a short distance from the now-diminished carcass and form pupation cells. One or both of the parents may remain with the pupae for several days and at least one parent, usually the female, may remain with the pupae until they pupate (Kozol 1991). So, for

approximately 22-28 days, adult ABBs are present with their brood. New adults emerge in about 26-51 days. The reproductive process from carcass burial to eclosure is about 48 to 79 days (Ratcliffe 1996, Kozol 1991, Bedick et al. 1999). Females are reproductively capable immediately upon eclosure. The young beetles emerging in late summer over-winter as adults, and comprise the breeding population the following summer (Kozol 1990b).

While the ABB has life history requirements similar to other carrion beetles, it is the largest *Nicrophorus* in North America and requires a larger carrion item to reach its maximum reproductive potential (*i.e.*, to raise a maximum number of offspring) than the other burying beetles (USFWS 1991, Kozol et al. 1988, Trumbo 1992). Preferred carrion sources for reproduction are dead birds and mammals weighing from 1.7-10.5 oz (48.19 – 297.67 g), with an optimum weight of 3.5-7.0 oz (99.22 – 198.45 g, USFWS 1991). Other burying beetle species are able to utilize much smaller carrion, ranging from 0.11 - 0.18 oz (3-5 g, Trumbo 1992) (USFWS 2008b).

Kozol et al. (1988) demonstrated that there is a positive relationship between carcass weight (100-200 grams is ideal) and brood weight. In addition, they found a significant positive correlation between the number of tenerals eclosed and carcass weight. Trumbo and Wilson (1993) found this true for other burying beetles as well. Lomonlino and Creighton (1993) found no relationship between carcass size and number of young raised in ABBs, but they speculated this may have been due to poor egg or larva survivorship in some broods. No significant correlation was found between carcass weight and mean weight of tenerals or mean pronotal width of tenerals (Kozol et al. 1988). The significant correlation between the number of adult's eclosed per brood and their average weight suggest that ABB individuals rearing broods may make a tradeoff between a large number of small offspring or a small number of large offspring.

Conservation

Reintroduction efforts have yet to demonstrate that an extirpated ABB population can become successfully re-established. Individuals released at a site may disperse from the area, making it difficult to establish a stable population. The first reintroduction of the ABB occurred on Penikese Island, Massachusetts from 1990- 1993 using captive-raised and wild beetles translocated from Block Island. However, this population became extirpated 9 years after the last release of ABBs (Amaral and Mostello 1997). A second long-term reintroduction effort on Nantucket Island, Massachusetts, is still being evaluated and has not yet reached either the population size or persistence target. In Ohio, a multi-year reintroduction effort has been implemented. However, to date no ABBs have been captured in post-release years.

The probability of successful reintroductions of ABBs might be enhanced by sequestering released pairs of adults on carrion (Amaral et al. 1997). Additionally, dispersal of teneral adults (progeny of released animals) might be lowered by providing carrion at or near the release site at the time when new adults are likely to emerge (48-65 days after carcass burial; Kozol et al. 1988). Still, ABB reintroduction efforts have not yet proved successful.

Threats

The American Burying Beetle Recovery Plan (USFWS 1991) and the 5-yr status review of the species (2008a) identify the following issues as potential threats to the ABB: disease/pathogens, DDT, direct habitat loss and alteration, interspecific competition, increase in competition for

prey, increase in edge habitat, decrease in abundance of prey, loss of genetic diversity in isolated populations, agricultural and grazing practices, and invasive species. None of these theories alone adequately explain why the ABB declined while congeneric species are still relatively common rangewide [there are eight sympatric congeners which are not in peril (Sikes and Raithel 2002)].

Direct Habitat Loss and Alteration

There is little doubt that habitat loss and alteration affect this species at local or even regional levels, and could account for the extirpation of populations once they become isolated from others (Kozol 1995, Ratcliffe 1996, Amaral et al. 1997, Bedick et al. 1999). The prevailing theory regarding the ABBs' decline is habitat fragmentation (USFWS 1991) which: (1) reduced the carrion prey base of the appropriate size for ABB reproduction, and (2) increased the vertebrate scavenger competition for this prey (Kozol 1995, Ratcliffe 1996, Amaral et al. 1997, Bedick et al. 1999) due to its relatively large size and specialized breeding behavior (Creighton et al. 2007).

Projects that cause ABB habitat fragmentation are common. For example, between October 1, 2005, and September 30, 2009, the Service's Oklahoma Field Office reviewed 895 proposed projects in Oklahoma that may have affected ABB. Projects evaluated included pipelines, roads, quarries, communication towers, residential housing development, bridges, mining, petroleum production, commercial development, recreational development, transmission lines, and water and wastewater treatment facilities. Impacts from these activities varied in size and duration, with projects such as quarries being hundreds of acres and having permanent impacts, to water treatment facilities of a few acres with both permanent and temporary impacts.

Creighton et al. (2007) studied the Tiak District of the Ouachita National Forest in southeastern Oklahoma. The habitat is dominated by mature oak-pine forest with moderate undergrowth and sandy soil. They found a significant decline in the densities of ABBs in seed tree timber harvested areas and burying beetles avoided clearcuts (Lomolino and Creighton 1996). Bedick et al. (1999) also found few ABBs in disturbed and fragmented habitats. Although a feeding generalist, ABBs avoided utilizing clear cuts even when feeding. At a regional level, encompassing east-central and southeastern Oklahoma, all *Nicrophorus* species exhibited significant habitat selectivity (i.e. their niche breadths were significantly less than the maximum value of 1.0), and ABBs were found in sites characterized with moderate to well-developed forest with moderate to deep soils and an understory with moderate cover of small shrubs.

Conversely, studies by Creighton et al. (1993) suggested that ABBs occur in both upland forests and grassland in Oklahoma and tend to avoid bottomland forests, but preference was shown for upland forest over grasslands. Holloway and Schnell (1997) found significant correlations between the numbers of ABBs caught in traps and the biomass of mammals and birds, irrespective of the predominant vegetation.

Dispersal is more likely to maintain metapopulations in naturally patchy landscapes than in formerly continuous landscapes fragmented by human activity (den Boer 1970). Natural patchy landscapes have less contrast between adjacent patches, whereas anthropogenic fragmentation creates intense, sudden contrast between patches. This edge habitat is a zone where the light, wind, microclimate, and moisture are altered. The affects from these changes extend into different forest types at distances of 450,656 to 1,640 feet. Climate edge effects may explain

why scarab and carrion beetle communities in 2.5 and 25 acre forest fragments in Brazil contain fewer species, sparser populations, and smaller beetles than do comparable areas within intact forest (Klein 1989). The drier conditions in small fragments, which are largely edge habitat, may lead to increased fatal desiccation of beetle larvae in the soil.

There is evidence to support a direct correlation between edge, or fragment size, and vertebrate scavenger pressure, with much of this work involving nesting bird populations (Paton 1994; Yahner and Mahan 1996; Suarez et al. 1997). Trumbo and Bloch (2000) found that burying beetles had significantly greater success in larger woodland plots and attributed this in part to lower vertebrate scavenger success in those areas. Sikes (1996), working with *N. nigrita*, found that most transects laid more than 328 feet from a trail or road had 10 percent or fewer carcasses taken by vertebrates, whereas transects near trails or roads had an average of 85 percent of the carcasses taken by vertebrate scavengers. Schnell et al. (1997-2005) found higher numbers and abundances of ABBs within Fort Chaffe and Camp Gruber boundaries than outside.

Although, some mobile species can integrate into a number of habitat patches this does not appear to be the case with the ABB. Schnell et al. (1997-2006) found that ABBs avoided clear-cut areas in southeast Oklahoma. Such fragmentation is comparable to pipelines, roads, well pads, utility corridors, commercial and residential development and quarries. The effect of competition, which should be strongly linked to habitat conditions, is likely to be a scale-dependent phenomenon. Tillman et al. (1994) suggest that even moderate levels of habitat destruction and fragmentation can cause time delayed, but deterministic extinction of dominant competitors in remnant patches.

Wide-ranging animals, like the ABB, are typically among the species most threatened by habitat fragmentation, in part because small areas fail to provide enough prey, but also because these animals are more likely to be killed by humans or their vehicles (Karr 1982, Pimm et al. 1988, Mladenoff et al. 1994, Noss et al. 1996). Large mobile species that roam over large areas daily must attempt to move through the fragmented habitat. Moving relatively long distances among different habitat types increases the ABB's chance of encountering appropriate-sized carcasses, but also increases the potential for natural and unnatural mortality, such as predation, insecticides, and insect traps (i.e., bug zappers)(Mladenoff et al. 1994, Noss et al. 1996). The probability of individual ABBs being subjected to these types of hazards also increases as areas become more developed (Lomolino and Creighton 1996). Nocturnal light pollution from buildings, highways or other human sources disrupts ABB behavior and draws the beetles toward areas where they may be more vulnerable to predation. A study in southeastern Ontario and Quebec, Canada found that several species of small mammals rarely ventured onto road surfaces when the road exceeded 65 feet in width (19.8 m, Oxley et al. 1974). Studies elsewhere report similar findings. These studies reveal potential indirect affects to the ABB by limiting its food and reproductive resources. These findings may explain, in part, why the highest densities of ABBs are in relatively large military installations with little agricultural, commercial or residential development.

Bedick et al. (1999) found in Nebraska and South Dakota that ABBs were observed in areas with low human population densities, minimal night-time artificial lights, and are primarily used for grazing of beef cattle and some agriculture. In Kansas, much of the area occupied by the ABB is privately owned native grass pasture and scattered woodlands of blackjack oak *Quercus marilandica* (Miller and MacDonald 1997). In Texas, the ABB has only been found on Camp Maxey and The Nature Conservancy's Lennox Woods in Red River County.

Interspecific competition

For most guilds, larger species tend to feed on larger prey, occupy a greater diversity of habitats, dominate in interference competition, and maintain larger home ranges, but may suffer from exploitative competition from smaller species (Ashmole 1968, Gittleman 1985, Hespenheide 1971, Rosenzweig 1968, Schoener and Gorman 1968, Werner 1974, Wilson 1975, and Zaret 1980). Because larger prey are less abundant than smaller prey (Peters 1983, Brown and Maurer 1987, Damuth 1991, and Lawton 1990), larger guild members require larger home ranges. In contrast to other guild members, the ABB must range over a larger area and a greater diversity of habitats to find suitable carcasses. In addition, larger carcasses are harder to bury than smaller ones (Creighton et al. 2007). While large size alone does not necessarily confer endangerment, rarity and extinctions tend to be higher for the larger species within trophic levels or guilds (Diamond 1984; Martin and Klein 1984; Vrba 1984; Owen-Smith 1988; and Stevens 1992). Although less than 2 grams in weight, the ABB is nevertheless the largest member of a guild that specializes on vertebrate carcasses, which are rare and unpredictable resources.

Size appears to be the most important determinant of success in competition for securing carrion; the largest individuals displace smaller burying beetles (Kozol et al. 1988). ABBs have been recorded as commandeering a carcass that has been buried by another burying beetle species. However, factors other than size (e.g., temperature or activity patterns) might also affect the outcome of competition (Wilson et al. 1984). Trumbo (1992) showed that the potential for competition for carrion from other burying beetles species (i.e., congeners) increased with carcass size, and Scott et al. (1987) found the same results with carrion-feeding flies. Habitat fragmentation caused increased vertebrate scavenger pressure, which decreased availability of carrion of the appropriate size, and increased competition between burying beetles (Creighton et al. 2009). As ABB populations decline, the competition between ABBs and sympatric congeners for sub-optimally sized carcasses would be expected to increase.

The ABBs most similar congener is *N. orbicollis*. Based on historical geographic range, presumably the ecological tolerances (e.g., diel periodicity, breeding season), and phylogenetic information indicates these species may be each other's closest surviving relatives (Szalanski et al. 2000). Being so similar, they likely are each other's greatest congeneric competitors (Sikes and Raithel 2002), and interspecific competition may affect populations at the local level. Typically, surveys for ABBs result in 10 or more times more *N. orbicollis* than ABBs (Lomolino and Creighton 1996, Amaral et al. 1997, Carlton and Rothwein 1998). Kozol (1989) demonstrated that *N. orbicollis* was about eight times more abundant than ABBs on Block Island, Rhode Island while Walker (1957) collected 19 times more *N. orbicollis* (175) than ABBs (9) in the single trapping array where the latter species was encountered in Tennessee. While the ABB is more successful than *N. orbicollis* in utilizing carcasses greater than 100 g, these data suggest that *N. orbicollis* may be a formidable competitor for the ABB (Sikes and Raithel 2002) and may have actually increased (have been released from competition) in those areas where ABBs disappeared (USFWS 1991). In addition, *N. marginatus* may also be a formidable competitor to ABBs. *N. marginatus* is on average slightly larger and utilizes larger carcasses than *N. orbicollis* and in Nebraska and South Dakota is typically more abundant (Backlund and Marrone 1997, Bedick et al. 1999). Another threat to ABB reproductive success is brood parasitism after the oviposition by other burying beetle species near an ABB buried carcass

(Müller et al. 1998, Trumbo 1994). Trumbo (1992) found that mixed species burying beetle broods were more common on larger carcasses .

The imported fire ant (*Solenopsis invicta)* has become a formidable competitor for carrion and a potential source of mortality for burying beetles when they co-occur at a food source (Warriner 2004, Godwin and Minich 2005). Scott et al. (1987) concluded that the inability of *N. carolinus* to successfully bury carrion provided experimentally in Florida was due to interference by imported fire ants. Only 5 of 48 carcasses were successfully exploited by *N. carolinus*, despite pitfall trapping that demonstrated that *N. carolinus* was locally abundant. Collins and Scheffrahn (2005) noted that fire ants may reduce ground-nesting populations of rodents and birds, and in some instances, may completely eliminate ground-nesting species from a given area. Fire ant infestations are not evenly distributed; rather, they tend to be more numerous in open, disturbed habitats (Carlton in litt. 1996). Of the states containing populations of ABB, fire ants now infest all or parts Arkansas**,** Oklahoma, and Texas (USDA 2003).

Loss of Genetic Diversity in Isolated Populations

Kozol et al. (1994) examined ABB genetic variation within and between the Block Island, Rhode Island population and the eastern Oklahoma and western Arkansas population. Both populations have low levels of genetic variation, and most of the variation occurs within a single population. There were no unique diagnostic bands within either population, but they found the Oklahoma-Arkansas population to be somewhat more diverse. Reduced genetic variation is often a result of founder effect, genetic drift, and inbreeding. Kozol et al. (1994) suggest that multiple bottleneck events, small population size, and high levels of inbreeding may be factors contributing to the pattern of genetic variation in ABBs.

Szalanski et al. (2000) expanded on Kozol et al.'s 1994 study and examined ABBs from five populations: Block Island in Rhode Island, Arkansas, South Dakota, Oklahoma, and Nebraska. The authors found little evidence that the five populations have maintained unique genetic variation and no evidence to suggest that these five populations should be treated as separate, genetically independent conservation segments.

Analysis of the Species/Critical Habitat Likely to be Affected

The ABB is likely to be adversely affected by the construction, operation and maintenance of the Keystone XL pipeline and the associated facilities. Various types of disturbance associated with typical construction activities can result in impacts to the ABB. As noted earlier, no critical habitat has been designated for the ABB; therefore, none would be affected by the Project.

ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human induced and natural factors leading to the current status of the species, its habitat, and ecosystem, within the action area (i.e., area affected by the project). The environmental baseline is a "snapshot" of the status of the ABB at the time this document was prepared. In the United States, the ABB is known or likely to occur in the action area only in the states of South Dakota, Nebraska, and Oklahoma (Keystone 2011: Appendix D; USFWS, unpublished data). Therefore, in this biological opinion, analyses of Project impacts are limited to these three states.

Status of the Species in the Action Area

The "action area" means all areas to be affected directly or indirectly by the Federal Action and not merely the immediate area involved in the action. For this consultation, the action area consists of not only the issuance of the Presidential Permit (the "Action"), but the resulting indirect effects of the proposed Keystone XL pipeline enabled by the permit. These include effects to all land disturbed by the footprint of the pipeline Project such as preconstruction, construction, operation and reclamation activities. Lands affected include the pipeline construction ROW and land used for by the above ground ancillary facilities (i.e., additional temporary workspace areas (TWAs), pipe stockpile sites, rail sidings, contractor yards, construction camps, pump stations, delivery facilities and access roads). The Cushing Tank Farm near Cushing, OK, and storage facilities at the termini of the pipeline in Texas are part of the Project listed above, as well as the below ground operation of the pipeline itself. Also included are the effects of the interrelated and interdependent power lines that would be built by private power companies to supply electricity to Project pump stations along the pipeline, as well as the 230 kV transmission line in Tripp and Lyman counties in South Dakota, and the interrelated facilities required by the Bakken Marketlink and Cushing Marketlink projects. The action area generally extends from the border of the United States with Canada to the termini of the pipelines and storage facilities in near Nederland and Moore Junction in Texas.

South Dakota: In 1995, a large population of ABBs was discovered in south-central South Dakota. The population has been monitored almost annually from 1995-2007, and has apparently remained stable in abundance and distribution. This population is likely part of the metapopulation that occurs in the Nebraska Sandhills (unpublished data, South Dakota Field Office, USFWS).

Surveys in 2005 revealed that ABBs in South Dakota are concentrated in southern Tripp County where the population is conservatively estimated to be approximately 1,000 individual ABBs in an area of approximately 220 square kilometers (54,363 acres; Backlund et al. 2008). However, the actual number or percentage of ABB in the vicinity of the proposed Keystone XL pipeline cannot be determined.

Nebraska: The following information is based on extensive trapping for ABB along the Keystone XL pipeline ROW in Nebraska. The complete survey report is found in Appendix D of Keystone 2011. In 2009, 17 traps were set along the Keystone XL pipeline ROW in southern and central Nebraska, in Jefferson, Saline, Fillmore, York, Hamilton, Merrick, Nance, Boone, and Greeley counties. No ABB were captured in these traps, although 244 ABB were captured in control traps in Lincoln and Holt counties during the same period. Based on the survey results, habitat along the pipeline route between mileposts (MP) 697 (in Greeley County) and 851 (in Jefferson County) does not appear to support populations of ABB (Keystone 2011: Appendix D).

In 2010, a total of 32 traps were placed on the pipeline ROW between MPs 597-697 in northern Nebraska to determine the presence of ABB. Sampling was conducted in June 2010 with nine traps set along the ROW in Wheeler, Garfield, and southern Holt counties. Sampling in these counties was hampered by remoteness from the relatively few roads in the sandhills and by

heavy rains and widespread flooding. Some traps were closed and then reopened a week later when conditions were drier. In August, 2010, sampling was conducted farther north to the South Dakota border in Holt, Rock, and Keya Paha counties. Twenty-three survey traps were placed near public road ROWs at the place where the pipeline ROW would cross the road. A total of 323 ABB were captured from 23 of the 32 traps in the northern area of the pipeline ROW. Traps placed in the pipeline ROW attracted increasing numbers of ABB from south to north. Beginning at milepost 691 in Wheeler County, ABB occurred throughout most remaining habitat continuing north along the pipeline route in Nebraska. Remaining traps exceeded 1 ABB per trap night with three locations exceeding 2 ABB and one Holt County trap more than 12 ABB per trap night. The highest concentrations of ABBs in Nebraska are in southern Holt County where average captures per trap night at one trap were above 21 individuals, the highest capture rate ever reported for the species (Keystone 2011: Appendix D). Therefore, the ABB population in the Nebraska Sandhills appears to be greater than previously recognized.

Oklahoma: Field surveys for ABB during the past 20 years confirmed ABB presence in six counties crossed by the Keystone XL pipeline: Okfuskee, Seminole, Hughes, Atoka, Coal, and Bryan counties (unpublished data, Oklahoma Ecological Services Field Office, Tulsa, Oklahoma). However, only Hughes, Atoka, Coal and Bryan counties have recent records that confirm ABB presence in the proximity of the Keystone XL pipeline route. In Seminole County, only one positive record of ABB exists since 1989, and this is 15 miles from the pipeline with intervening negative records. Likewise, in Okfuskee County, The positive ABB record nearest to the proposed Project ROW is 19 miles from the pipeline ROW with intervening negative records. On this basis, the Service does not consider ABB habitat in Seminole and Okfuskee counties in the analysis of impacts although no random and systematic surveys for ABBs have occurred in those counties. As described previously, five miles is considered a reasonably likely area of movement for the ABB, and there are positive recent records for ABB within five miles of the Keystone XL pipeline ROW in Huges, Atoka, Coal and Bryan counties.

Habitat Availability in the Action Area

In South Dakota, ABBs occur south of State Highway 18 (C. Bessken, USFWS; Pierre, South Dakota; personal communication) in the southern half of Tripp County (Backlund et al. 2008). The Project ROW passes through about 34 miles of habitat where ABBs are most likely to occur (25 miles of prime habitat and 9 miles of good habitat). Remaining habitat north of Highway 18 at about MP 563 is fair to marginal and is outside the known range of ABBs. For habitat ratings by mile from mile post (MP) 536 to MP 595, see Table 3.1-4 in the BA (Keystone 2011).

The Project would result in construction of approximately 500 miles of pipeline through South Dakota and Nebraska. Windshield surveys of habitat suitability for ABBs along the pipeline route in South Dakota and Nebraska were conducted by Dr. W.W. Hoback in 2008 (Keystone 2011: Appendix D). Habitat affected by the ROW and other Project facilities was classified using a rating system based on moisture, land use, and the presence of American burying beetle from previous studies in Nebraska. For the Nebraska Sandhills population, this ranking system appears to generally describe areas of potential ABB occurrence. The habitat rating system was developed in northern Nebraska and was used for evaluation of habitats in the Project areas in Nebraska and South Dakota. The following five habitat classifications were used to describe ABB habitat quality pipeline ROW in South Dakota and Nebraska (Figure 3):

Prime (5): Undeveloped wet meadows dotted with trees (especially cottonwoods [*Populus deltoids*]) or forest areas visible. Water sources are available including the presence of a river, stream or sub-irrigated soils. Cropland is not visible within the mile segment evaluated or is at a distance greater than 2 miles.

Good (4): Native grasslands (tall or mixed grass prairie) with forbs. Low wetland meadows that are grazed by cattle or used for haying. Trees (usually cottonwoods) are present. Sources of water are within a mile, but the area has either some cropland or light pollution such as yard lights or houses within a mile.

Fair (3): Grassland with exotic species such as brome grass (*Bromus* spp.). Soil moisture content is lower than for prime or good habitat. Row crop agriculture is located within one mile.

Marginal (2): Potential habitat restricted to one side of the pipeline ROW, with row crop agriculture on one side or dry, sandy, upland areas with exposed soil or scattered dry-adapted plant such as yucca (*Yucca* spp.).

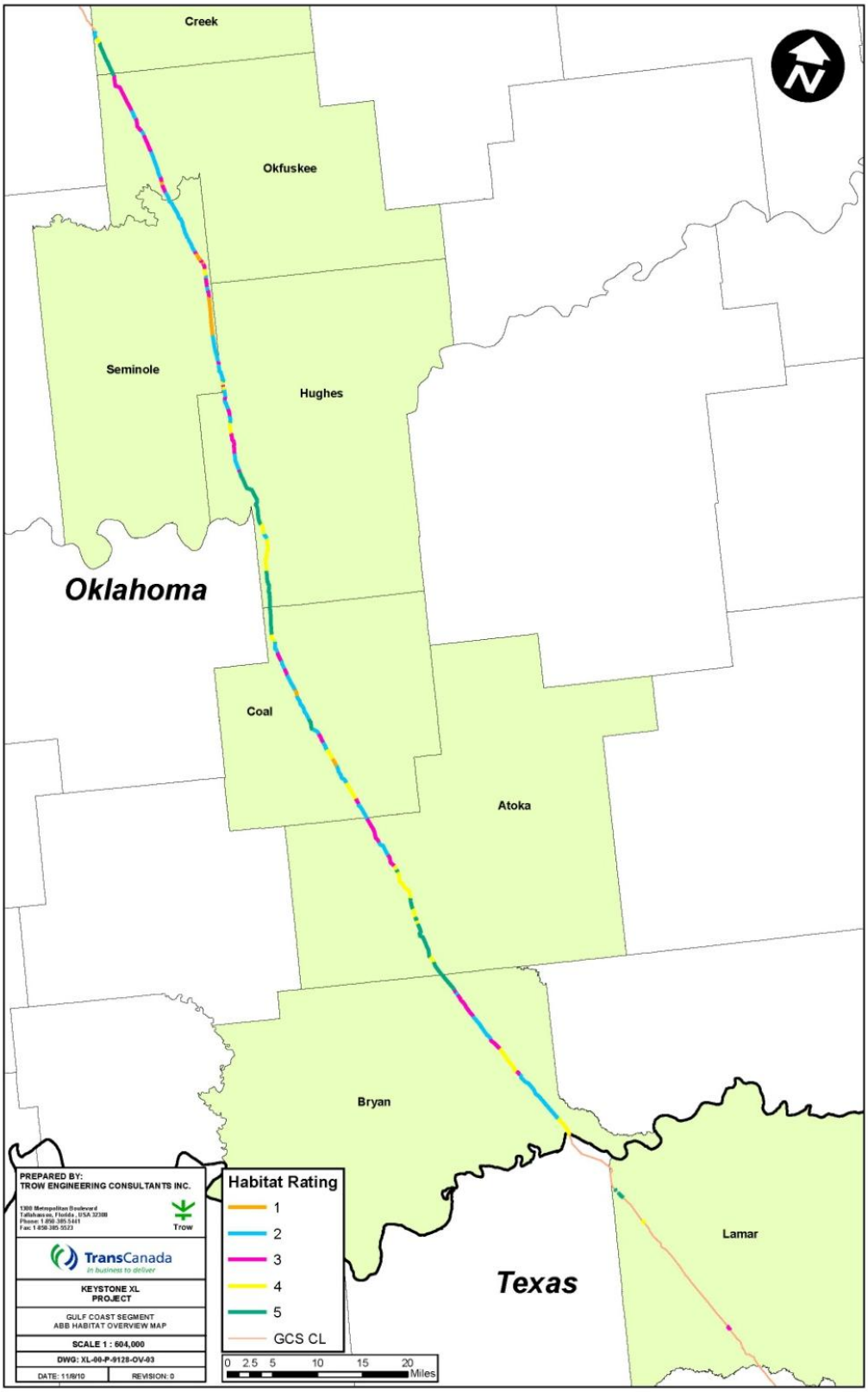
Poor (1): Both sides of the pipeline ROW with row crop agriculture or habitat with the potential for large amounts of light pollution and disturbance associated with town or city edge.

The above habitat descriptions for prime and good habitat are consistent with Backlund et al. (2008) description of the best habitat for ABB in South Dakota, which they described as sandy grasslands with scattered stands of trees dominated by cottonwood, and commonly including sub-irrigated meadows and groundwater streams. As in Nebraska, the dominant landcover in the South Dakota ABB habitat is native grassland, and is primarily used for range and hayland. Low meadows are dominated by grasses and forbs typical of tallgrass prairie while the uplands consist mostly of mixed grass prairie flora.

The Project ROW in Oklahoma and Texas were also evaluated using this five-category habitat quality system and desktop surveys using high resolution satellite photography. The entire Project ROW and extra areas such as construction yards, construction camps, pump stations, and pipe yards were rated using this system. Figure 4 illustrates ABB habitat quality within the pipeline construction ROW in Oklahoma and Texas.

Figure 3. American burying beetle habitat quality within the Keystone XL pipeline ROW in South Dakota and Nebraska based on a five-category habitat quality rating system. (Source: Keystone 2011: Figure 3.1-2)

Figure 4. American burying beetle habitat quality within the Keystone XL pipeline ROW in Oklahoma and Texas, based on a five-category habitat quality rating system. (Source: Keystone 2011: Figure 3.1-4)



Factors Affecting Species Environment Within the Action Area

Adequately evaluating the effects of this proposed project on the ABB requires that the Service consider not only the impacts from the proposed Project, but the context in which they would likely occur. This context includes ongoing effects to ABB from current activities as well as anticipated effects from projects likely to occur in the foreseeable future.

In the northern part of their range, the primary causes of decline of the ABB are thought to be (1) pesticide use, and (2) habitat loss, degradation, and fragmentation, which correspond to a decrease in availability of suitable carrion and removal of previously suitable ABB habitat. Developed land and land that has been converted for agricultural, grazing, and other uses, often favor scavenging mammal and bird species that compete with carrion beetles for carcasses. Additionally, developing and converting land have led to declines in ground nesting birds, which probably historically provided a large portion of the carrion available to ABB. Fire suppression in prairie habitats allows the encroachment of woody plant species, particularly the eastern red cedar, which is thought to degrade habitat for burying beetles by limiting their ability to forage for carrion.

In South Dakota and Nebraska, we do not have information specific to the Project action area regarding the impacts of ongoing human and natural factors and how those factors may affect the use of the Keystone XL Project sites by ABB. However, it is reasonable to assume that continuing development activities in the sandhills such as conversion of native prairies to row crops, increased human developments or disturbances, increased lighting, and placement of man-made structures such as homes, power lines, and roads on the landscape would affect ABB and ABB habitat on Project lands in the same manner as elsewhere in the sandhills.

Shifts in land use are affecting ABB habitat within the species range. South Dakota and Nebraska are losing native prairie rangeland through conversion to cropland at an escalating rate because the accelerating use of ethanol in gasoline has increased demand for corn and consequently raised the price of the grain (GAO 2007). About a third of the average increase in harvested cultivated crop acreage on corn and soybean farms in the United States, results from the average conversion of hay, USDA Conservation Reserve Program grassland or grassland pasture (Pore, Robert. August 28, 2011). Factors influencing landowners' decisions to convert grasslands to cropland include farm program payments, rising crop prices, hardier seed varieties and new farming techniques such as no-till methods (GAO 2007). In Oklahoma, in addition to the factors discussed above, many native forests have been converted to treed plantations, where ABBs are scarce (USFWS, Oklahoma Field Office, unpublished data). In Oklahoma in particular, oil and gas wells and pipelines transect the landscape in numerous places, as do power lines, roads and numerous other types of development. All of these play a role in fragmenting and degrading ABB habitat.

EFFECTS OF THE ACTION

As noted previously, the Federal Action under consideration is the potential issuance of a Presidential Permit by DOS to Keystone. Indirect effects of that Action include the preconstruction, construction, operation and reclamation activities associated with the proposed Keystone XL pipeline (Project). Therefore, activities associated with the pipeline, including interrelated and interdependent activities, are the principle focus of analyses in this Biological Opinion.

The "action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR §402.02). Indirect effects of the Action are also part of the action area and include all land disturbed by the footprint of the proposed pipeline Project pre-construction, construction, operation and reclamation activities. This includes construction of the pipeline ROW and land affected by the above ground ancillary facilities (i.e., additional temporary workspace areas (TWAs), pipe stockpile sites, rail sidings, contractor yards, construction camps, pump stations, delivery facilities and access roads). The Cushing Tank Farm near Cushing, OK, and storage facilities at the termini of the pipeline in Texas are part of the Project listed above, as well as the below ground operation of the pipeline itself. Effects to be considered also include the effects of the interrelated and interdependent power lines that would be built by private power companies to supply electricity to Project pump stations along the pipeline, as well as the 230 kV transmission line in Tripp and Lyman counties in South Dakota, and the interrelated facilities required by the Bakken Marketlink and Cushing Marketlink projects. The action area extends generally from the border of the United States with Canada to the termini of the pipelines and storage facilities near Nederland and Moore Junction in Texas.

The proposed Project requires multiple activities at different stages of construction and operation. Each of these may result in different effects to ABB depending on when during the life cycle of the ABB the activities occur. These activities include preconstruction survey and staking of all Project areas. Within the ROW, construction activities would include vegetation clearing; top soil removal and grading; trench excavation, pipe fitting, lowering, welding, inspection, hydrostatic testing, and backfilling and clean up; reclamation activities, such as re-contouring where necessary, soil decompaction and seeding. Post-construction reclamation of all temporary ancillary sites would also involve decompaction of soil where necessary, and re-seeding. Borrow material would be used to back fill the pipe trench; for road construction or upgrading and road crossings, and preparation of ancillary sites, as necessary. The operation of the Project would cause increases in temperature around the pipeline as the heat generated by the flowing oil dissipates from the pipe through surrounding soil. Conservation measures have also been incorporated into the project to avoid and minimize adverse impacts to ABB, and to provide for the conservation of the species.

Pre-construction Activities

The pipeline ROW and auxiliary sites would be surveyed and staked prior to construction. In the Sandhills of Nebraska, the clearing described above would remove the vast majority of ABBs from Project sites, so minimal adverse impacts are anticipated (discussed below). However, project areas would not be cleared of ABB in South Dakota or Oklahoma. To the extent surveying and staking take place during the summer periods when ABB are above ground, there is a potential of injury to or mortality of ABB from collision or crushing by truck or other vehicles used in quality grassland ABB habitat in Oklahoma and South Dakota.

Pre-construction conservation measures are essential and would occur in Nebraska to appreciably reduce direct mortality and injury of ABB in that state. In 2010, presence/absence sampling of Project areas in Nebraska revealed unprecedented numbers of ABB occurring in the Nebraska Sandhills, particularly in remote areas of Holt County that would be crossed by the proposed Project. All areas affected by Keystone XL pipeline construction would be essentially "cleared" of ABB through trapping and relocating ABB adults to areas of good or prime ABB habitat at least 5 miles from the Project areas. Following the trapping and relocation of the ABB, additional pre-

construction measures would be implemented to make the Project areas unattractive to ABB until the beetles bury underground for the winter.

In 2010, Dr. Hoback and his team captured a total of 323 ABB in 23 of 32 traps set along accessible areas of the pipeline ROW between mile point (MP) 597 and MP 697. Much of this 100-mile section of the pipeline is located in very remote and hilly country with few roads, so the beetle traps were set in the most likely habitat at points where the pipeline ROW crossed public roads. The highest concentrations of ABB were found in southern Holt County, likely due to the region's native grasslands, which are extensive, secluded and intact. In fact, one trap in southern Holt County caught an average of 21 ABB per trap night, the highest capture rate ever recorded for the species (Keystone 2011: Appendix D). Additionally, high or substantial numbers of ABB were captured at other trap sites in the Nebraska Sandhills. It is clear from the trapping effort that an extremely large population of ABB occurs in the remote areas crossed by the Keystone XL pipeline, and efforts to reduce the Project impacts to ABB are necessary in this area. Dr. Hoback holds a Section 10(a)(1)(A) permit from the Service allowing trapping and relocation of ABB in Nebraska when such efforts promote the conservation of ABB.

Estimating the number of beetles that are likely to be trapped in conjunction with this unprecedented clearing effort is challenging. In 2010, 32 traps were placed within approximately the same length of pipeline ROW as would be trapped in 2011 using approximately 100 traps. If a proportional number of beetles were trapped in 2011 as in 2010, one might expect 323/.032 ABB, or 1,009 ABB captured in August of 2011. However, the placement of traps in 2011 would include multiple areas that were remote and inaccessible in 2010, and these areas likely contain the highest numbers of ABB, based on record ABB capture rates experienced in such remote areas in 2010 (W.W. Hoback, personal communication). Given that one half of the total ABB captured in 2010 (i.e., 161 of the 323 ABB) were caught in just two traps adjacent to extensive and remote grasslands, a strictly proportional estimate of 2011 ABB captures likely results in a substantial underestimate of the number of individual ABB to be trapped and relocated in 2011. If 1,009 ABBs trapped is estimated simply on the basis of the proportion of trapped area, a better estimate may be double that number, or as many as 2,018 ABB captured and relocated in August of 2011, based on the amount of remote and intact grasslands that would be trapped compared to that trapped in 2010. If the effort needs to be repeated in 2012 due to project delays, it is likely that fewer beetles would be captured during the second clearing, because so many had already been removed from the area in 2011.

The trapped ABB are relocated to areas of good or prime habitat occupied by ABB. Protective measures at the release site such as creating a tunnel in moist soil for each released ABB with a light cover (e.g., a leaf), and not releasing more than 50 ABB at any one site, increase the survivability of the relocated ABB. Nevertheless, there may be an increase in intraspecific encounters at the release site due to the increased number of ABB in the areas. Unless the release areas are at or near carrying capacity, these interactions would not likely result in substantial adverse effect to the ABB in the areas. However, some small and indeterminable amount of disturbance to ABBs from intraspecific interactions may occur. In August of 2011, these interactions would occur only at feeding sites; during the June activity period, increased competition for available carcasses used by breeding pair may occur at the release sites.

Pre-construction trapping and relocating of ABB and mowing would not take place in South Dakota and Oklahoma. Because trapping and relocating is not without cost, benefits gained from

the process must be carefully measured against risk. The best available information suggests that ABB population levels in the action area in South Dakota and Oklahoma are not as high as in Nebraska. The high density of ABB occurring on and near Project lands in the Sandhills of Nebraska requires additional measures to reduce mortality from construction of the Project. During both informal and formal consultations, the Service, DOS, NGPC, and Keystone sought to avoid incidental take by implementing pre-construction conservation measures. A combined guidance plan was developed by the NGPC and the Service's Grand Island Field Office and requires the implementation of two conservation measures described in Appendix B, American Burying Beetle Trapping Protocol, and Conservation Measures for Use in Nebraska. These measures would be implemented prior to construction through areas occupied by the ABB to reduce mortality of ABB from pipeline construction in Nebraska. In addition, to offset unavoidable impacts to American burying beetle habitat, funds would be contributed by Keystone for reclamation, protection and management of ABB habitat in the states of South Dakota and Oklahoma, as well as Nebraska. Therefore, all three states would receive funds to offset habitats lost and benefit conservation of ABBs in the long-term.

Construction Activities

Project activities would result in a variety of temporary and permanent effects to ABB habitat. Project construction activities such as clearing and grubbing of trees and shrubs, vegetation removal, grading, removal and stockpiling of topsoil, trenching, pipe laying, soil backfilling and compaction, and final grading and reclamation activities would occur in the pipeline ROW. These ROW construction activities and construction of temporary access roads in grassland areas would result in temporary habitat loss, temporary habitat fragmentation, and/or alteration of suitable ABB habitat. ABB habitat degradation from human activities, soil compaction and vegetation disruption in pipe yards, construction camps and contractor yards would result in similar temporary habitat loss and fragmentation. The extent of such habitat loss would depend on the time necessary to successfully restore affected grassland habitats after project construction.

There are landscape-level differences in ABB habitat between the northern sandhills populations in South Dakota and those in Oklahoma. The ABB habitat in the northern sandhills consists of large areas of relatively undisturbed grasslands compared to the more fragmented grassland/woodland matrices in Oklahoma. Both grasslands and woodlands are used by ABB in Oklahoma. Clearing of trees and shrubs from the ROW and project lands in Oklahoma, and post-construction vegetation maintenance in large tracts of natural forest would result in conversion of ABB forest habitat to grasslands where the Project pipeline ROW is not co-located with or adjacent to other utility ROWs. Whether this habitat conversion would result in meaningful habitat fragmentation in the already highly fragmented landscape in Oklahoma is unclear.

Placement of the above-ground pump stations (i.e., pump station numbers 21, 22, 23, 34 and 35), and construction of one permanent access road in Oklahoma would cause the permanent loss of the ABB habitat. Whether meaningful fragmentation of extensive grassland habitats would result from the small scale of permanent habitat loss (from 5 acres to 15 acres each) is questionable, but likely not substantial due to the small areas involved. Most discussions of habitat fragmentation in the literature involve clear-cutting natural mature forest. Additionally, the proposed pump stations in ABB grassland habitat in South Dakota and Nebraska are located along or between roads that already affect ABB habitat to some extent, and the Project facilities would not provide habitat to competing wildlife. Therefore, while grasslands under the pump stations would be permanently

lost, the effect of that loss in terms of habitat fragmentation of large extensive grassland landscapes is likely not substantial.

Amount of ABB Habitat Affected

Permanent loss of ABB habitat results from 1) habitat covered by the pipeline pump stations (pipeline pump stations being built on ABB habitat), 2) the one permanent access road in Oklahoma, and 3) ABB habitat areas in South Dakota and Nebraska rendered permanently unsuitable habitat by heat dissipating from the operating pipeline. All other Project related impacts to grasslands should be temporary and limited to the time necessary for successful post-construction habitat restoration. It is anticipated that the construction methods of replacing topsoil and re-establishing natural vegetation would cause restoration of natural soil hydrology within the construction ROW and avoid long-term impacts to ABB habitat. Tables 4 through 7 detail the quantity and quality of ABB habitat affected by the Project in South Dakota, Nebraska and Oklahoma.

Methods

The calculation of the number of acres temporarily affected by all activities (except access roads) was completed by Cardno ENTRIX for DOS using GIS layers provided by Keystone. Areas of Project site polygons were summed by county and state. These areas included the ROW outside the 22-foot width affected by pipeline heat dissipation, temporary work areas, construction camps, pipe yards, and any other areas that would be restored to grassland following pipeline construction. Following that analysis, the Service used a GIS layer of access roads in the DEIS to calculate acres affected by access roads in the areas of ABB habitat in each state, consistent with the study area analyzed by Cardno ENTRIX. (Minor adjustments to ROW route may occur prior to construction, but substantial changes in quantities of habitat affected by access roads are not anticipated). Roads designated as "existing" in the GIS layers were excluded from mitigation calculations. The acres of new temporary and permanent access roads were calculated assuming a 30-foot construction ROW and are identified in Tables 4 through 7. All temporary access roads would be restored following pipeline construction.

South Dakota

In South Dakota, the Project ROW and ancillary sites would affect approximately 5,439 acres during construction and operation, of which about 630 acres (11 percent) have reasonable potential for occurrence of the ABB (Table 4). Of this 630 acres south of Highway 18 in Tripp County, 374 acres (60 percent) is classified as prime ABB habitat, 118 acres (19 percent) is good ABB habitat, 107 acres (16 percent) is classified as fair habitat, and 30 acres (5 percent) is marginal habitat. Within the affected area, 530 acres would experience a temporary loss of habitat up to 4 years or longer, depending on rainfall and success of restoration efforts. Construction and operation of the Project would cause the permanent loss of more than 95 acres of ABB habitat in Tripp County due to pump stations and the 22-foot-wide strip centered on the pipeline and affected by heat dissipating through the soil (discussed further in "Operation of the Project" sub-section).

Table 4. Estimated area of temporary[1] and permanent[2] impacts to American burying beetle habitat from the Keystone XL pipeline project, south of Highway 18 in southern Tripp County, South Dakota. Number of acres are summed by county and habitat quality. (Source: Keystone 2011, Table 3.1-5; number of acres of habitat rounded to the nearest 0.1 acre).

	Poor (1)		Marginal (2)		Fair (3)		Good (4)		Prime (5)		Total	
County	**Miles**	**Acres**	**Miles**	**Acres**	**Miles**	**Acres**	**Miles**	**Acres**	**Miles**	**Acres**	**Miles**	**Acres**
Temporary Loss												
Tripp	0.00	0.0	0.00	30.0	1.20	98.9	8.01	92.9	24.89	307.9	34.10	529.7
Temporary access roads						4.7						
Permanent Loss												
Tripp	0.00	0.0	0.00	0.0	1.20	3.2	8.01	25.6	24.89	66.4	34.10	95.2
Total	**0.00**	**0.0**	**0.00**	**30.0**	**1.20**	**106.8**	**8.01**	**118.5**	**24.89**	**374.3**	**34.10**	**629.6**

[1] Temporary impacts are caused by temporary construction workspace, and construction of temporary access roads.
[2] Permanent impacts are caused by the placement of permanent above-ground facilities (i.e., pump stations), and the 22-foot corridor spanning the center of the pipeline ROW affected by heat dissipation from the operating pipeline (see *Project Operation* subsection, below).
Note: miles are the same for both temporary and permanent impacts as both are calculated using the pipe centerline.

Nebraska

In the Nebraska Sandhills, the Project would affect approximately 1,782 acres within the expected range of the ABB. Of the 1,782 acres, 1,399 acres (79 percent) is classified as prime ABB habitat, 186 acres (10 percent) is classified as good ABB habitat, 121 acres (7 percent) are fair habitat, 42 acres (2+ percent) are marginal habitat and 35 acres (2 percent) are poor ABB habitat (Table 5). ABBs would be least likely to occur in poor habitat. Within the range of the ABB, 1,493 acres of habitat would be temporarily lost, for approximately four years or longer, depending on rainfall and success of restoration efforts. Construction of the pump stations and operation of the pipeline would cause the permanent loss of approximately 289 acres of ABB habitat.

Table 5. Estimated miles and acres of temporary[1] and permanent[2] loss of ABB habitat from construction and operation of the Keystone XL pipeline in the Nebraska Sandhills. Number of acres are summed by county and habitat quality. Only counties where ABB were documented are included. (Source: Keystone 2011, Table 3.1-7; acres of habitat lost are rounded to the nearest 0.1 acre).

	Poor		Marginal		Fair		Good		Prime		Total	
County	**Miles**	**Acres**	**Miles**	**Acres**	**Miles**	**Acres**	**Miles**	**Acres**	**Miles**	**Acres**	**Miles**	**Acres**
Temporary Loss												
Keya Paha	0.00	0.0	0.00	0.0	2.17	25.0	4.34	80.2	12.25	136.5	18.76	241.6
Rock	0.00	0.0	0.02	0.3	1.00	11.9	2.01	21.9	6.47	76.5	9.50	110.6
Holt	0.00	30.0	3.00	33.3	4.01	45.1	0.00	61.0	37.86	485.7	44.87	655.0
Garfield	0.00	0.0	0.00	0.0	1.00	16.9	0.00	0.0	9.48	144.3	10.48	161.2
Wheeler	0.35	3.7	0.00	0.0	0.00	0.0	0.00	0.0	17.93	280.2	18.28	283.9
Temporary access roads								6.1		34.2		40.3
Subtotal	**0.35**	**33.7**	**3.02**	**33.6**	**8.18**	**98.8**	**6.36**	**169.1**	**83.99**	**1,157.4**	**101.89**	**1,492.6**
Permanent Loss												
Keya Paha	0.00	0.0	0.00	0.0	2.17	5.8	4.34	11.6	12.25	32.7	18.76	50.0
Rock	0.00	0.0	0.02	0.1	1.00	2.7	2.01	5.4	6.47	17.2	9.50	25.3
Holt	0.00	0.0	3.00	8.0	4.01	10.7	0.00	0.0	37.86	110.3	44.87	129.0
Garfield	0.00	0.0	0.00	0.0	1.00	2.7	0.00	0.0	9.48	25.3	10.48	28.0

Wheeler	0.35	0.9	0.00	0.0	0.00	0.0	0.00	0.0	17.93	56.3	18.28	57.2
Subtotal	**0.35**	**0.9**	**3.02**	**8.1**	**8.18**	**21.8**	**6.35**	**16.9**	**83.99**	**241.8**	**101.89**	**289.5**
Total	**0.35**	**34.7**	**3.02**	**41.7**	**8.18**	**120.6**	**6.35**	**186.1**	**83.99**	**1,399.2**	**101.89**	**1,782.1**

[1] Temporary impacts are caused by temporary construction workspace, and construction of temporary access roads.
[2] Permanent impacts are caused by the placement of permanent above-ground facilities (i.e., pump stations), and the 22-foot corridor spanning the center of the pipeline ROW affected by heat dissipation from the operating pipeline (see *Project Operation* subsection, below).
Note: Miles are the same for both temporary and permanent impacts as both are calculated using the pipe centerline.

Table 6 describes the number of acres of grassland in five Nebraska Sandhills counties through which the Keystone XL pipeline passes and where ABB occur. Also included are the number of acres in each of these counties affected by the Project (rounded to the nearest acre). Not all acres affected by the Project are grasslands, and not all grassland acres constitute quality ABB habitat. Nevertheless, given an assumption that the proportion of ABB habitat is the same on Project lands as in the counties as a whole (i.e., the Project lands constitute a representative sample of the ABB grassland habitat in general), then a worst case grassland impact scenario can be estimated. That is, if it is assumed that all acres affected by the Project are grasslands (worst case scenario), then the Project causes temporary loss of 0.054 percent of the grassland habitat in the pertinent five Nebraska counties, below, and permanent loss of 0.010 percent of grassland habitat in the same area.

Table 6. Number and percent of acres in five Nebraska Sandhills counties affected by Project ROW and ancillary facilities, and where ABB occur.

			Acres Affected by KXL Project	
County	**Total Acres**	**Grassland Acres**	**Temporary**	**Permanent**
Keya Paha	495,189	398,016	242	50
Rock	646,634	567,854	111	25
Holt	1,546,122	1,184,143	655	129
Garfield	365,514	328,171	161	28
Wheeler	368,009	304,462	284	57
Access Roads			40	
Total Acres	**3,421,468**	**2,782,648**	**1,493**	**289**
Maximum potential proportion of grasslands affected by Project in 5 Nebraska Sandhills			**0.054%**	**0.010%**

Oklahoma

In Oklahoma, the Project would affect approximately 1,836 acres within the action area where ABB are expected to occur, including the loss of habitat from construction of several temporary and one permanent access road. Of the 1,836 acres, 349 acres (19 percent) are classified as prime ABB habitat, 456 acres (25 percent) are classified as good ABB habitat, 291 acres (16 percent) are classified as fair, 457 acres (25 percent) are marginal, and 282 acres (15 percent) are poor ABB habitat (Table 7). ABBs would be least likely to occur in poor habitat. Within the range of the ABB, approximately 1,816 acres of habitat would be temporarily lost for approximately 4 years, depending on rainfall and success of restoration efforts. Construction and operation of the Project would cause permanent loss of approximately 20 acres of ABB habitat.

Table 7. Estimated miles and acres of temporary[1] and permanent[2] loss of ABB habitat from construction and operation of the Keystone XL pipeline in Oklahoma. Number of acres are summed by county and habitat quality. Only counties where ABB were most likely occur within the Project area are included. (Source: Keystone 2011, Table 3.1-7; acres of habitat lost are rounded to the nearest 0.1 acre).

	Poor (1)		Marginal (2)		Fair (3)		Good (4)		Prime (5)		Total	
County	**Miles**	**Acres**	**Miles**	**Acres**	**Miles**	**Acres**	**Miles**	**Acres**	**Miles**	**Acres**	**Miles**	**Acres**
Temporary Loss												
Atoka	0.00	0.0	1.93	26.4	6.46	72.6	6.07	81.1	5.70	94.1	20.16	274.2
Bryan	0.00	16.8	9.51	134.6	5.71	74.3	5.28	231.4	2.22	31.9	22.72	488.9
Coal	1.71	23.5	12.37	183.2	4.11	52.5	4.02	54.9	4.26	57.5	26.47	371.7
Hughes	0.00	242.1	6.35	91.5	9.15	84.9	4.48	81.3	7.94	125.9	27.92	625.7
Temporary access roads				4.3		3.4		7.7		39.6		55.0
Subtotal	**1.71**	**282.4**	**30.16**	**440.0**	**25.43**	**287.7**	**19.85**	**456.4**	**20.12**	**349.0**	**97.27**	**1,815.5**
Permanent Loss												
Bryan	0.00	0.0	0.14	10.0	0.00	0.0	0.00	0.0	0.00	0.0	0.14	10.0
Coal	0.00	0.0	0.12	7.1	0.00	0.0	0.00	0.0	0.00	0.0	0.12	7.1
Permanent access road						3.2						
Subtotal	**0.00**	**0.0**	**0.26**	**17.1**	**0.00**	**3.2**	**0.00**	**0.0**	**0.00**	**0.0**	**0.26**	**20.3**
Total	**1.71**	**282.4**	**30.42**	**457.1**	**25.43**	**290.9**	**19.85**	**456.4**	**20.12**	**349.0**	**97.53**	**1,835.8**

Based on the above, approximately 4,247 acres of habitat would be affected by construction and operation of the project. However, about 317 acres of this habitat is classified as "poor" quality, and ABBs would have a substantially less chance of reproducing in such areas. Excluding poor quality habitat, approximately 404 acres of ABB habitat would be permanently lost, and 3,522 acres of ABB habitat would be temporarily lost; of these acres, 308 acres (76 percent) of the area permanently lost, and 1,814 acres (52 percent) of the area temporarily lost are classified as prime habitat. Additionally, 43 (11 percent) of the 404 acres permanently lost, and 718 (20 percent) of the 3,522 acres temporarily lost are classified as good ABB habitat. The duration of the temporary loss would depend on the time necessary to successfully restore the affected areas. In Oklahoma, this likely would occur more quickly than in the sensitive sandhill areas of Nebraska and South Dakota. Funds contributed to the ABB Habitat Conservation Trust to compensate for these losses, discussed in the *Post-construction Conservation Measures* section, below, would reflect the duration of habitat loss.

In South Dakota and Oklahoma, Keystone XL pipeline construction and related activities would likely adversely affect ABB in a variety of ways. If construction occurs during periods when ABB are active above ground in the early or late summer, movement of vehicles and other human activities in the ROW or on ancillary construction sites could cause mortality or injury of adult beetles through collision or compression by vehicles. Construction activities such as vegetation clearing, grading, and topsoil stripping, (i.e., if these activities occur during mid-summer when ABB are reproducing and raising broods underground), would likely cause direct injury or mortality of ABB adults, larvae, and eggs by crushing or exposure to desiccation during soil excavation. American burying beetles are sensitive to soil moisture and die quickly when desiccated (Bedick et al. 2006). Construction activities in the ROW that occur after grading and topsoil stripping would already be lost and additional ABB would not be drawn to the area from outside Project lands. Heavy equipment traffic in the ROW and on auxiliary construction sites (e.g., pipe yards, contractor yards, construction camps, pump stations) would compact the soil and may also injure or crush ABB adults, larvae, and eggs.

Mortality Estimates

South Dakota: In South Dakota, no ABB presence/absence surveys were conducted along the pipeline ROW or on other Project lands. However, the mortality of adult ABB caused by construction of the pipeline can be estimated by combining the number of acres affected within the ABB range in southern Tripp County (from Table 4, earlier), with the number of ABB estimated to occur per acre [from Backlund et al. (2008) population estimate for southern Tripp County], and then using a habitat quality modifier to adjust for the likelihood of higher numbers of ABB in better habitat. For example: 1,000 ABB/54,363 acres (Backlund et al. 2008) = 0.01839 ABB estimated per acre. Modifiers that reflect habitat quality are: prime = 4, good = 3, fair = 2, marginal = 1, poor = 0 (i.e., encountering a beetle in poor habitat is unlikely). Using the acres (temporary and permanent combined) provided in the Table 4, approximately 38 ABB may be killed or injured as a result of construction activities in South Dakota (Table 8).

If construction and use of auxiliary areas takes place during the breeding season in mid-summer, larvae and eggs would be destroyed as well as adults. Assuming a 50:50 sex ratio in the population, there may be 19 pairs of ABB affected by construction. Given the typical range of 12 - 18 larvae per brood, perhaps 15 larvae or eggs per pair of ABB (i.e., 285 offspring) might be destroyed by construction activities on the ROW and other Project lands in South Dakota.

Table 8. Estimated number of American burying beetles killed or injured as a result of Keystone XL pipeline construction in Tripp County, South Dakota.

Habitat Quality	Acres Impacted	ABB/Acre	Quality Modifier	Total ABB
Prime	374.3	0.018	4	26.95
Good	118.5	0.018	3	6.40
Fair	106.8	0.018	2	3.84
Marginal	30.0	0.018	1	0.54
Poor	0	0.018	0	0
Total	**629.6**			**37.73**

Oklahoma: In Oklahoma, no ABB presence/absence surveys were conducted along the pipeline ROW or on other Project lands. However, ABB population densities in several Oklahoma counties were estimated by the Service in 2004, based on assessments of available habitat and results of trapping efforts in those counties. These can be used to estimate the number of ABB directly affected in Oklahoma using the same method as for South Dakota, above. For the purposes of the following calculations, the habitat quality modifiers used are: prime = 4, good = 3, fair = 2, marginal = 1, poor = 0. Using the acres provided in the Table 7 (temporary and permanent combined), approximately 11 ABB that may be killed or injured as a result of construction activities in Oklahoma.

As above, assuming a 50:50 sex ratio, about five pairs of beetles may be killed. If the pipeline is constructed during the breeding season, and an estimated 15 eggs/larvae per brood were destroyed, then an additional 75 ABB offspring might be killed (Table 9).

Table 9. Estimated number of American burying beetles killed or injured as a result of Keystone XL pipeline construction in Oklahoma.

	Marginal Habitat			Fair Habitat			Good Habitat			Prime Habitat			Total
County	**QD***	**Acres**	**ABB**	**QD***	**Acres**	**ABB**	**QD***	**Acres**	**ABB**	**QD***	**Acres**	**ABB**	**#ABB**
Atoka	0.0013	26.4	0.03	0.0026	72.6	0.19	0.0039	81.1	0.32	0.0052	94.1	0.49	1.03
Bryan	0.0009	144.6	0.13	0.0018	74.3	0.13	0.0027	231.4	0.62	0.0036	31.9	0.11	0.99
Coal	0.0033	190.3	0.63	0.0066	52.5	0.35	0.0099	54.9	0.54	0.0132	57.5	0.76	2.28
Hughes	0.0065	91.5	0.59	0.0130	84.9	1.10	0.0195	81.3	1.59	0.0260	125.9	3.27	6.55
Total			**1.38**			**1.77**			**3.07**			**4.63**	**10.85**

* QD = the habitat quality modifier multiplied by the estimated ABB densities in the counties.

The Service is required to use the best information available in its determinations, but when estimating ABB densities based on mark-recapture studies, the Service also recognizes that the "best" information available usually includes some uncertainty. Estimates of population densities, in South Dakota and Oklahoma, above, are based on mark- recapture field studies. Mark-recapture studies estimate the number of animals in population based on the proportion of marked animals recaptured during a series of trapping efforts. The method has limitations, particularly when wide-ranging and potentially inaccessible (when breeding underground) species such as ABB are involved. Therefore, the estimated of the number of ABB killed or injured due to construction activities, are not precise, and should not be considered definitive.

Nebraska: In Nebraska, the number of ABB killed or injured as a result of construction activities is expected to be very low due to the pre-construction conservation measures described above. Nevertheless, due the probability of not being able to completely clear all individuals from the corridor, a small number of ABB may still occur over the 100 miles of construction sites in the ABB range in Nebraska despite extensive trapping and relocation efforts. For example, in areas with particularly high density of ABB, a trap might not be cleared (i.e., not reach 3 consecutive trap nights without capturing ABB). If the average number of ABB per trap night in such a trap is less than 5, the Service and NGPC have agreed that no subsequent trapping would be necessary. It is anticipated that no more than ten of the trap sites in the 100 miles of trapping may involve that number of ABB. Assuming that 10 trap sites cannot be reduced below 5 ABB per trap night, the number of ABB potentially impacted per acre of pipeline project can calculated as follows:

Each trap has an assumed 0.5 mile radius (approximately 500 acres) of attraction (Bedick et al. 1999). If an average of 5 ABB per trap night are caught over a 10 day trapping period (with no recaptures), it is assumed that 50 ABB are present in the 500 acres area sampled by the trap, or 1 ABB per ten acres, or 0.1 ABB/acre. If ten traps are not cleared, 133 acres of potentially suitable habitat (i.e., 13.3 acres of Project ROW per mile trapped) with 0.1 ABB per acre would be affected, resulting in a potential take of 13 ABB. Assuming a sex ratio of 50:50 males to females, and 7 females are killed by construction activities, potentially 105 offspring would be lost assuming an average of 15 offspring per brood. Therefore, the anticipated mortality from inability to remove beetles by trap and relocation is 13 adult ABB, plus potentially 105 offspring, if construction occurs during the breeding season.

The ABB lives for one year and breeds only one time. Therefore, the offspring produced in one summer form the entire breeding population in the next summer. The loss of pre-breeding adults, larvae or eggs due to Project activities removes not only those individuals, but a portion of the following years breeding population and the young they might have otherwise produced. Therefore, the loss of adult ABB represents a reduction in population reproductive potential.

However, the loss of a generation of ABB from a limited area in the current range of the ABB constitutes a short-term pulse of adverse effect, and has a smaller effect on the species ability to survive than a longer-term, chronic effect.

Miscellaneous Impacts of Construction Activities

Artificial lighting during construction has the potential to attract ABB, as they are known to be positively phototrophic. Lights used during nighttime construction can disrupt ABB foraging behavior and increase predation on ABBs. However, lighting used during construction activities would be down-shielded to reduce the level of light pollution from the activity and limit the impacts to ABB to a smaller area. Localized contamination of soil from diesel fuel or oil spills could occur during refueling or maintenance. However, in the event of a spill, Keystone would implement a Spill Prevention Control and Countermeasures Plan (SPCC Plan) for potential construction-related fuel spills which would mitigate or avoid any short-term impacts (Keystone 2011). In addition, ABB would be unlikely to be in areas that had been stripped of vegetation, such as the ROW or construction yards, where the refueling and maintenance of equipment would be done. Additionally, all fueling vehicles would carry sufficient absorbent material to contain and facilitate removal of up to moderate fuel spills.

Foraging efficiency of local ABBs would be reduced temporarily by construction activities and permanently from habitat fragmentation due to placement of permanent above ground facilities (pump stations in all three states, and a permanent access road in Oklahoma). Reduced availability of carrion may result from greater competition for carrion from vertebrate scavengers attracted to edge effect of pipeline facilities; this is especially true in Oklahoma, in those areas where the pipeline ROW transects blocks of natural woodland (i.e., where ROW is not co-located with utility or other pipeline ROWs.

Operation of the Project

Thermal Effects from Heat Dissipation

Transport of oil through the pipeline creates heat that is dissipated through the soil to the ground surface. The TQUEST geothermal model was used to predict soil temperature changes at the ground surface and at various depths and distances from the center of the pipeline (Hazen 2011). Combined with general assumptions about ABB life history, it is possible to estimate whether adverse impacts to ABB would likely result from the increases in soil temperatures caused by operation of the pipeline.

In northern areas of the ABB range, such as Nebraska and South Dakota, soil temperatures decline to below freezing during the winter when the beetles are underground. The ABB in northern parts of their range likely have adapted a survival strategy that requires cooling to or very near freezing to slow metabolism such that fat reserves are sufficient to last until emergence in late May or early June. Whether ABB would suffer mortality from starvation if they were prohibited from freezing is not known, but the Service believes that substantial decreases in length of time soil temperatures are below freezing might cause the beetles to use too much fat during the winter months when they are underground. In addition, warming of the soil from the pipeline may also cue the beetles to emerge prematurely (i.e., prior to midnight air temperatures reaching about 60 degrees F.). This may result in ABBs coming to the surface when air temperatures preclude foraging activity, or to use more resources to re-bury themselves in the soil, assuming temperatures are warm enough to

permit such activity. Additionally, the early emergence of ABB may affect their ability to reproduce successfully because they would temporarily be out of synch with the vast majority of ABB in the region (i.e., ABBs overwintering outside the zone of temperature change likely would remain underground for days or weeks until natural environmental cues caused them to emerge).

Impacts from heat dissipation vary with the depth ABBs overwinter in the soil, and there are a broad range of depths reported in the literature. Schnell et al. (2008) noted in field experiments in Arkansas that ABB overwintered at a depth of 20 cm (approximately 8 inches). However, most information refers to depth of carcass burial associated with reproduction and depths of reproductive chambers are described as "several inches" Ratcliffe (1996, p. 46), or up to 60 cm underground (approximately 24 inches) (Wilson and Fudge 1984, Pukowski 1933, and Hinton 1981; as cited in Scott 1998). The ABB is the largest carrion beetle in North America (Ratcliffe 1996), and Eggert and Sakaluk (2000) found that larger beetles buried carcasses deeper in the soil. Thermal impacts from operation of the proposed pipeline were evaluated by analysis of modeled temperature changes (compared to background) at depths of 6 inches, 12 inches and 24 inches, and at various distances from the pipeline center line. Two basic soil types at different water saturations were included in the analysis (Table 10).

The temperature modeling predicted that background temperatures (i.e., at 80 feet from the center line of the pipe) would be below freezing during the winter at a depth of 24 inches in all but the driest of the two types of soils (Table 10). In the three sandy soils prevalent in the Sandhills (i.e., SH4, SH5, and SH6), background temperatures at 12 inches depth equaled or fell below 32.0 degrees F. during seven or eight two-week intervals during the winter. However, at 11 feet from the pipe (22-foot-wide subcorridor), soil froze during four and six two-week intervals (i.e., in SH5 and SH6), and not at all in SH4 soils (Table 10). Modeling showed a reduction in the incidence of frozen soil from 25% (twice) to 100% (twice) at a depth of 12 inches and 11 feet from the pipe center line. Because the model produces output at two-week intervals, the duration of temperature shifts would likely be substantial, and would adversely affect ABB overwintering at those depths. While acknowledging uncertainties and assumptions associated with the modeling and biology of the ABB, the Service nevertheless considers the modeled temperature shifts substantial enough to render habitat out to 11 feet from the pipeline (i.e., a 22-foot width) unsuitable habitat for the ABB. It is possible that the impact extends beyond the 22-foot width, but 11 feet from the pipe center was the maximum modeled distance that could be compared to background temperatures. Therefore, permanent impacts to ABB habitat from operation of the pipeline include the central 22-foot width affected by the heat generated during pipeline operation.

During operation, the proposed Keystone XL pipeline is considered to be a permanent fixture underground, with operations and maintenance occurring nearly continuously for 50 years. Keystone (2011) has stated that adverse effects to ABB resulting from a crude oil spill from the operating pipeline are highly improbable due to: 1) the low probability of a spill, 2) the low probability of a spill coinciding with the presence of ABBs, and 3) the low probability of an ABB contacting the spilled product (see Keystone 2011: Appendix B; Pipeline Risk Assessment [PRA] and Environmental Consequence Analysis). Subsequent to issuance of the BA, the frequency of spills PRA was revised to include more recent information on frequency of spills associated with the Keystone pipeline, an existing pipeline located principally to the north and east of the proposed Project. Of the 14 spills unintentional releases of crude oil between pre-startup testing and May 29, 2011, none involved the pipeline itself but rather occurred at pump stations and main line valves. In each of these incidents, the oil was discovered early, in most cases the leaks were limited to the

ground surface, the oil was minimal and was cleaned immediately and no environmental damage was reported. While there is still a very low probability of that individual ABBs would come in contact with the oil from a spill, the more likely affect to ABB would come from soil compaction and soil disturbance during by the clean-up activities necessary in the unlikely event of a failure of the pipeline.

Table 10. The incidence of modeled soil temperatures at freezing or below (i.e., ≤ 32º F. at various distances from pipeline center line, and at different depths. Incidence of temperatures ≤ 32º F. are described in W-X-Y-Z format, where W is the incidence of freezing at the ground surface, X is the incidence of freezing at a depth of 6 inches, Y is the incidence of freezing at 12 inches and Z is the incidence at 24 inches deep. Temperature output is modeled at 2-week intervals. Differences in incidence of frozen soil between background (80 feet) and at 11 feet from the center of the pipe (i.e., a 22-foot width) are shown in bold, red, italics.

	Silty Loam Soil			**Sandy Soil**		
Distance from Center Line	**SH1**	**SH2**	**SH3**	**SH4**	**SH5**	**SH6**
80 ft. (BkGr)	8-***9-6***-0	8-8-***7-3***	9-***8-8-2***	8-***8-7***-0	8-***8-7-4***	9-***8-8-5***
11 ft.	8-***7-0***-0	8-8-***5-0***	9-***7-6-0***	8-***5-0***-0	8-***7-4-0***	9-***7-6-0***
7 ft.	8-5-0-0	8-6-0-0	7-6-0-0	7-3-0-0	7-5-0-0	7-6-0-0
3 ft.	8-2-0-0	6-0-0-0	5-0-0-0	6-0-0-0	4-0-0-0	4-0-0-0

Lights associated with operation and security of above-ground pump stations may have an adverse effect to ABB. However, only one light above each pump station door would be used during pipeline operation and those lights would be down-shielded in areas within the range of ABBs in South Dakota, Nebraska and Oklahoma. Down-shielding of the lights lessens the likelihood that ABB would be attracted to them.

Post-construction and Reclamation

Post-construction activities associated with reclamation, such as grading to lands to approximate pre-construction contours, would not result in additional mortality of beetles on already disturbed lands. On auxiliary lands where the grass may not have been removed, soil compaction from vehicular traffic would have rendered this areas unusable for reproduction by ABB (i.e., ABB cannot bury carcasses in compacted soils). Therefore, ripping Project lands to loosen compacted soils as part of the reclamation process likely would not result in additional ABB mortality. However, if soil erosion occurs and extends to off-project lands, such erosion may disturb or expose ABB broods or over-wintering adults to adverse environmental conditions if they are displaced. Indirect mortality of eggs and larvae could occur if adults abandon active broods in occupied habitat as a result of disturbance or habitat disruption.

Regular post-construction maintenance of the ROW through mowing in wooded areas may cause mortality of adult ABB exposed to mowing equipment. Grassland areas would likely not be mowed as a part of regular maintenance of the ROW (J. Schmidt, pers.comm.). If mowing of the ROW reduces vegetation height to less than 8 inches, the soil may dry to the point that: 1) ABBs have difficulty burying carcasses, 2) soil may not structurally support reproductive chambers, or 3) adult or larval ABB become desiccated (Bedick 2006). Any of these potential consequences of leaving grass and vegetation less than 8 inches tall could adversely affect ABB reproduction (Appendix B: American Burying Beetle Trapping Protocol and Conservation Measures for Use in Nebraska).

Exotic, invasive grasses are disruptive to the native ecosystem (Smith and Knapp 2001). Sod-forming, cool season grasses do not promote conservation of the ABB because they slow carcass burial (McPherron and Hoback, personal communication). Additionally, genetically modified cultivars of prairie grasses or non-local seed mixes can affect plant community structure, ecosystem function, and the short- and long-term success of grassland restorations (Gustafson et al. 2004; Annese et al. 2006, Martin et al. 2005). Because fragile Sandhills habitat can be difficult to revegetate, there is a possibility that post-construction restoration and maintenance of ABB habitat in the Project ROW may fall short in some areas of that required to support ABB. Circumstances resulting in such conditions may include drought, wind erosion, or establishment of invasive species in the restored areas. However, the driest sandy areas near ridge tops are the most prone to wind erosion, and these areas are poor ABB habitat because soils are too dry. Therefore, the loss of ABB habitat due to wind erosion alone is not likely unless drought conditions destabilize large areas of the sandhills.

Effects of Mitigation and Conservation Measures

The following proposed executing agreements were developed during formal consultation and will go into effect if and only if the DOS determines to issue a permit for the proposed Keystone XL pipeline and prior to construction in the states of South Dakota, Nebraska, and Oklahoma.

Monitoring Program

The DOS would retain a third-party contractor to develop and implement an American burying beetle monitoring program. This monitoring program would be approved and overseen by DOS in consultation with USFWS. Keystone would fund the monitoring program prior to construction of the proposed Project.

Monitoring would not replace the environmental quality control plan or the actions that Keystone would put in place, but is in addition to those tasks and would serve as a quality control monitor on behalf of DOS. The monitoring program would include but is not limited to, a combination of site visits, aerial surveillance, spot checks for seed mixture, and transect sampling for plant restoration that would be recorded in monitoring logs with photographs to provide a reasonable level of confidence that mitigation measures for restoration are followed. Monitoring would look at, but is not limited to, replacement of top soil; compliance with seeding specifications and seed mix; erosion control; that construction impacts match permitted footprint, and habitat restoration for the American burying beetle. This monitoring program would identify the number of acres disturbed by the project in the states of South Dakota, Nebraska and Oklahoma and the number of acres restored as described in the Reclamation Performance bond stipulations (see below). The information collected would be used to evaluate whether the impacts to ABB described in this biological opinion are comparable to impacts that result from construction and operation of the Project.

ABB Habitat Conservation Trust

The establishment of an ABB Habitat Conservation Trusts as described in Appendix D would offset permanent and temporary losses of ABB habitat in all three states at ratios greater than 1:1, and thereby provide long-term benefits to ABB populations in those areas. Land crossed by the pipeline in South Dakota, Nebraska and Oklahoma is almost entirely in private ownership. The

ABB Habitat Conservation Trusts would perpetually protect grasslands through easement or purchase from willing landowners at ratios greater than a 1:1, assuming lands temporarily disturbed are restored to conditions stipulated in the Reclamation Performance Bond. Protection of privately owned grasslands at greater than a 1:1 ratio would also incrementally offset habitat loss of grasslands from conversion to agriculture in the South Dakota and Nebraska Sandhills. The number of acres of prime habitat lost would be mitigated at a 3:1 ratio, and the loss of good habitat would be mitigated at a 2:1 ratio. These two classifications of quality habitat (combined) comprise 87 percent of the 404 acres permanently lost, and 72 percent of the 3,522 acres temporarily lost due to Project construction and operation. Proper management and protection of grasslands through the Habitat Conservation Trusts would more than offset permanent and temporary loss of ABB habitat due to construction and operation of the Project and is consistent with recovery actions 1.23 and 5.3 in the Recovery Plan for the American Burying Beetle (USFWS 1991).

Reclamation Performance Bond

To ensure restoration of disturbed areas within ABB habitat, Keystone would establish a reclamation performance bond that includes the stipulated requirements in Appendix E. Written conditions would ensure this performance bond would be accessible and executed by DOS, or a third party contractor under direction of DOS, in the case that disturbed land in the ABB habitat area, as defined by the Biological Assessment, should fail to re-vegetate in a manner as outlined in Appendix E, and if Keystone fails to take corrective action. Release of the bond would be solely at the discretion of DOS after soliciting recommendations from USFWS and NGPC. The establishment of the reclamation performance bond serves as an additional back-up to measures in the Project CMRP which would be undertaken by Keystone to successfully re-vegetate lands temporarily affected by the Project to vegetation conditions in surrounding areas.

Effects of Interrelated and Interdependent Actions

The Service is required to evaluate the effects of the action under consideration (i.e., DOS issuance of a Presidential Permit enabling the Project) "…together with the effects of other activities that are interrelated to, or interdependent with, that action." (50 CFR §402.02). Interrelated actions are those that are part of the larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

Power Lines to Pump Stations and Associated Substations

The Construction of power lines to pump stations and the associated substations are interrelated with the action and may cause adverse impacts to ABB within the range of the species in each of the three states. These impacts might include mortality of ABB during construction of the power lines due to interaction with construction equipment during clearing of vegetation, if necessary, and during excavation of holes or foundations for the power poles. Restoration of vegetation after construction would not likely cause adverse effects unless grading of undisturbed habitats are involved, and those instances should be infrequent. Maintenance of vegetation under the power lines may also result in ABB injury or mortality if mowing or use of herbicides or pesticides occurs during times when ABB are active above ground.

Only five of the 30 planned power line routes to pump stations would occur within the current occupied range of the ABB: power lines to pump stations 21, 22, 23, 34 and 35, which collectively total 85.6 miles (DOS 2011b, Table 2.5.1-1). The power line to pump station number 35 would be built with funding from RUS, and the power company building the line is currently in consultation with the Service office in Tulsa, Oklahoma, regarding ways to minimize or mitigate impacts to ABB and other threatened and endangered species affected by construction of the line. (Information on the other four lines is included in the *Cumulative Effects* section, below). Therefore, adverse effects to ABB from the construction of these five power lines to pipeline pump stations is not expected to be substantial.

Big Bend to Witten 230 kV transmission line

In South Dakota, the principal population of ABB occurs south of Highway 18 in southern Tripp County. For this reason, impacts to ABB from construction of the pipeline Project were considered only south of Highway 18 (Keystone 2011). The Big Bend to Witten 230 kV transmission line in Tripp County, South Dakota, occurs north of Highway 18, or outside the southern Tripp County area where ABB occur in substantial numbers. Therefore, impacts from this interrelated Big Bend to Witten transmission line are not likely to result in adverse impacts to ABB.

Bakken Marketlink Project

Aside from the Keystone XL pipeline to transport the oil, this interrelated project would consist of piping, booster pumps, meter manifolds and two tank terminals; one terminal would be near Plevna and Baker, Montana, and the second would be at the proposed Cushing tank farm in Lincoln County, Oklahoma. In addition, the project would include a proposed pipeline, approximately 5 miles long, originating at an existing Montana tank farm facility in Township 7N, Range 58 East, Section 4. The ABB does not occur in Montana, so the northern end of this project would have no impact on the ABB. The southern facilities near Cushing would be located in a highly developed area outside the current range of ABB in Oklahoma. Therefore, the construction and operation of this facility would not to adversely affect ABB.

Cushing Marketlink Project

This interrelated and interdependent project would be constructed and operated within the boundaries of the Cushing Tank Farm, in Lincoln, County. Like the Bakken Marketlink project, this activity would occur outside the current range of ABB and, therefore, would have no adverse impact on the endangered ABB.

CUMULATIVE EFFECTS

Cumulative effects are those effects of future, non-federal state, tribal, local government, and private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Endangered Species Act (ESA).

In addition to those projects with a federal nexus that undergo consultation, there are numerous actions that do not require federal funding, permitting, or authorization and consequently do not require consultation with the Service. Any of several private development projects may occur in the three states. Examples of these include tree management and harvest on private holdings in Oklahoma, and conversion of native prairie rangeland to cropland in South Dakota and Nebraska.

When large areas of native woodland and native grasslands are affected, loss and fragmentation of these habitats incrementally reduce the recovery potential of ABBs by damaging the functionality of these supporting ecosystems. For example, one owner of approximately 1,500 acres of grassland in Keya Paha County, Nebraska, is planning to convert that grassland to row crops. Trapping for ABB adjacent to this grassland found low densities of ABB present, but all of the ABB using the converted grasslands would be lost when the grasslands are converted to row crops. This conversion causes a much greater adverse impact to the ABB population than the 110-foot-wide swath of the pipeline ROW through the Sandhills, because the conversion to cropland would remove large geographic areas of habitat, where the temporarily lost habitat in the pipeline ROW would be lost in a linear area approximately 110 feet wide and in small, isolated tracts. Included as cumulative impacts are the effects of privately owned and constructed power line projects without a federal nexus, such as the power lines to pump station 21 in southern South Dakota, 22 and 23 in Nebraska, and to pump station 34 in Oklahoma. Each of the companies building these power lines have sent letters to the Service indicating their wouldingness to coordinate with the Service and incorporate measures into their projects to minimize or mitigate adverse impacts to endangered and threatened species. For example, in Nebraska, trapping and relocation of ABB within power line ROWs to pump stations 22 and 23 would take place prior to construction, and following the Service and NGPC protocols for that activity (see Appendix B of this document). Likewise, the companies building the remaining two power lines and substations would likely implement measures to minimize or mitigate impacts to ABB because the power companies have submitted letters to the Service committing to work with the Service to identify such measures. Therefore, the effects of these power lines and substations associated with Project pump stations would not negatively affect ABB.

There are over 400 new oil and gas wells constructed annually, on average, in eastern Oklahoma, with the majority not having a federal nexus. Additionally, numerous oil and gas seismic surveys and pipelines are constructed through the counties affected by the proposed Project. There are multiple new or expanding surface coal mines in southeastern Oklahoma. Commercial development is expanding to undeveloped lands on the periphery or in suburbs of cities. Residential developments are being constructed outside city limits or in previously undeveloped or rural areas. The specific numbers of new or anticipated projects and associated acres of disturbance are difficult if not impossible to quantify. However, it is clear that there are numerous, continuing, and expanding impacts to ABBs and their habitat from projects without a federal nexus. All of the above activities cause loss and further fragmentation of ABB habitat in Oklahoma, reducing incrementally the ability of the species to recover in that state. Construction activities that disturb soils within the current range of ABB cause mortality of ABB adults, and (potentially) ABB larvae and eggs. Although direct mortality of ABB from individual construction activities is local and constitutes a short-term adverse effect, the cumulative loss of ABB from multiple development projects in a larger area may eventually reduce the ability of a given population to survive in a fragmented landscape.

Lighting associated with construction of new roads (i.e., not associated with the proposed Project) and new residential developments can result in harassment and disruption of normal feeding behavior when ABB are attracted to lights. Future construction and developments of this type by state or private entities may harass ABB and interfere with feeding or breeding by distracting the ABB.

CONCLUSION

"Jeopardize the continued existence of means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." (50 CFR §402.02). After reviewing the current status of the ABB, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed Project is not likely to jeopardize the continued existence of the ABB. No critical habitat has been designated for this species; therefore, none would be affected. The Service's determination is based on the following primary factors.

- Since the Recovery Plan was developed in 1991, numerous other populations have been discovered, and the recovery objective of reducing the immediate threat of extinction through discovery or establishment of new populations has been met (USFWS 2008a). Currently at least four eco-regions support ABB populations estimated at greater than 1000 ABB (USFWS 2008a). Based on extinction modeling by K. Holzer, Amaral et al. (eds)(2005) surmised that population of greater than 1000 ABB have the potential to remain demographically viable over the long term in the absence of severe catastrophic events or reductions in carrying capacity through reduced carcass availability, habitat loss or fragmentation.

- The sentinel population of ABB on Block Island off the coast of Rhode Island is stable, as is the population of ABB in southern Tripp County, South Dakota. The moderately large Nebraska Loess Hills population was thought to be declining in 2006 and 2007, but that short-term decline was likely caused by the effects of drought on carrion availability (W. Hoback, pers. comm.), and that population has increased in recent years with relief from the drought. Additionally, several habitat improvement projects in the Loess Hills have or will soon remove counterproductive red cedars from the Loess Hills, improving ABB habitat there. Population levels in Oklahoma and Arkansas fluctuate every other year or so, but downward or upward trends in the long term are difficult to ascertain. Fort Chaffee in western Arkansas and Fort Gruber in eastern Oklahoma have robust populations that, along with populations in Nebraska, are believed to be resilient to the effects of stochastic weather events (USFWS 2008a). Little information is available on trends in the small populations of ABB in Kansas and there is some evidence that a small population of ABB in northern Lamar County, Texas, may be declining (USFWS 2008a). Therefore, although one small population on the periphery of the range may be declining, available evidence indicates that populations of ABB are relatively stable.

- Based on trapping efforts over the last 2 years in the Nebraska Sandhills, many more ABB occur in this population than previously recognized. In 2010, more than 1,000 ABB were trapped on and near Project lands in Nebraska with relatively limited trapping. Whether the Nebraska Sandhills and Oklahoma populations are stable, increasing or decreasing is

not known. However, as noted above, large populations are more resilient to short term adverse impacts than small populations.

- The construction and operation of the Keystone XL pipeline would likely cause mortality, harm, and harassment of ABBs in South Dakota, Nebraska and Oklahoma. There is considerable uncertainty involved with estimating population levels or densities of ABB in any area, including lands affected by the proposed Project. Nevertheless, the best data available regarding the number of ABBs on Project lands in South Dakota, Nebraska and Oklahoma suggest an estimated mortality of 38 adult ABB in South Dakota, 13 adult ABB in Nebraska, and 11 ABB in Oklahoma may occur. If construction occurs during the breeding season, an additional 285, 103, and 75 larvae or eggs may be lost in South Dakota, Nebraska, and Oklahoma, respectively. These losses constitute a one-time or short-duration pulse effect to the ABB populations in these states. Such consequences are less likely to affect population survival than longer-duration adverse effects to the populations. Additionally, ABB naturally experience fluctuations caused by poor reproduction in some years (i.e., due to weather, disease, etc.), and these short-term stochastic events do not have long-term effects in robust populations like those in South Dakota, Nebraska, and portions of Oklahoma (USFWS 2008a). Therefore, loss of ABB at these anticipated levels is not likely to appreciably reduce survival and recovery of the species in the wild.

- In Nebraska, where record concentrations of ABB occur, trapping and relocating of ABB from Project lands, followed by measures to discourage reestablishment of ABB on Project lands prior to pipeline construction, would substantially reduce mortality of ABB caused by construction and operation of the pipeline. ABB would be removed from Project lands, and moved to prime or good habitat at release sites known to be occupied by the species. Procedures implemented at the release site further promote ABB survival and success at their new location. These measures would minimize adverse effects to survival of the ABB population in Nebraska.

- The cumulative loss of ABB habitat from multiple development projects (especially in Oklahoma), and conversion of grasslands to cropland (in Nebraska and South Dakota) may eventually reduce the ability of a given population to survive in a fragmented landscape. However, this level of cumulative impact has not been reached in Nebraska and South Dakota, where population levels appear healthy and stable in a landscape that still consists of broad areas of native grassland. Thus, based on the best available information, current levels of moderate to high quality ABB habitat are supporting populations of ABB across the vast majority of its current range.

- Permanent loss of ABB habitat as a result of Project construction and operation causes a decrease the availability of suitable habitat for ABB to successfully overwinter and reproduce. The ABB cannot shelter (overwinter) or reproduce in areas covered by above ground facilities such as pump stations. Soils heated by dissipation of heat from the pipeline in an approximately 22-foot-wide corridor likely do not cool to freezing or below long enough in South Dakota and Nebraska to provide suitable overwinter shelter for the beetle. A total of approximately 404 acres of ABB habitat would be permanently lost, 308 acres (52 percent) of which is prime habitat. Of the 3,522 acres of ABB habitat

temporarily lost due to construction and operation of the Project, 1,814 acres (76 percent), is also prime habitat. However, the loss of this amount of habitat spread over approximately 234 miles of ROW and areas under isolated pump stations does not constitute a significant portion of available habitat for ABB breeding, feeding and sheltering. For example, in the Nebraska Sandhills, less than 0.054 percent of grasslands in the counties with ABB affected by the Project would be temporarily lost, and less than 0.010 of the grasslands in the same area would be permanently lost (see also Table 7). Therefore, this permanent habitat loss would not appreciably reduce the likelihood of survival and recovery of the ABB. Moreover, because lost acres of high quality habitat are mitigated at a 3:1 or 2:1 ratio, the establishment and funding by Keystone of the ABB Habitat Conservation Trust as described in Appendix D is expected to more than offset the effects of the habitat loss, provided restoration of habitat temporarily lost is restored as stipulated in the Reclamation Performance Bond (Appendix E).

- Project plans include the restoration of all grassland areas temporarily affected by construction of the pipeline to the vegetation type and quality existing adjacent to the affected areas. Progress and success of habitat restoration will be monitored by DOS and reported to the Service. In the event that any areas fail to restore to surrounding vegetation conditions as noted above and, to the extent that funds are not available under the Reclamation Performance Bond, the ABB Habitat Conservation Trust (see below) will be supplemented accordingly so that other grasslands will be protected by easement or purchase from willing sellers in excess of the amount of grassland not restored. Based on experience with various landowners in the Sandhills, the Service believes there are sufficient willing landowners available to acquire easements or properties to offset grasslands lost to the Project. Successful restoration of grasslands temporarily affected by the Project will minimize adverse effects to the grassland ecosystem necessary for survival and recovery of ABB populations.

- To ensure restoration of disturbed areas within ABB habitat, Keystone will establish a reclamation performance bond that includes the stipulated requirements in Appendix E. Written conditions will ensure this performance bond will be accessible and executed by DOS or a third party under the direction of DOS in the case that disturbed land in the ABB habitat area, as defined by the Biological Assessment, should fail to re-vegetate as outlined in Appendix D, and if Keystone fails to take corrective action. Release of the bond will be solely at the discretion of DOS after soliciting recommendations from USFWS and NGPC.

- The establishment of an ABB Habitat Conservation Trust (Trust) as described in Appendix D will offset permanent and temporary losses of ABB habitat in all three states at ratios greater than 1:1, and thereby provide long-term benefits to ABB populations in those areas. Land crossed by the pipeline in South Dakota, Nebraska and Oklahoma is almost entirely in private ownership. In addition to temporarily disturbed lands being restored, the ABB Habitat Conservation Trust will perpetually protect grasslands through easement or purchase at ratios greater than a 1:1. Protection and management of grasslands through the Habitat Conservation Trust will more than offset permanent and temporary loss of ABB habitat due to construction and operation of the Project and is consistent with recovery actions 1.23 (i.e., “Explore all measures necessary to provide long-term protection”), and 5.3 (i.e., “Provide protection and management for additional populations”) in the Recovery

Plan for the American Burying Beetle (USFWS 1991). Protection of privately owned grasslands at greater than a 1:1 ratio will also incrementally offset habitat loss of grasslands from conversion to agriculture in the South Dakota and Nebraska Sandhills. Habitat loss and fragmentation are two severe threats to the survival and recovery of ABB, and protection of more grassland than lost by the Project will ameliorate to some degree such grassland habitat loss and fragmentation. Actions that protect a functioning grassland ecosystem to sustain ABB populations will facilitate recovery of the ABB.

- Co-location of the Project ROW with other project easements or rights-of-way in Oklahoma, (i.e., already fragmented woodland habitats), and would reduce the effects of habitat fragmentation due to loss of woodland habitat. In Project areas, woodland ABB habitat would be converted to grassland habitat for ABB.

The proposed action would not appreciably reduce the survival and recovery of the ABB because conservation measures included as part of the Keystone XL Project would likely result in a net increase in protected ABB habitat. Within the context of stable or increasing populations in the northern portion of the species range, an increase in protected ABB habitat in an area where a portion of unprotected habitat may be lost through conversion to agriculture would improve the likelihood of survival and recovery of the species. The combination of the monitoring program and the reclamation performance bond (Appendices C and E, respectively) would ensure that the acres disturbed by the Project would be either restored appropriately, or mitigated at a rate exceeding a 1:1 ratio (i.e., 3:1 or 2:1 for prime and good habitat, respectively). While the ABB Recovery Plan provides criteria only for downlisting of the species, given the limited knowledge of populations at the time the recovery plan was developed in 1991, establishment of the Trust and the habitat protection it would enable are consistent with recovery actions 1.23 and 5.3 in the recovery plan (USFWS 1991). Protection of privately owned grassland habitat that is vulnerable to loss through conversion to agriculture, as it is in the Sandhills, would be particularly beneficial and facilitate survival and recovery of the species in the northern portion of the species range. Additionally, substantially reducing ABB mortality from Project construction and operation through pre-construction trapping, relocation and other measures would minimize loss of ABB in an important area of high ABB density. The ABB mortality that occurs as a result of the Project would constitute a short-term effect to the populations, which has less effect on survival and recovery than long-term effects. The combination of these primary factors, together with the others noted above, underlie the Service's opinion that the Keystone XL pipeline is not likely to jeopardize the continued existence of the endangered American burying beetle.

INCIDENTAL TAKE STATEMENT

Section 9 of the Endangered Species Act (ESA) and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful

activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by DOS so that they become binding conditions for any action, grant, or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. The DOS is the lead agency with oversight of the activity covered by this incidental take statement. If DOS (1) fails to assume and implement the terms and conditions or (2) fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, DOS must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement. [50 CFR §402.14(i)(3)].

Amount and Extent of Incidental Take Anticipated

The Service expects incidental take of ABB would be difficult to detect and monitor for the following reasons: 1) the ABB has a small body size making it hard to locate, which makes encountering dead or injured individuals unlikely; 2) ABB losses may be masked by annual fluctuations in numbers and movements of ABB; and 3) ABBs spend a substantial portion of their lifespan underground. Therefore, incidental take of adult ABB not caused by trapping, as well as incidental take of eggs and larvae, would be virtually impossible to detect and monitor. Unless otherwise noted, following factors apply to incidental take of ABB in each of the three states where ABB would be affected.

Anticipated Take from Pre-construction Activities

Incidental take associated with pre-construction trapping and relocation of ABB in Nebraska is one component of the proposed Project designed to minimize ABB mortality from Project construction in Nebraska. Some mortality directly caused by the trapping and transport during relocation may occur. Unpredictable incidents such as heavy rain, accidents, or predation of beetles in the traps may result in death or injury to the ABB. Based on Dr. W.W. Hoback's experience during the last 10 years study of ABB, the incidence of such unpredictable death or injury associated with trapping is approximately five ABB per 1,000 captured (W. Hoback, pers. comm). Therefore, the anticipated incidental take expected from the trapping and transport of approximately 2,018 ABB is the approximately 10 ABB. If trapping and relocation are repeated in 2012 due to unexpected delays in Project construction, the Service expects substantially fewer beetles would be captured during the second round of capture, so likely no more than three ABB would be taken in June of 2012.

Although trapping and relocating ABB away from Project lands would substantially reduce injury and mortality due to construction activities, relocation of ABB to areas already inhabited by ABB could potentially cause some intra-specific competition resulting in take of ABB. This take would be virtually impossible to document however, due to the small size of ABB and the difficulty in locating carrion with ABB in the act of defending it, burying it, or feeding on it.

Anticipated Take from Construction and Operation Activities

Incidental take in the form of mortality or injury of individual ABB is likely to occur as a result of Project construction in all three states. In South Dakota and Oklahoma, based on discussions of direct mortality and injury in the *Effects of the Action* section, the Service anticipates that 38 adult ABB may be taken in South Dakota, and 11 adult ABB may be taken in Oklahoma Assuming a sex ratio of 50:50, and if construction occurs within the breeding season, an additional 285 larvae or eggs may be taken in South Dakota, and 75 larvae or eggs may be taken in Oklahoma.

Although trapping and relocating of ABB would substantially reduce take associated with construction of the Project in Nebraska, it is possible that some areas may not be cleared entirely of ABB, despite the best to clear Project sites of ABB. For example, an area is considered "cleared" if no ABB are captured in an open trap for three consecutive days. Trapping efforts continue at each trap site for 10 days or until 3 consecutive days occur without capturing ABB, whichever comes first. Due to the high densities of beetles encountered at some of the trap sites, there may be instances where ABBs are not "cleared" within 10 days. Supplemental trapping would occur in these cases. If an average ABB per trap night of up to 5 ABB remain at a given trap site after the supplemental trapping, that site would no longer be trapped and those ABB would then be vulnerable to death, injury or harassment from pipeline construction activities in 2012. It is anticipated that no more than ten of the trap sites may involve that number of ABB. Assuming that 10 trap sites cannot be reduced below 5 ABB per trap night, the number of ABB potentially impacted per acre of pipeline project can be calculated as follows:

Each trap has an assumed 0.5 mile radius (approximately 500 acres) of attraction (Bedick et al. 1999). If an average of 5 ABB/trap night are caught over a 10 day trapping period, it is assumed that 50 ABB are present in the 500 acres area sampled by the trap, or 1 ABB per ten acres, or 0.1 ABB/acre. If ten traps are not cleared, 133 acres of potentially suitable habitat (i.e., 13.3 acres of Project ROW per mile trapped) with 0.1 ABB per acre would be affected, resulting in a potential take of 13 ABB. Assuming a sex ratio of 50:50 males to females, and 7 females are killed by construction activities, potentially 105 offspring would be lost assuming an average of 15 offspring per brood. Therefore, the anticipated mortality from inability to remove beetles by trap and relocation is 13 adult ABB, and potentially 105 offspring if construction occurs during the breeding season.

Due to its small size and life history, it is not possible to detect or directly monitor American burying beetle mortality caused by construction and operation of the Project. Therefore, acres of habitat disturbed by the Project would serve as a surrogate for direct mortality or injury of American burying beetles resulting from construction and operation of the Project. The monitoring program would identify the number of acres disturbed by the Project in the states of South Dakota, Nebraska and Oklahoma, and the number of acres restored as described in the Reclamation Performance bond stipulations. This information would be used to determine if the number of acres affected by the Project is comparable to the level analyzed in this Biological Opinion.

Permanent loss of ABB habitat as a result of Project construction and operation constitutes take of ABB in the form of harm because ABB cannot reproduce in areas covered by above ground facilities such as pump stations, and soils heated by dissipation of heat from the pipeline do not provide suitable overwinter habitat for the beetle. A total of approximately 404 acres of ABB

habitat would be permanently lost, and 3,522 acres of ABB habitat would be temporarily lost due to construction and operation of the Project. The establishment and funding by Keystone of the ABB Habitat Conservation Trust as described in Appendix D is expected to more than offset the effects of such harm, provided restoration of habitat temporarily lost is restored as stipulated in the Reclamation Performance Bond (Appendix E).

Reasonable and Prudent Measures (RPMs) to Minimize Incidental Take, and Corresponding Terms and Conditions for the RPMs

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of the American burying beetle (ABB). In order to be exempt from the prohibitions of section 9 of the Endangered Species Act (ESA), Keystone and its sub-Contractors must comply with the terms and conditions, which implement the reasonable and prudent measures and outline required reporting requirements. These terms and conditions are non-discretionary.

RPM 1: Mortality during the trap and relocation effort can be minimized to the extent possible through the use of knowledgeable field technicians experienced in the use of the Nebraska trap, relocation, and maintenance of cleared condition protocols.

Terms and Conditions for RPM 1:

1(a): Only field technicians who have been trained and have experience trapping and relocating ABB according to the approved protocols (Appendix B) would participate in the pre-construction "clearing" effort in Nebraska.

1(b): The trapping and relocation protocols would be consistently followed, (with exception noted in 1(c), below). These protocols are described in two December 2008 documents in Appendix B: "American Burying Beetle - Nebraska Trapping Protocol" and "Conservation Measure for the American Burying Beetle (ABB)," developed by the Service and NGPC. If any deviations from the protocol are necessary due to unforeseen circumstances, a change in field activity would be made only after consultation with both the Service Nebraska Field Office and the Nebraska Game and Parks Commission.

1(c): The protocols in Appendix B note that captured ABB would be relocated a minimum of 2 miles from the point of capture to reduce the potential for their recapture. The Service and NGPC recommend captured ABB be relocated to good or prime habitat a distance of three to five miles from the point of capture, whenever feasible.

1(d): To reduce the potential for post-release, intra-specific competition for carrion at relocation sites, no more than 50 beetles would be released at any re-location site, and the release site should be at least three to five miles from the capture site.

1(e): All injuries or deaths of ABBs would recorded along with apparent cause of mortality at the time of observation, and reported immediately to Mike Fritz at the Nebraska Game and Parks Commission (phone 402-471-5419), and Bob Harms at the Service. Following the trapping and relocation effort, a report would be submitted to the Nebraska Filed Supervisor, USFWS, and to the Nebraska Game and Parks Commission by October 31, 2011, documenting the trapping,

relocation and habitat maintenance (of cleared sites) activities. The report would include, at minimum, a summary of mortality by age and site, number and age of ABB captured per trap night, and average catch per trap night per MP and other Project land, and whether the site was "cleared." Where, when and at what distance ABB were released with a habitat rating of all release sites would also be documented, along with a description of post-clearing habitat modification activities.

1(f): The Service would contact the DOS designated point of contact when the Reasonable and Prudent Measures and Terms and Conditions set forth in the USFWS's Biological Opinion are not being met and work with DOS to remedy the situation(s). Reinitiation of consultation would occur if incidental take associated with trapping and relocation exceeds 10 ABB in 2011, and 3 ABB in 2012.

RPM 2: To the extent allowed and practicable, conservation measures to avoid or minimize ABB mortality resulting from construction must be implemented within the range of ABB in all three states. To that end, trapping and relocation of ABB would be implemented in high ABB population areas of the Nebraska Sandhills, and all other conservation measures listed in the BA to avoid or minimize impacts to ABB must be implemented in each of the states. In areas of Nebraska that are not "cleared" of ABB during the standard 5 days of trapping due to high ABB, would continue for up to 10 days. If trapping still does not meet criteria for being "cleared," additional measures such as repeat trapping would be implemented to minimize the potential for harm or harassment of ABB from construction the following year.

Terms and Conditions for RPM 2:

2(a): If trapping at a site fails to "clear" ABBs from the site areas in Nebraska, (i.e., no consecutive three days without ABB capture occurs at the site), the trap would continue until the area meets the criteria for "cleared", or until September 1, 2011, whichever comes first.

2(b): When subsequent attempts fail to "clear" an area prior to September 1, 2011, the following criteria would determine the required action. 1) If an average of five or more ABB per trap night are captured during the final attempts to clear the trap, then the trap- relocation process would need to be repeated on that area ***prior to construction*** during the next period when ABB are active above ground, or 2) if an average of 4.99 ABB or less are captured in the final bout of trapping, then no retrapping of the area would be required prior to construction the following season. During 2012, trapping attempts to relocate ABB would be limited to 10 days.

2(c): Keystone would train all workers operating in ABB habitat and would include discussion of American burying beetle habitat, biology, reasons for their decline, and responsibilities of all workers for the protection of the ABB (including removing food wastes from the ROW each day, reporting any ABB sightings to an Environmental Inspector, and avoiding bringing dogs and cats to the ROW). Keystone would produce a full color Endangered Species Card with a picture of the ABB and all of this information summarized on the card. The card would be handed out to all construction workers operating in ABB habitat.

2(d): Signs would be posted at all access points to the ROW highlighting the areas as ABB habitat and reminding workers to follow special restrictions in the area.

2(e): The Service would contact the DOS designated point of contact when the Reasonable and Prudent Measures and Terms and Conditions set forth in the USFWS's Biological Opinion are not being met and work with DOS to remedy the situation(s).

RPM 3: Keystone would use restoration methods described in Appendix A of the BA, in conjunction with agreements developed with the Service and NGPC, to restore lands to the condition of prairie grasslands adjacent to Project areas.

Terms and Conditions of RPM 3:

3(a): Keystone would employ all methods necessary to restore Project lands to pre-construction vegetation diversity as per stipulations in Reclamation Performance Bond, and within the bounds of circumstances within their control (i.e., landowner preferred re-seeding is exempted).

3(b): The funding of the ABB Habitat Conservation Trust (Appendix D) is based on the assumption that project lands not permanently affected would be restored to at least the characteristics of the surrounding land in four years. If this objective is not attained by the fall of year four post-construction, the monitoring program may be extended until restoration objectives of project lands are met. Additionally, if the habitat restoration objectives are not attained by the fall of year 4, post-construction, the Reclamation Bond established by Keystone (Appendix E) in the event of restoration failure, could be used to finance supplemental restoration efforts. In the event restoration is insufficient on Project lands by the end of year 8, post construction (i.e., Reclamation Bond stipulations not met), and to the extent that funds are not available under the Reclamation Bond, the ABB Habitat Conservation Trust would be supplemented by Keystone to reflect the additional temporal loss of those acres not reaching the goals established pursuant to the Reclamation Performance Bond (Appendix E). Supplemental amounts, if any, would be calculated on the same basis as the original compensatory mitigation. The acres not meeting pre-construction restoration goals by the fall of year 12, post-construction, would be deemed permanently lost, and the ABB Habitat Conservation Trust further supplemented for any acreage amounts not covered by the previous supplemental amount. Again, additional supplemental amounts, if any, would be calculated on the same basis as the original compensatory mitigation. When determining amount of ABB Habitat Conservation Trust supplementation, credit would be given for funds initially contributed to offset those acres of habitat permanently lost on the areas not meeting restoration goals.

3(c): By October 1 of each year, the DOS would submit an annual monitoring report to the Service documenting the monitoring accomplished and progress of restoration of Project lands. The report would detail and document the number of acres affected by Project activities , and the number of acres meeting reclamation stipulations of the bond [Appendix E]). At the end of this Agreement, all original files and documents would be provided to the Service.

3(d): The Service would contact the DOS designated point of contact when the Reasonable and Prudent Measures and Terms and Conditions set forth in the USFWS's Biological Opinion are not being met and work with DOS to remedy the situation(s). Reinitiation of consultation would occur if the number of acres of ABB habitat permanently lost within the current range of the species (i.e., as calculated in the effects section of this Biological Opinion- 404 acres) plus the number of acres in the same areas where restoration (as defined by Reclamation Bond stipulations)

fails to occur by the fall of post-construction year 12, is greater than anticipated in this Biological opinion.

CONSERVATION RECOMMENDATIONS

1. Conduct research on the ABB coordinated with the Service. For example, provide funding to: a) monitor use of restored Project lands by ABB or, b) evaluate success of various vegetation restoration methods or, c) investigate the effect of soil compaction on non-endangered burying beetles or, d) measure the actual temperature increases surrounding the operating pipe to determine accuracy of modeled temperature dissipation around operating pump.

2. DOS can promote actions supporting conservation of ABB through its responsibilities under section 7(a)(1) of the Endangered Species Act.

3. Minimize habitat loss and alteration by minimizing soil disturbance to the extent feasible, utilizing existing roads, staging areas, etc.

4. Avoid construction during ABB breeding and brood-rearing season, which is June thru August

5. Develop educational/informational materials, with the assistance of the Service, for placement onsite to inform visitors of the potential ABB presence in the area, encourage reporting of sightings, and potentially reduce the risk of potential disturbance scenarios. Distribution of the information to schools and the media may also assist ABB tolerance and promote public support for ABB recovery.

6. Develop incentives to encourage those blocks of grassland areas where the pipeline is placed to remain as native grasslands and not be converted to other uses or planted to non-native species. A concern exists that this project, with its new and/or improved road system, would facilitate conversion of grasslands to other uses; we recommend that Keystone promote continued conservation of grasslands along the Keystone XL pipeline.

CLOSING STATEMENT

This concludes formal consultation on the actions outlined in the May 19, 2011, request from the DOS for formal consultation on the construction and operation of the Keystone XL pipeline, as described in the Final Biological Assessment and subsequent additions/amendments to same. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control is authorized by law and if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, the specific action(s) causing such take shall be subject to reinitiation expeditiously.

The Service appreciates the cooperation extended by DOS, Keystone, CardnoENTRIX, exp Energy Services, Nebraska Game and Parks Commission, and multiple Service Ecological Services Field Offices in this consultation. If further assistance or information is required, please contact Martha Tacha or me at the above address or telephone (308) 382-6468.

Sincerely,

Michael D. George
Nebraska Field Supervisor

cc: Regional Director, USFWS, Denver, CO
Michael Schmaltz, TransCanada
Jon Schmidt, exp Energy Services
Lynn Noel, CardnoEntrix
Michelle Koch, Nebraska Game and Parks Commission

LITERATURE CITED

Amaral, M. and C. Mostello. 2007. Reintroduction of the American burying beetle (*Nicrophorus americanus*) to Penikese Island, Massachusetts 1990-1993 and post-release monitoring through 2006. Abstract submitted to American burying beetle conference in Tahlequah, OK, May 2007.

Amaral, M., A.J. Kozol, and T. French. 1997. Conservation strategy and reintroduction of the endangered American burying beetle. Northeastern Naturalist 4(3): 121-132.

Anderson, R.S. 1982. On the decreasing abundance of *Nicrophorus americanus* Olivier (Coleoptera: Silphidae) in eastern North America. The Coleopterists Bulletin 36: 362-365.

Annese, V., E. Cazzato, A. Corleto. 2006. Quantitative and qualitative traits of natural ecotypes of perennial grasses (*Dactylis glomerata* L., *Festuca arundinacea* Schreb., *Phalaris tuberosa* L., *Brachypodium ruestre* (Host) R. et S.) collected in southern Italy. Genetic Resources and Crop Evolution. 53(2): 431-441.

Ashmole, N.P. 1968. Body size, prey size, and ecological segregation in five sympatric tropical terns (Aves: Laridae). Syst. Zool. 17 (1968), pp. 292–304.

Backlund, D. C., G. M. Marrone, C. K. Wouldiams, and K. Tillman. 2008. Population Estimate of the Endangered American Burying Beetle, *Nicrophorus americanus*, Olivier (Coleoptera: Silphidae) in South Dakota. Coleopterists Bulletin 62(1): 9-15.

Backlund, D. C., and G.M. Marrone. 1997. New records of the endangered American burying beetle, *Nicrophorus americanus* Olivier, (Coleoptera: Silphidae) in South Dakota. Coleopterists Bulletin 51(1): 53-58.

Backlund, D. and G. Marrone. 1995. Surveys for the endangered American burying beetle (*Nicrophorus americanus*) in Gregory, Tripp and Todd Counties, South Dakota. Final rep. to the Service, Pierre, SD. 12 pp. Unpub. MS.

Bartlett, J. 1987. Evidence for a sex attractant in burying beetles. Ecological Entomology 12: 471-472.

Bedick, J.C., Brett C. Ratcliffe, W. Wyatt Hoback, and Leon G. Higley. 1999. Distribution,

ecology and population dynamics of the American burying beetle *Nicrophorus americanus* Olivier (Coleoptera, Silphidae)] in South-central Nebraska, USA. Journal of Insect Conservation 3(3): 171-181.

Bedick, J.C., B.C. Ratcliffe, and L.G. Higley. 2004. A new sampling protocol for the Endangered American burying beetle, *Nicrophorus americanus* Olivier (Coleoptera: Silphidae). The Coleopterist Bull. 58(1): 57-70.

Bedick, J.C., W.W. Hoback, and M.C. Albrecht. 2006. High water-loss rates and rapid dehydration in the burying beetle, *Nicrophorus marginatus*. Physiological Entomology 31: 23-29.

Brown, J.H., and B. Maurer. 1987. Evolution of species assemblages: Effects of energetic constraints and species dynamics on diversification of the North American avifauna. American Naturalist 130: 1-17.

Carlton, C.E. and F. Rothwein. 1998. The endangered American burying beetle, *Nicrophorus americanus* Olivier, at the edge of its range in Arkansas (Coleoptera: Silphidae). Coleopterists Bulletin 52: 179-185.

Case, T.D. 1975. Species number, density compensation and colonizing ability of lizards on islands in the Gulf of California. Ecology 56:3-18.

Collins, L. and R.H. Scheffrahn. 2005. Featured creatures: Red-imported fire ant. University of Florida, Dept. of Entomology and Nematology. Publ. no. EENY-195.

Cox, G.W. and R.E. Ricklefs. 1977. Species diversity, ecological release and community structuring in Caribbean landbud faunas. Oikos 29: 60-66.

Creighton, J.C. and G. Schnell. 1998. Short-term movement patterns of the endangered American burying beetle *Nicrophorus americanus*. Biological Conservation 86: 281-287.

Creighton, J.C., R. Bastarache, M.V. Lomolino, M.C. Belk. 2007. Effect of forest removal on the abundance of the endangered American burying beetle, Nicrophorus americanus. J Insect Conserv, Published online: 16 October 2007.

Creighton, J.C., C.C. Vaughn, and B.R. Chapman. 1993. Habitat preference of the endangered American burying beetle (*Nicrophorus americanus*) in Oklahoma. The Southwestern Naturalist 38: 275-277.

Crowell, K.L. 1983. Islands-insight or artifact?: Population dynamics and habitat utilization in

insular rodents. Oikos 41: 442-454.

Damuth, J. 1991. Of size and abundance. Nature, Lond. 351: 268–269.

den Boer, P.J. 1970. On the significance of dispersal power for populations of carabid beetles (Coleoptera, Carabidae). Oecologia 4: 1-28.

Diamond, J. 1984. Historic extinctions: a Rosetta stone for understanding prehistoric extinctions. Pages 824-862 in P. S. Martin and R. G. Klein, editors. Quaternary extinctions: a prehistoric revolution. University of Arizona Press, Tucson, Arizona, USA.

Eggert, A. and S.K. Sakaluk. 2000. Benefits of communal breeding in burying beetles: a field experiment. Ecological Entomology 25: 262-266.

Ellsworth, J.W. and B.C. McComb. 2003. Potential effects of passenger pigeon flocks on the structure and composition of presettlement forests of eastern North America. Jour. Of Cons. Biol. 17(6): 1548-1557.

Federal Register (FR). April 12, 2011. Basin Electric Power Cooperative: Notice of Intent To Hold Public Scoping Meetings and Prepare an Environmental Assessment. 76 (70): 20311-20312.

Fetherston, I.A., M.P. Scott, and J.F.A. Traniello. 1990. Parental care in burying beetles: The organization of male and female brood-care behavior. Ethology 85:177-190.

Floyd, R.P. 1978. Geodetic benchmarks. NOAA Manual NOS NGS 1. National Oceanic and Atmospheric Administration, Rockville, Maryland. September, 1978.

Garrott, R. A., White P.J., and Vanderbilt White C.A. 1993. Over-abundance: An Issue for Conservation Biologist? Conservation Biologist 7: 946-949.

Gittleman, J.L. 1985. Carnivore body size: ecological and taxonomic correlates. Oecologia, Berl. 67 (1985), pp. 540–554.

Godwin, Wouldiam B. 2003. Report of the discovery of the American burying beetle (*Nicrophorus americanus* Oliver) at the Texas Army National Guard facility Camp Maxey, Lamar County, Texas. Unpub. MS.

Godwin, W.B. and V. Minich. 2005. Status of the American burying beetle, *Nicrophorus americanus* Olivier, (Coleoptera: Silphidae) at Camp Maxey, Lamar County, Texas. Interagency final rep. to Texas Army Natl. Guard. 19 pp. Unpub. MS.

Grant, P.R. 1971. The habitat preference of *Microtus pennsylvanicus* and its relevance to the distribution of this species on islands. Journal of Mammalogy 52: 551-361.

Gustafson, D.J., D.J. Gibson, D.L. Nickrent. 2004. Competitive relationships of *Andrpogon gerardii* (Big Bluestem) from remnant and restored native populations and select cultivated varieties. Functional Ecology. 18: 451-457.

Hazen, B. 2011. Geothermal model predictions for the sandhills segment of the Keystone XL pipeline. Unpublished report, February, 2011. Model used: "TQUEST, A General Purpose, Finite-Element Program for One, Two and Three Dimensional Heat Transfer." Prepared for TransCanada Keystone Pipeline, LP by Northern Engineering and Scientific, Anchorage, Alaska.

Hespenheide, H.A. 1971. Hespenheide, Food preference and the extent of overlap in some insectivorous birds, with special reference to Tyrannidae. Ibis 113**:** 59–72.

Hinton, H.E. 1981. Biology of insect eggs. Oxford: Pergammon. 1113 pgs.

Holloway, A.K. and G. D. Schnell. 1997. Relationship between numbers of the endangered American Burying beetle, *Nicrophorus americanus* Olivier (Coleoptera: Silphidae) and available food resources. Biological Conservation 81:145-152.

Jurzenski, J. and W.W. Hoback. 2010. Updated distribution of American burying beetle in Nebraska and predictive model for its occurrence. Unpubl. report prepared for the U.S. Fish and Wildlife Service, Nebraska Field Office, Grand Island.

Karr, J.R. 1982. Population variability and extinction in the avifauna of a tropical land bridge island. Ecology 63: 1975-1978.

Keystone (TransCanada Keystone Pipeline, LP). 2008. Keystone XL Project Environmental Report (ER). November 2008. Document No. 10623-006. Submitted to the U.S. Department of State and the Bureau of land Management by Keystone. Available online at: http://www.keystonepipeline-xl.state.gov/clientsite/keystonexl.nsf?Open

Keystone (TransCanada Keystone Pipeline, LP). 2009. Supplemental Filing to ER. July 6, 2009. Document No.: 10623-006. Submitted to U.S. Department of State and Bureau of Land Management by TransCanada Keystone Pipeline, L.P. Available online at: http://www.keystonepipeline-xl.state.gov/clientsite/keystonexl.nsf?Open

Keystone (TransCanada Keystone Pipeline, LP). 2010. Supplemental Filing to ER. May 19, 2010. Document No.: 10623-006. Submitted to U.S. Department of State and Bureau of Land

Management by TransCanada Keystone Pipeline, L.P. Available online at: http://www.keystonepipeline-xl.state.gov/clientsite/keystonexl.nsf?Open

Keystone (TransCanada Keystone Pipeline, LP). 2011. Keystone XL Project Biological Assessment. Final Report May 2011. Initial draft prepared by TransCanada Keystone Pipeline, L.P. (project applicant) with subsequent revisions and additions completed by the U.S. Department of State (lead federal agency). 139 p. + appendices.

Klein, B.C. 1989. Effects of forest fragmentation on dung and carrion beetle communities in Central Amazonia. Ecology 70: 1715-1725.

Kozol, A.J. 1995. Ecology and population genetics of the endangered American burying beetle, *Nicrophorus americanus*. Dissertation, Boston University, Massachusetts.

Kozol, A.J. 1991. Annual monitoring of the American burying beetle on Block Island. Report to The Nature Conservancy, 294 Washington Street, Boston, Massachusetts. Unpub. MS.

Kozol, A.J. 1990a. *Nicrophorus americanus* 1989 laboratory population at Boston University. Report prepared for the Service, Concord, NH. Unpub. MS.

Kozol, A.J. 1990b. The natural history and reproductive strategies of the American burying beetle, *Nicrophorus americanus*. Report to the Service, Hadley, MA. Unpub. MS.

Kozol, A.J. 1989. Studies on the ABB, on Block Island. Repot for The Nature Conservancy, 294 Washington Street, Boston, Massachusetts. Unpub. MS.

Kozol, A.J., M.P. Scott, and J.A. Traniello. 1988. The American burying beetle: studies on the natural history of an endangered species. Psyche 95: 167-176.

Kozol, A.J., J.F.A. Traniello, and S.M. Wouldiams. 1994. Genetic variation in the endangered burying beetle *Nicrophorus americanus* (Coleoptera: Silphidae). Annals of the Entomological Society of America 6:928-935.

Lawton, J.H. 1990. Species richness and population dynamics of animal assemblages. In: Patterns in body size: abundance and space. Phil. Trans. R. Soc. Lond. B, 330: 283–291.

Lomolino, M.V. 1984. Mammalian island biogeography: Effects of area, isolation and vagility. Oecologia 61: 376-382.

Lomolino, M.V. and J.C. Creighton. 1996. Habitat selection, breeding success and conservation of the endangered American burying beetle, *Nicrophorus americanus*. Biological

Conservation 77: 235-241.

Lomolino, M.V. and J.C. Creighton. 1993. Habitat use and genetic characterization and variability in the American burying beetle, *Nicrophorus americanus*, in Oklahoma. Unpubl. report to U.S. Fish and Wildlife Service.

Lomolino, M.V., J.C. Creighton, G.D. Schnell, and D.L. Certain. 1995. Ecology and conservation of the endangered American burying beetle, *Nicrophorus americanus*. Conservation Biology 9: 605-614.

Martin, L.M., K.A. Moloney, and B.J. Wilsey. 2005. An assessment of grassland restoration success using species diversity components. Journal of Applied Ecology 42: 327-336.

Martin, P.S., and R.G. Klein, editors. 1984. Quaternary extinctions: a prehistoric revolution. University of Arizona Press, Tucson.

Matthews, C.Y. 1995. Interspecific competition between the burying beetles *Nicrophorus americanus* and *Nicrophorus orbicollis*. M.S. Thesis, Univ. of Oklahoma, Norman. 32 pp.

McPherron, M.M., M.A. Albrecht, K.M. Farnsworth-Hoback, J.J. Shaffer, and W.W. Hoback. In prep. Impact of sod-forming grass on the carcass burial behavior of *Nicrophorus* sp. Ecological Entomology.

Miller, J. and L. McDonald. 1997. Rediscovery of *Nicrophorus americanus* Olivier in Kansas. Coleopterists Bulletin 51:22.

Miller, B., Biggins D. and Reading R. 1990. A proposal to conserve black-footed ferrets and the prairie dog ecosystem. Environmental Management 14: 763-769.

Mladenoff, D.J., M.A. White, T.R. Crow, and J. Pastor. 1994. Applying principles of landscape design and management to integrate old-growth forest enhancement and commodity use. Conserv. Biol. 8: 752-762.

Müller, J.K., A.K. Eggert, and S. K. Sakaluk. 1998. Carcass maintenance and biparental brood care in burying beetles: are males redundant? Ecological Entomology 23: 195-200.

Noss, R.F., H.B. Quigley, M.G. Hornocker, T. Merrill, and P.C. Paquit. 1996. Conservation biology and carnivore conservation in the Rocky Mountains. Conserv. Bio. 10: 949-963.

Owen-Smith, R.N. 1988. Megaherbivores: The influence of very large body size on ecology. Cambridge University Press, Cambridge, England.

Oxley, D.J., M.B. Fenton, and G.R. Carmody. 1974. The effects of roads on populations of small mammals. J. Appl. Ecol. 11: 51-59.

Paton, P.W.C. 1994. The effect of edge on avian nest success: how strong is the evidence? Conservation Biology 8(1):17-26.

Peck, S.B. and M.M. Kaulbars. 1987. A synopsis of the distribution and bionomics of the carrion beetles (Coleoptera: Silphidae). Proceedings of the Entomological Society of Ontario. 118: 47-81.

Peters, R.H. 1983. The ecological implications of body size. Cambridge University Press, Cambridge.

Peyton, M. M. 1996. The American burying beetle (*Nicrophorus americanus*). Range and population study for the dissected hills south of the Platte River, Dawson and Lincoln Counties, Nebraska, 1966. Unpublished report to the U.S. Fish and Wildlife Service and the Nebraska Game and Parks Commission. 16 pp.

Pimm, S.L., H.L. Jones, and J. Diamond. 1988. On the risk of extinction. Am. Nat. 132: 757-785.

Pukowski, E. 1933. Okoloische untersuchungen an Necrophorus F. Z. Morphol. Okol. Tiere. 27: 518-586.

Raithel, C.J. 1996-2002. Monitoring and management of American burying beetles in Rhode Island. Section 6 Performance Reports, no. E-17-27 submitted to Service, Hadley, MA. Unpub. MS.

Ratcliffe B. 1995. Nebraska's threatened and endangered species: American burying beetle. Nebraska Games and Parks commission. Unpub. MS.

Ratcliffe, B.C. 1996. The carrion beetles (Coleoptera: Silphidae) of Nebraska. Bulletin of the Nebraska State Museum Vol. 13.

Rosenzweig, M.L. 1968. The strategy of body size in mammalian carnivores. Amer. idl. Nat. 80: 299–315.

Schnell, G. D., A.H. Hiott and V. Smyth. 1997-2003. American burying beetle survey, Camp

Gruber, Oklahoma. Sam Noble Oklahoma Museum of Natural History, Norman, Oklahoma. Final rep. to Camp Gruber National Guard Training Center. Unpub. MS.

Schnell, G. D., A.H. Hiott and V. Smyth. 1997-2005. American burying beetle survey at Fort Chaffee, Arkansas. Final rep. to Chaffee Maneuver Training Center. Unpub. MS.

Schnell, G. D., A.H. Hiott and V. Smyth. 1997-2006. Evaluation of American burying beetles on the Weyerhaeuser Habitat Conservation Plan Area. Final rep. to Weyerhaeuser Company. Unpub. MS.

Schnell, G.D., A.E. Hiott, and J.C. Creighton. 2008. Factors affecting overwinter survival of the American burying beetle, Nicrophorus americanus (Coleoptera: Silphidae). Journal of Insect Conservation 12: 483-492.

Schnell, G.D., A. E. Hiott, J.C. Creighton, V.L. Smyth, and A. Komendat. 2007. Factors affecting overwinter survival of the American burying beetle, Nicrophorus americanus (Coleoptera: Silphidae). Journal of Insect Conservation DOI 10.1007/s10841-007-90865.

Schwelling, S.R., P.S. Showalter, J.R. Singhurst, and C.D. German. 2000. Habitat prediction for Texas trailing phlox (*Phlox nivalis* ssp. *texensis*) using Landsat Thematic Mapper and ancillary biophysical data. [online] http://cswgcinnew/dm/Phlox/p120.html. Accessed 2003.

Schoener, T.W. and G.C. Gorman. 1968. Some niche differences in three Lesser Antillean lizards of the genus Anolis. Ecology 49: 819–830.

Scott, M.P. 1990. Brood guarding and the evolution of male parental care in burying beetles. Behavioral Ecology and Sociobiology 26: 31-39.

Scott, M.P. and J.F.A. Traniello. 1987. Behavioral cues trigger ovarian development in the burying beetle *Nicrophorus tomentosus*. J. Insect Physiol. 33: 693-696.

Scott, M.P. and J.F.A. Traniello. 1989. Guardians of the underworld. Natural History 6: 32-36.

Scott, M.P., J.F.A. Traniello, and I.A. Fetherston. 1987. Competition for prey between ants and burying beetles: differences between northern and southern temperate sites. Psyche 94: 325-333.

Scott, M.P. 1998. The ecology and behavior of burying beetles. Annual Review of Entomology 43: 595-618.

Sikes, D.S. 1996. The natural history of *Nicrophorus nigrita*, a western Nearctic species

(Coleoptera: Silphidae). The Pan-Pacific Entomologist. 72: 70-81.

Sikes, D.S. and Christopher J. Raithel. 2002. A review of hypotheses of decline of the endangered American burying beetle (Silphidae: *Nicrophorus americanus* Olivier). Journal of Insect Conservation 6: 103-113.

Smith, M.D. and A.K. Knapp. 2001. Physiological and morphological traits of exotic, invasive exotic, and native plant species in tallgrass prairie. International Journal of Plant Science. 162(4): 785-792.

Stevens, G. 1992. Spilling over the competitive limits to species co-existence. Pages 40-56 in N. Eldredge, editor. Systematics, ecology and the biodiversity crisis. Columbia University Press, New York.

Suarez, A.V., K.S. Pfenning, and S.K. Robinson. 1997. Nesting success of a disturbance-dependent songbird on different kinds of edges. Conservation Biology 11: 928-935.

Szalanski, A.L., D.S. Sikes, R. Bischof and M. Fritz. 2000. Population genetics and phylogenetics of the endangered American burying beetle, *Nicrophorus americanus* (Coleoptera: Silphidae). Annals of the Entomological Society of America 93: 589-594.

Tillman, D., R.M. May, C.L. Lehman, and M.A. Nowak. 1994. Habitat destruction and the extinction debt. Nature Lond. 371: 65–66.

Trumbo, S.T. 1994. Interspecific competition, brood parasitism, and the evolution of biparental cooperation in burying beetles. OIKOS 69: 241-249

Trumbo, S.T. 1992. Monogamy to communal breeding: exploitation of a broad resource base by burying beetles (*Nicrophorus*). Ecological Entomology 17: 289-298.

Trumbo, S.T. 1990. Reproductive success, phenology, and biogeography of burying beetles (Silphidae, *Nicrophorus*). American Midland Naturalist 124(1): 1-11.

Trumbo, S.T. and P.L. Bloch. 2000. Habitat fragmentation and burying beetle abundance and success. Jour. of Insect Conservation 4(4): 245-252.

Trumbo, S.T. and D.S. Wilson. 1993. Brood discrimination, nest mate discrimination, and determinants of social behavior in facultatively quasisocial beetles (*Nicrophorus* spp.). Behavioral Ecology 4: 332-339.

United States Department of Agriculture (USDA) -APHIS. 2003. Imported Fire Ants: An agricultural pest and human health hazard. March 2003 Fact Sheet.

United States Department of State (DOS). 2010. Draft Environmental Impact Statement for the Keystone XL Oil Pipeline Project. Issued April 16, 2010. Available online at: http://www.keystonepipeline-xl.state.gov/clientsite/keystonexl.nsf?Open

United States Department of State (DOS). 2011a. Supplemental Draft Environmental Impact Statement for the Keystone XL Oil Project. Issued April 15, 2011. Available online at: http://www.keystonepipeline-xl.state.gov/clientsite/keystonexl.nsf?Open

United States Department of State (DOS). 2011b. Final Environmental Impact Statement for the Keystone XL Project. Issued August 26, 2011. Available online at: http://www.keystonepipeline-xl.state.gov/clientsite/keystonexl.nsf?Open

United States Fish and Wildlife Service (USFWS). 2008a. Five-year review of the status of the American Burying Beetle. June 16, 2008. Southwest Regional Office, Albuquerque, New Mexico.

United States Fish and Wildlife Service (USFWS). 2008b. December 8, 2008 letter to Kimberly D. Bose, Federal Energy Regulatory Commission, transmitting its biological opinion regarding construction and operation of the Arkoma Connector Pipeline in Atoka, Coal, and Bryan counties, Oklahoma, by MarkWest Pioneer, L.L.C.

United States Fish and Wildlife Service (USFWS). 1991. American burying beetle (*Nicrophorus americanus*) recovery plan. Newton Corner, Massachusetts. 80 pp.

United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). 2003. A Field Book Compilation of the Endangered Species Consultation Handbook: Procedures for conducting consultation and conference activities under section 7 of the Endangered Species Act. Final. U.S. Fish and Wildlife Service and National Marine Fisheries Service. March, 1998.

Vrba, E.S. 1984. Evolutionary patterns and process in the sister-group Alcephalinii-Aepycerotini (Mammalia: Bovidae). Pages 62-79 in N. Eldredege and S.M. Stanley, editors. Living fossils. Springer-Verlag, Berlin.

Walker, Thomas J. 1957. Ecological studies of the arthropods associated with certain decaying materials in four habitats. Ecology 38(2) 262-276.

Walker, T.L. and W. Hoback. 2007. Effects of invasive eastern red cedar on capture rates of *Nicrophorus americanus* and other Silphidae. Env. Entolol. 36(2): 297-307.

Warriner , M.D. 2004. Survey for the American burying beetle (*Nicrophorus americanus*) On Arkansas Game and Fish Wildlife Management Areas (Coleoptera: Silphidae). Arkansas Nat. Heritage Comm. Unpubl rep. Little Rock, AR. 14 pp.

Werner, E.E. 1974. The fish size, prey size, handling time relation of several sunfishes and some implications. J Fish. Res. Bd. Can. 31: 1531–1536.

Wilcove, D.S., C.H. McLellan, and A.P. Dobson. 1986. Habitat fragmentation in the temperate zone. In M.E. Soule (ed.), Conservation Biology: The Science of Scarcity and Diversity, pp. 237-256. Sinauer Associates, Sunderlan, MA.

Wilson , D.S. and J. Fudge. 1984. Burying beetles intraspecific interactions and reproductive success in the field. Ecological Entomology 9: 195-203.

Wilson, D.S., W.G. Knollenberg, and J. Fudge. 1984. Ecological Entomology 9: 205-216.

Wilson, E.O. 1975. Sociobiology, the new synthesis. Belknap Press, Harvard University Press, Cambridge, Mass. 697 pp.

Wilson, E.O. 1971. The Insect Societies. Harvard University Press, Cambridge, MA.

Yahner, R.H. and C.G. Mahan. 1996. Effects of forest fragmentation on burrow-site selection in the eastern chipmunk. American Midland Naturalist 136: 352-357.

Zaret, T.M. 2005. Using local seed in prairie restoration: data supports the paradigm. Native Plants Journal 6 (1): 25-28.

Zaret, T.M. 1980. Predation and freshwater communities. Yale University Press, New Haven, CT.

References/ Personal Communication

Bessken, Charlene. USFWS, South Dakota Field Office, Pierre, South Dakota. Personal communication, October, 2010.

Carlton, C.E. <ccarlton@fs.fed.us>, Fire ants in Arkansas, April 3, 1996, E-mail correspondence to Michael Amaral, USFWS, Concord, NH, regarding county by county American burying beetle surveys and fire ants in Arkansas, 2 pp. Personal communication, December 8, 2008.

Fristik, Richard. Senior Environmental Protection Specialist, Rural Development, Rural Utilities Service, U.S. Department of Agriculture,1400 Independence Ave., S.W., Washington, D.C. 20250. Personal communication, August 26, 2001.

Graham, Kyle J. USFWS, Fort Niobrara National Wildlife Refuge, Valentine, Nebraska. Personal communication, March 2011.

Hoback, W. Wyatt. University of Nebraska – Kearney. Personal communication, March 24, 2011.

Pore, Robert. Study: Ethanol growth has influenced cropping practices. Grand Island Independent, August 28, 2011. (Newspaper article).

U.S. Government Accounting Office (GAO). Interim Results: Impact of USDA payments and Sodbuster on grassland conversions to grassland. Briefing for staff of Senator Tom Harkin, Chairman, Senate Committee on Agriculture, Nutrition, and Forestry; and Representative Collin Peterson, Chairman, House Committee on Agriculture. May 24, 2007.