

# American Burying Beetle Impact Assessment for Project Reviews



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U.S. Fish and Wildlife Service  
Southwest Region

Oklahoma Ecological Services Field Office

March 6, 2014



## INTRODUCTION

The American burying beetle (*Nicrophorus americanus* Olivier, ABB) was federally listed as endangered in 1989 (54 FR 29652) by the U.S. Fish and Wildlife Service (Service) in accordance with the Endangered Species Act of 1973, as amended; 16 U.S.C. 1531 *et seq.*, (ESA). The ABB Recovery Plan was finalized in 1991 and a 5-year Review was completed in 2008 that recommended the ABB's status remain as endangered. Due to its Federal listing as endangered, activities that may affect ABB, whether adverse or completely beneficial, are regulated to ensure conservation and persistence of the species.

The Service recommends that project proponents use this document to determine whether their project may affect the ABB for section 7 consultation for Federal projects or may result in take of the ABB for non-Federal projects. This document describes how to assess the potential impacts of your project. Additional information regarding the recommended level of offsets or mitigation based on project location and type of impacts can be found in the ABB Conservation Strategy and Mitigation Guidance document, found on our webpage:

[http://www.fws.gov/southwest/es/oklahoma/ABB\\_Add\\_Info.htm](http://www.fws.gov/southwest/es/oklahoma/ABB_Add_Info.htm). The Service anticipates that with the accumulation of more detailed information, management strategies and priorities may change.

One of the goals of the ESA is to conserve ecosystems upon which listed threatened and endangered species of fish, wildlife, and plants depend. Section 9 of the ESA makes it illegal for any person subject to the jurisdiction of the United States to “take” any federally listed endangered or threatened species of fish or wildlife without a special exemption. “Person” is defined under the ESA to include individuals, corporations, partnerships, trusts, associations, or any other private entity; local, state, and Federal agencies; or any other entity subject to the jurisdiction of the United States. Under the ESA, “take” means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering (50 CFR § 17.3). Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering(50 CFR § 17.3). Consequently, it is a violation of Federal law to take endangered species without appropriate permits. Take of federally-listed species incidental to an otherwise lawful activity may be authorized through section 7 or 10 of the ESA.



Section 7(a)(1) of the ESA directs Federal agencies, in consultation with the Service, to use their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species. Additionally, Section 7(a)(2) of the ESA requires Federal agencies to ensure that any action they authorize, fund, or carry out (Federal nexus) is not likely to jeopardize the continued existence of any federally listed threatened or endangered species or result in the destruction or adverse modification of designated critical habitat. Jeopardy is defined as an appreciable reduction in the likelihood of survival and recovery in the wild. This includes actions 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). In the event that a Federal agency determines that their authorized, funded, or carried out action “may affect” a listed threatened or endangered species or designated critical habitat, the agency is required to consult with the Service regarding the degree of impact and measures available to avoid or minimize the adverse effects.

Section 10 provides a mechanism for take authorization for private entities where no Federal nexus exists. This provision authorizes the Service, under some circumstances, to permit the taking of federally listed fish and wildlife if such taking is “incidental to, and not the purpose of carrying out otherwise lawful activities.” This process is also intended to be used to reduce conflicts between listed species and private development and to provide a framework that would encourage “creative partnerships” between the private sector and local, state, and Federal agencies in the interest of endangered and threatened species and habitat conservation. Applications for such permits include habitat conservation plans (HCP). When an HCP meets issuance criteria (50 CFR §§ 17.22(b) and 17.32(b)) and is approved by the Service, an incidental take permit is issued for the anticipated incidental take. The HCP must include appropriate conservation measures that, to the maximum extent practicable, minimize and mitigate the effects of the authorized take of the species.

## **SPECIES DESCRIPTION**

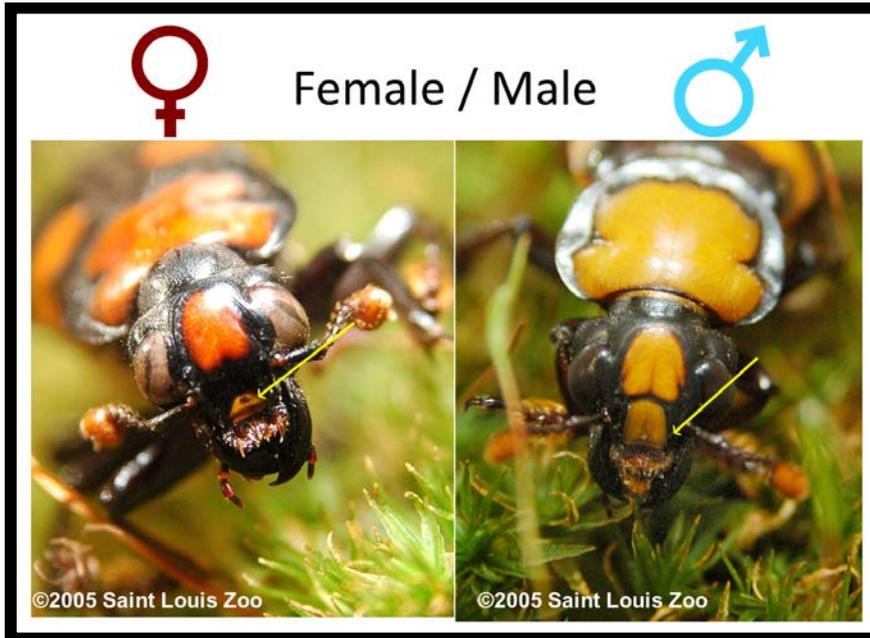
### **Physical Characteristics**

The ABB is the largest species of its genus (*Nicrophorus*) in North America, measuring 25-46 mm (1 – 1.8 inches) long (Wilson 1971, Anderson 1982). Species in the genus *Nicrophorus* are generally referred to as burying or undertaker beetles due to their unique behavior of burying carrion to provide a source of nutrition for developing young.

ABBs are black with orange-red markings (Figure 1). The most diagnostic feature of the ABB is the large orange-red marking on the raised portion of the pronotum (the upper surface of the first



segment of the body that lies between the head and the abdomen), a feature shared with no other members of the genus in North America (USFWS 1991). Gender can be determined from markings on the clypeus (a shield-like plate on the front of the head of an insect); males have a large, rectangular, red marking and females have a smaller, triangular, red marking.



**Figure 1.** Female and Male American burying beetles. The female (left) has a smaller, triangular, red marking, while the male (right) has a larger, rectangular marking. Photo credit: Saint Louis Zoo, St. Louis, Missouri.

### Geographic Distribution

The ABB once occurred throughout much of temperate eastern North America, including 35 U.S. states (USFWS 1991). Its absence throughout much of its former range became apparent in the 1980s, and by 1989 the ABB was thought to occur only on Block Island, Rhode Island, and at one location in Oklahoma (Davis 1980; Kozol et al. 1988; USFWS 1991). Currently, the ABB can be found in less than 10% of its historic range, with localized, extant populations discovered in six states (Backlund and Marrone 1997, Bedick et al. 1993, Godwin 2003, Lomolino et al. 1995, Miller and McDonald 1997, Ratcliffe 1996, Sikes and Raithel 2002, USFWS 2008). These locations include Block Island off the coast of Rhode Island, eastern Oklahoma, western Arkansas, the Sand Hills and Loess Hills regions in Nebraska, the Chautauqua Hills region of southeastern Kansas, south-central South Dakota, and northeastern Texas. Additionally, a reintroduced population on Nantucket Island off the coast of Massachusetts is thought to be stable and a recent reintroduction attempt in Missouri in 2012 has reported successful brood



rearing and overwintering (personal communication with Bob Mertz, St. Louis Zoo, May 30, 2013).

## **Life History**

The ABB is a nocturnal species. Individuals usually live for only one year. Adults and larvae are dependent on carrion (flesh of dead animals) for food and reproduction. The ABB competes with other invertebrate species, as well as vertebrate species, for carrion. They are active in the summer months (active season) and bury themselves in the soil during the winter months (inactive season). The length of the inactive season can fluctuate depending on temperature. (Once nighttime temperatures are below 60 degrees Fahrenheit (°F), the ABB retreat underground and become inactive until the temperatures are above 60 °F.) In Oklahoma the inactive season is typically from October to April or May. The ABB begins reproduction soon after emergence from the inactive season, finding and securing a mate and carcass for reproduction. Adults bury a small vertebrate carcass (35-250 grams; 1-9 ounces) and lay eggs beside it. Resulting ABB larvae use the carcass as a food source until they emerge. The entire reproductive process takes approximately 48-65 days (Kozol et al. 1988). Following metamorphosis from larva to adult, teneral (adult ABBs newly emerged from the pupal case) typically emerge from underground in late summer; although timing can vary based on latitude and weather conditions and some presence/absence surveys in Oklahoma have documented tenerals in early summer (USFWS species files). Typically, tenerals over-winter as adults and comprise the breeding population the following spring and summer (Kozol 1990).

## **Movement**

ABBs fly and have been reported moving nightly distances ranging from 0.16 to 30 kilometers (km) (0.10 to 18.6 miles) in various parts of their range (Bedick et al. 1999, Creighton and Schnell 1998, Jurzenski et al. 2011, Schnell et al 1997-2006). In Oklahoma, ABBs have been recorded to move approximately 10 km (6.2 miles) in 6 nights (Creighton and Schnell 1998). In Nebraska, one ABB was reported to move, wind-aided, approximately 30 km (18.6 miles) in one night (Jurzenski et al. 2011).

## **Habitat**

ABBs have been successfully live-trapped in several vegetation types including native grassland, grazed pasture, riparian zone, coniferous forest, mature forest, and oak-hickory forest, as well as on a variety of 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) and are considered to be habitat generalists. However, they are believed to have more selective breeding habitat (suitable soils and vegetation layer) compared to their feeding habitat (Anderson 1982).

### Areas Unfavorable for the ABB

While the ABB uses a wide variety of habitats, the Service currently believes that areas exhibiting the following characteristics are *unfavorable* for use by ABBs based on disturbance regime, vegetation structure, unsuitable soil conditions and carrion availability:

1. Land that is tilled on a regular basis, planted in monoculture, and does not contain native vegetation.
2. Pasture or grassland that have been maintained through frequent mowing, grazing, or herbicide application at a height of 20 cm (8 inches) or less.
3. Land that has already been developed and no longer exhibits surficial topsoil, leaf litter, or vegetation.
4. Urban areas with maintained lawns, paved surfaces, or roadways.
5. Stockpiled soil without vegetation.
6. Wetlands with standing water or saturated soils (defined as sites exhibiting hydric-soils, and vegetation typical of saturated soils, and/or wetland hydrology).

**NOTE: Areas adjacent to wetlands and/or riparian areas may be used by the ABB (and are therefore not considered unfavorable for the ABB). These areas may be important for ABBs seeking moist soils during dry conditions.**

Additional information regarding ABB biology and habitat can be found on the Oklahoma Ecological Field Service's website at:

[http://www.fws.gov/southwest/es/Oklahoma/Documents/TE\\_Species/Species%20Profiles/American%20Burying%20Beetle.pdf](http://www.fws.gov/southwest/es/Oklahoma/Documents/TE_Species/Species%20Profiles/American%20Burying%20Beetle.pdf) and

[http://www.fws.gov/southwest/es/Oklahoma/ABB\\_Add\\_Info.htm](http://www.fws.gov/southwest/es/Oklahoma/ABB_Add_Info.htm).

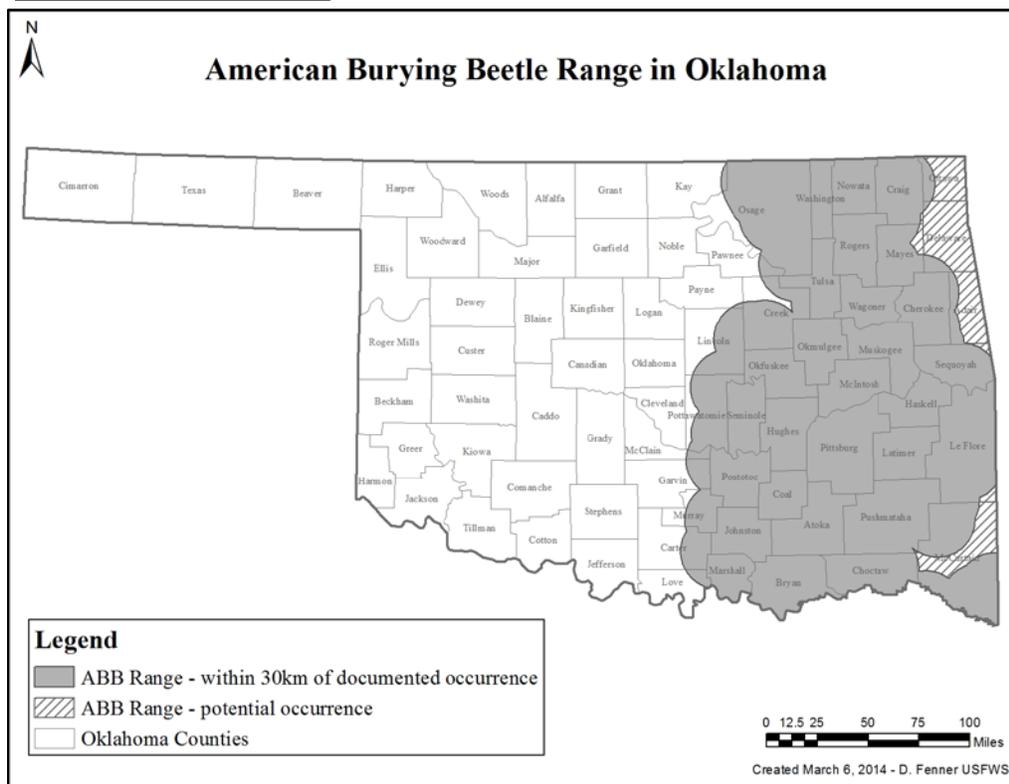
### **ABB RANGE IN OKLAHOMA**

The Service has delineated the range of the ABB in Oklahoma based on locations of known ABB occurrences. The primary source for documented ABB occurrences is ABB presence/absence



surveys conducted by Service-permitted biologists. The ABB range in Oklahoma includes all areas within 30 km (18.6 miles) (maximum ABB movement recorded by Jurzenski et al. 2011) of all documented ABB occurrences. The Service also considers portions of counties on the eastern edge of Oklahoma that are not within 30 km of a documented ABB occurrence as potential ABB range, due to the potential for ABB habitat in these areas and previously documented ABB locations in adjacent states. These areas are identified at the Information, Planning, and Conservation System (IPaC) website at <http://ecos.fws.gov/ipac/>.

The ABB range will be updated as new occurrence data are gathered using the above delineation methods unless the best available science identifies a better technique for identifying ABB range. Updated ABB range information will be available through our website [http://www.fws.gov/southwest/es/Oklahoma/ABB\\_Add\\_Info.htm](http://www.fws.gov/southwest/es/Oklahoma/ABB_Add_Info.htm) and the IPaC website (<http://ecos.fws.gov/ipac/>).



**Figure 2.** Range of ABB within Oklahoma. Portions of several counties on the Eastern edge of the ABB range in Oklahoma are not within 30 km of a recent survey (identified within IPaC, <http://ecos.fws.gov/ipac/>). However, these areas may contain ABB habitat.

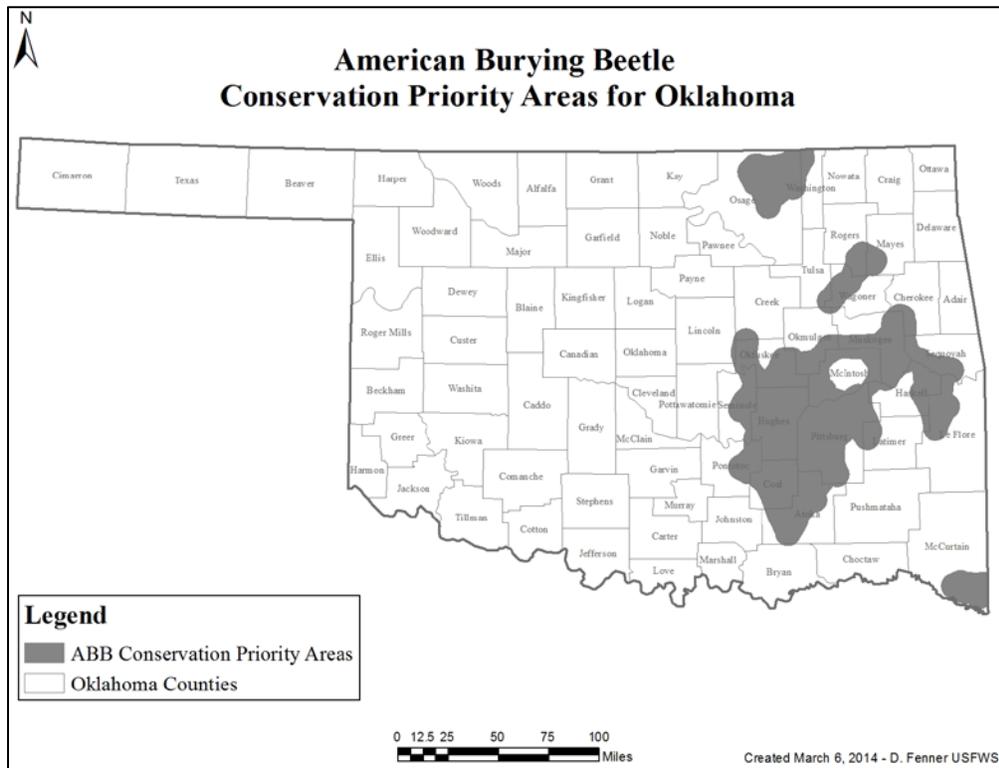
Part or all of the following counties are currently included in the ABB range in Oklahoma (**Figure 2**): Adair, Atoka, Bryan, Carter, Cherokee, Choctaw, Coal, Craig, Creek, Delaware, Garvin, Haskell, Hughes, Johnston, Kay, Latimer, Le Flore, Lincoln, Love, Marshall, Mayes,



McClain, McCurtain, McIntosh, Murray, Muskogee, Nowata, Okfuskee, Okmulgee, Osage, Ottawa, Pawnee, Payne, Pittsburg, Pontotoc, Pottawatomie, Pushmataha, Rogers, Seminole, Sequoyah, Tulsa, Wagoner, and Washington. If a project is located within the ABB range, the Service recommends that the project proponent consider impacts to ABB. In several counties on the western edge, only the eastern portion of that county is included in the ABB range (see Figure 2). Within the ABB range, the Service recommends ABB presence/absence surveys for any proposed projects with potential impacts to suitable habitat.

### ABB CONSERVATION PRIORITY AREAS IN OKLAHOMA

The Service has identified areas where conservation of the ABB should be targeted in Oklahoma (Figure 3.) The ABB Conservation Priority Areas (CPA) will serve as areas where conservation efforts should be focused and where higher ratios of mitigation for impacts to ABBs should occur. CPAs include areas with recent (within 10 years) documented ABB presence that the Service believes are likely to contain important elements for ABB conservation, such as documented presence over multiple years, relatively high density populations, suitable breeding, feeding, and sheltering habitat, and carrion resources.



**Figure 3.** American burying beetle Conservation Priority Areas in Oklahoma.



The Service anticipates re-analyzing and updating the CPAs in Oklahoma every three years using the most recent 10 years of ABB occurrence data. The Service will also use the best available scientific information to determine whether a new method for identifying CPAs should be used in the future.

**IMPACTS ANALYSIS**

The Service’s recommended *step-wise process* for determining the potential for take of the ABB resulting from a proposed activity is described below. The Service provides a step-wise process to assist project proponents in evaluating their action’s risk of taking ABBs. However, the responsibility for this determination is ultimately that of each Federal agency or project proponent, as applicable. These recommendations are based on the best available information and are subject to change at any time.

- 1. a. Project has a Federal nexus (Federal agency is undertaking, funding, permitting, or authorizing actions).....Cont. to Step 2
- 1. b. Project does not have a Federal nexus (no Federal agency is undertaking, funding, permitting, or authorizing actions).....Cont. to Step 6
  
- 2. a. Entire Action Area (all areas to be affected directly or indirectly by the action and not merely the immediate area involved in the action [50 CFR §402.02]) occurs outside of ABB range (as defined by the Service).....*Activity will have “No Effect” on the ABB. No concurrence from the Service required. Document your decision in your project files.*
- 2. b. All or portions of the Action Area occur within ABB range.....Cont. to Step 3
  
- 3. a. Entire Action Area considered unfavorable for use by ABBs (see list in “Areas unfavorable for the ABB” section above).....*Activity “May Affect, Not Likely to Adversely Affect” the ABB. Federal agency requests concurrence from the Service through informal Section 7 consultation.*
- 3. b. All or portions of the action area may be favorable for use by the ABB (ABB habitat; areas not excluded by list of “Areas unfavorable for the ABB”).....Cont. to Step 4



- 4. a. Valid and current ABB presence/absence survey conducted for portion(s) of action area with ABB habitat did not find any ABBs (according to the latest ABB Oklahoma Presence/Absence Survey Guidance – <http://www.fws.gov/southwest/es/Oklahoma/>.) **AND** the entire action area is farther than 0.8 km (0.5 miles) from any valid positive survey (the effective radius of an ABB survey, as described in ABB Oklahoma Presence/Absence Survey Guidance)..... *Activity “May Affect, Not Likely to Adversely Affect” the ABB. Federal agency requests concurrence from the Service through informal Section 7 consultation.*
- 4. b. Presence/absence surveys conducted for the action area find ABBs (according to the latest ABB Oklahoma Presence/Absence Survey Guidance), **OR** no presence/absence surveys are conducted, **OR** any portion of the Action Area is within 0.8 km (0.5 miles) of a valid positive ABB survey (the effective radius of an ABB survey, as described in ABB Oklahoma Presence/Absence Survey Guidance).....Cont. to Step 5
- 5. a. Project actions do not include soil disturbance, use of vehicles or heavy equipment, artificial lighting, vegetation removal, use of herbicides, pesticides, other hazardous chemicals, **OR** any activity that may impact soil or vegetation or otherwise harm ABBs..... *Activity will have “No Effect” on the ABB. No concurrence from the Service required. Document your decision in your project files.*
- 5. b. Project actions include soil disturbance, use of vehicles or heavy equipment, artificial lighting, vegetation removal, use of herbicides, pesticides, other hazardous chemicals, **OR** any activity that may impact soil or vegetation or otherwise harm ABBs..... *Activity “May Affect, Likely to Adversely Affect” ABBs. Submit a Biological Assessment (BA) to the Service and initiate formal consultation through Section 7(a)(2) of the ESA. Incorporate the Service’s best management practices (BMPs) for the ABB (Appendix A) into the proposed project description as conservation measures in the BA. Additionally, the Service encourages Federal agencies to improve the status of the species and reduce the relative impacts of their actions by including conservation measures as part of their project, through acquisition of mitigation lands (described below in Appendix B).*



- 6. a. Entire Action Area (all areas to be affected directly or indirectly by the action and not merely the immediate area involved in the action [50 CFR §402.02]) occurs outside of ABB range (as defined by the Service)..... *Activity causes “No Take” of ABB, Incidental Take Permit not needed.*
- 6. b. All or portions of the Action Area occur within ABB range.....Cont. to Step 7
  
- 7. a. Entire Action Area considered unfavorable for use by ABBs (see list in “Areas unfavorable for the ABB” section above).....*Activity causes “No Take” of ABB, Incidental Take Permit not needed.*
- 7. b. All or portions of the action area may be favorable for use by the ABB (ABB habitat; areas not excluded by list of “Areas unfavorable for the ABB”).....Cont. to Step 8
  
- 8. a. Valid and current ABB presence/absence survey conducted for the portion(s) of the action area with ABB habitat did not find any ABBs (according to the latest ABB Oklahoma Presence/Absence Survey Guidance – <http://www.fws.gov/southwest/es/Oklahoma/>) **AND** the entire action area is farther than 0.8 km (0.5 miles) from any valid positive survey (the effective radius of an ABB survey, as described in ABB Oklahoma Presence/Absence Survey Guidance) ..... *Activity causes “No Take” of ABBs, Incidental Take Permit not needed.*
- 8. b. Presence/absence surveys conducted for the action area find ABBs (according to the latest ABB Oklahoma Presence/Absence Survey Guidance), **OR** no presence/absence surveys are conducted, **OR** any portion of the Action Area is within 0.8 km (0.5 miles) of a valid positive ABB survey (the effective radius of an ABB survey, as described in ABB Oklahoma Presence/Absence Survey Guidance).....Cont. to Step 9



9. a. Project actions do not include soil disturbance, use of vehicles or heavy equipment, artificial lighting, vegetation removal, use of herbicides, pesticides, other hazardous chemicals, **OR** any activity that may cause take of ABBs.....*Activity causes “No take” of ABB, Incidental Take Permit for the ABB is not needed.*
9. b. Project actions include soil disturbance, use of vehicles or heavy equipment, artificial lighting, vegetation removal, use of herbicides, pesticides, other hazardous chemicals, **OR** any action that could cause take of ABBs.....*The Service recommends obtaining an ESA Section 10(a)(1)(B) permit through the development of a Habitat Conservation Plan (either individually or as part of an applicable General Conservation Plan). Incorporate the Service’s BMPs for the ABB (Appendix A) as minimization measures in the HCP. Contact the Service for more information on how to prepare a Habitat Conservation Plan or permit application.*

Surveys results should only be used in the decision-making process if they are current and valid (as defined in the latest *ABB Oklahoma Presence/Absence Live-trapping Survey Guidance – <http://www.fws.gov/southwest/es/Oklahoma/>*). Project proponents should re-evaluate impacts if survey results have expired prior to project implementation. For example, a project proponent expects to start construction in September. Therefore, ABB presence/absence surveys are conducted in August. Due to unexpected delays, the project does not end up starting construction until the following June. In this situation, the surveys conducted in August are no longer valid or current. Therefore, additional surveys should be conducted, or if ABB presence is likely, occupancy could be assumed in order to avoid further project delays. See the latest *ABB Oklahoma Presence/Absence Live-trapping Survey Guidance* for more information; this document can be found on the OKESFO webpage [http://www.fws.gov/southwest/es/oklahoma/ABB\\_Add\\_Info.htm](http://www.fws.gov/southwest/es/oklahoma/ABB_Add_Info.htm).

Additionally, see Appendix A for the Service’s BMPs for American burying beetle in Oklahoma. These BMPs should be incorporated as conservation measures in Federal project Biological Assessments and as minimization measures in non-Federal project HCPs. The list of BMPs is not exhaustive and is subject to change at any time. To ensure you have the most recent version, visit our webpage at [http://www.fws.gov/southwest/es/oklahoma/ABB\\_Add\\_Info.htm](http://www.fws.gov/southwest/es/oklahoma/ABB_Add_Info.htm).



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For projects that cannot avoid take of the ABB, the Service recommends mitigating the effects of the take through conservation (protection, preservation, and management) of occupied ABB habitat in perpetuity (referred to as “mitigation lands”) to assist in recovery efforts for the ABB (Appendix B). The Service strongly encourages habitat offsets to Federal agencies conducting formal Section 7 consultations, and the Service requires them of private entities developing HCPs (pursuant to section 10(a)(1)(B) of the ESA). Additionally see the *American Burying Beetle Conservation Strategy for the Establishment, Management, and Operations of Mitigation Lands* document on our webpage at <http://www.fws.gov/southwest/es/oklahoma/ConsBank.htm>.



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**APPENDIX A:**

## **Best Management Practices for American burying beetle (ABB) in Oklahoma**

*Oklahoma Ecological Services Office  
October 29, 2013*

1. To decrease habitat loss, minimize clearing of temporary work areas and use small equipment or hand cutting techniques that leave the root zone intact. In general, using hand cutting techniques is likely to result in a smaller area of impact and reduce soil compaction relative to heavy equipment.
2. Minimize construction requiring artificial lighting. In situations where night construction work is necessary, shield direct light to the work area and prevent light from projecting upwards, thus minimizing the potential to attract insects, including ABBs.
3. In areas where ABBs are present (determined by valid surveys) or where ABB presence is assumed (when no ABB surveys were completed), return surface soils to approximate pre-construction conditions.
4. Restore areas in native range using approved native seed mixes developed for the applicable ecozone.
5. Prior to the topsoil replacement, rip (i.e., mechanically turn soil with a plow or ripping device) the impacted area. Rip and disk at a time when the soil is dry enough for normal tillage operations to occur on undisturbed farmlands adjacent to the areas to be ripped. This soil de-compaction treatment should be beneficial to the ABB by reducing the extent of soil compaction.
6. Educate all workers operating in the project areas about ABB habitat, biology, reasons for ABB decline, and the responsibility of all workers to protect the ABB. Require all workers to report any ABB sightings to the project manager or environmental inspector, remove all food wastes from the ROW each day, and prohibit dogs or cats on the ROW. Provide each worker a full color Endangered Species Card with a picture of the ABB and all information summarized on the card before they are allowed to conduct soil disturbing activities. Post signs at all access points to the project area highlighting the areas as ABB habitat and reminding workers to follow special restrictions in the area.



7. Install appropriate erosion controls, including such items as straw bales, biologs, silt fence, and similar materials.
  
8. Implement Pollution Prevention Requirements as required in section 3.3.3 of the Oklahoma Department of Environmental Quality General Permit OKR10 for Storm Water Discharges. Additionally, fuel all equipment outside of ABB habitat (that is, outside of undisturbed native vegetation) and store all fuel and motor vehicle oil outside of ABB habitat.



**APPENDIX B:**

**Mitigation Recommendations for the American burying beetle (ABB) in Oklahoma**

*Oklahoma Ecological Services Office*

The Service recommends that each project proponent conserve an amount of land proportional to the impacts to ABB habitat resulting from the project. The Service’s proportions, or ratios, are based on proximity of the impacts to areas of importance to ABB conservation (location) and duration of habitat impacts (**Table 1**).

**Table 1.** Mitigation Ratios for ABB impacts. Ratio = acres of impact : acres of offset

	Location of impact		
Impact Duration	ABB Range (but not within CPA)	Conservation Priority Area (CPA)	Mitigation Land
Temporary	1:0.25	1:0.5	1:1.5*
Permanent Cover Change	1:0.5	1:1	1:2*
Permanent	1:1	1:2	1:3*
*Mitigation Land ratio= CPA ratio plus replacement of lost mitigation value.			

Areas where impacts may result in a greater magnitude of take, and thus a larger effect on ABB, have higher mitigation ratios. For example, for permanent impacts occurring within the ABB range but outside of a CPA, for each acre of impact, 1 acre of mitigation is required (1:1 ratio). For permanent impacts occurring within an ABB CPA, for each acre of impact, 2 acres of mitigation is required (1:2 ratio). For impacts occurring within an established mitigation area, 3 acres of mitigation is expected for each acre of impact (1:3 ratio); this is the same as the ratio for impacts in a CPA, plus replacement for the acre of mitigation from prior projects that would be impacted by the action. Mitigation ratios start at 1:0.25 for temporary impacts and increase as duration of impacts increase. Greater duration of impacts likely results in greater adverse impacts to the ABB.



The ABB CPAs have a higher proportion of positive ABB surveys; consequently these areas will contribute more towards ABB conservation and recovery than areas within the ABB's range but outside the CPAs. Factors such as availability of habitat, food resources, and environmental variables likely contribute to higher density of ABB present within the CPAs. Therefore, impacts that could cause take and that occur within the CPAs have a greater effect on ABB and thus have a higher mitigation ratio than impacts in areas outside of CPAs.

Conservation easements are required for mitigation lands to protect the land from various potential impacts. However, it may not be possible to avoid all impacts, such as sub-surface mineral exploration. In cases where impacts to mitigation lands cannot be avoided, the Service expects a higher mitigation ratio. For temporary impacts the ratio is 1:1.5 and for permanent impacts 1:3. Mitigation lands are usually within ABB CPAs, have additional conservation value for the ABB through permanent protection by a conservation easement, and have a management plan specifically for the ABB.

Temporary impacts are those that impact ABB habitat for 5 years or less (areas impacted by the project are restored to a condition suitable for ABB use within 5 years of the original impact). Based on the climate and vegetation types of eastern Oklahoma, the Service expects that most grass and shrub-dominated cover types can be re-established to their pre-impact condition within 5 years. When considering precipitation, vegetation regrowth time, etc. in ABB range in Oklahoma, 5 years after the impacts occur is a reasonable timeframe for habitat to be restored to a condition suitable for ABB use.

Permanent cover change impacts are defined as impacts that change the successional stage of an area to a different stage (e.g., forest or shrubland to grassland; grassland to forest), resulting in habitat that is possibly less preferable for ABB use. Similar to temporary impacts, these areas will be restored to a condition suitable for ABB use within 5 years. However, if these areas will be permanently maintained at a different successional stage (through vegetation control, tree planting, or suppression of natural vegetation), the Service considers the vegetation cover of the area to have been permanently changed. Anthropogenic changes in cover type create intense, sudden contrast between patches (e.g., a grassland ROW fragmenting a contiguous stand of forest habitat or a forest stand fragmenting a contiguous grassland), compared to the natural patchy landscapes in Oklahoma, which have less contrast between adjacent patches. Evidence suggests that permanent change in cover, even if the types are native to the area, can increase threats to ABBs (Trumbo and Bloch 2000) by increasing invasive plant and animal species (Marvier et al. 2004), reducing the carrion prey base of the appropriate size for ABB reproduction (Oxley et al. 1974), or increasing the vertebrate scavenger competition for carrion (Kozol 1995, Ratcliffe 1996, Amaral et al. 1997, Bedick et al. 1999) necessary for ABB reproduction.



Permanent impacts are those that eliminate ABB habitat (e.g., buildings, roads, quarries, strip mines), as well as any impact to habitat that takes more than 5 years to re-establish as suitable for ABB use.

Please see the *American Burying Beetle Conservation Strategy for the Establishment, Management, and Operations of Mitigation Lands* document for additional information about implementing appropriate mitigation ratios. This is available on our webpage at <http://www.fws.gov/southwest/es/oklahoma/ConsBank.htm>.

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