

Biological Opinion and Incidental Take Statement
for Indiana bat (*Myotis sodalis*) at the Herrington Place Subdivision,
Reminderville, Summit County, Ohio.

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INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service’s (FWS or Service) Biological Opinion (BO) based on our review of the proposed issuance of a Section 404 permit by the U.S. Army Corps of Engineers Buffalo District (Corps) to Reminderville Investment Company, LLC (Applicant), for the proposed Herrington Place Subdivision, to be located in Reminderville, Summit County, Ohio, and its effects on the Indiana bat (*Myotis sodalis*) per section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). The Corps’ March 16, 2007 request for formal consultation was received on March 16, 2007, and formal consultation was initiated on March 16, 2007.

This biological opinion is based on information provided in the February 2007 Biological Assessment (Davey Resource Group 2007), a site inspection by the Service, numerous telephone conversations and e-mails between the FWS, Corps, the Applicant, and their representatives, and other sources of information. A complete administrative record for this consultation is on file at the Service’s Reynoldsburg, Ohio Ecological Services Field Office (ROFO).

CONSULTATION HISTORY

Table 1. Consultation History for the Herrington Place Subdivision Project

Date	Event
Jan. 26, 2005	Phone calls and emails between Service and Flickinger Wetland Services Group regarding the proposed project. Service requests additional information on quality and quantity of Indiana bat habitat onsite.
Mar. 25, 2005	Corps calls Service, asks if tree clearing onsite is OK if done prior to April 15.
Mar. 25, 2005	Service e-mail to Flickinger Wetland Service Group and Corps stating no tree clearing should occur until section 7 consultation has occurred. Seasonal clearing may not be sufficient to completely avoid and minimize impacts due to proximity of site to several known Indiana bat captures, large size of site, and amount and quality of forested habitat.
Apr. 22, 2005	Conference call between Service, Flickinger Wetland Services Group, Applicant, and Attorney regarding Indiana bat, federal nexus, and consultation requirements. Agree to complete an Indiana bat habitat survey of project area.
July 12, 2005	Davey Resource Group (Davey) submits Indiana bat habitat assessment report to Service
July 15, 2005	Service and Davey telephone call. Service recommends mist net survey of property based on presence of large amount of high quality habitat.
Aug. 8-9, 2005	Davey conducts mist net survey for Indiana bat on property.
Aug. 31, 2005	Davey submits mist net survey report to Service. No Indiana bats were captured, but numerous other bats were.
Oct. 25, 2005	Service submits letter to Davey accepting results of mist net survey, and concludes that presence of Indiana bat maternity colony onsite is unlikely.
Nov. 29, 2005	Service and Corps conference call regarding consultation.
Nov. 30, 2005	Service and Davey site visit & conference call with Corps of Engineers.

Dec. 6, 2006	Service receives Draft Biological Assessment (BA) from Davey.
Jan. 4, 2007	Service submits comments on Draft BA to Davey and Corps.
Feb. 16, 2007	Service receives Revised BA from Davey.
Mar. 13, 2007	Conference call between Service, Corps, Davey, Applicant, and Attorney regarding formal consultation timeframe and tree clearing. Agree that formal consultation will be initiated this week, and will be concluded by March 30, so that tree clearing of Phase I can be completed prior to April 15, 2007.
Mar. 16, 2007	Service receives Corps complete initiation package for formal consultation; Statutory timeframe for formal consultation begins.
Mar. 27, 2007	Service submits draft Biological Opinion to Corps for review.
Apr. 4, 2007	Corps submits comments on Draft Biological Opinion to Service
Apr. 5, 2007	Davey/Applicant submit comments on Draft Biological Opinion to Service
Apr. 6, 2007	Service submits final Biological Opinion to Corps and Applicant

The Corps determined that the Herrington Place Subdivision project is likely to adversely affect the Indiana bat, and submitted a request for initiation of formal consultation to the Service on March 16, 2007. In a March 20, 2007 response letter, the Service concurred with the Corps determination, and agreed that the initiation package was complete in accordance with 50 CFR §402.14, and that the timeframe for formal consultation had begun effective March 16, 2007.

BIOLOGICAL OPINION

Description of the Proposed Action

The following description of the proposed action is taken from the Biological Assessment (Davey Resource Group 2007) unless otherwise indicated:

The applicant, Reminderville Investment Company, LLC, is proposing to construct a residential development (Herrington Place) to provide cluster and villa home sites to residents in the Village of Reminderville and surrounding communities. The purpose of the project is to provide new affordable homes for first-time homebuyers in the region and upgrades for current residents of

Reminderville. This project will offer a cluster home development to serve the community of Reminderville with affordable housing choices.

The proposed action will take place on a 125-acre project site located in the Village of Reminderville, Ohio, south of Glenwood Boulevard, east of Nautilus Trail (entrance to Aurora Shores subdivision), and west of Maryland Avenue. This site will extend existing side roads for entrance and exit from the development. The navigational coordinates for the center of the subject area are 41.341308°N and 81.397212°W.

Currently the 125-acre project site is 90 percent second-growth forest, with primarily beech, maple, and oak communities. In addition, 37.182 acres of wetlands and 6,330.88 linear feet of streams exist on the project site. An Indiana bat habitat survey identified fourteen potential maternity roost trees on the project area, and much of the site is suitable as potential foraging habitat for the bat.

This project will be constructed in three phases over three years, with the first phase beginning in spring 2007. The first phase will begin this spring and will impact only seven acres of the project area. It will include the construction of the entrance road off Glenwood Boulevard, 20 homes, and two stormwater basins. To avoid and minimize impacts to the Indiana bat, clearing of trees in Phase I will occur prior to April 15, 2007. In 2008 and 2009, all clearing activities will be completed between November 15 and March 15, further reducing potential direct and indirect adverse effects Indiana bats that may be using the site. Construction will occur in summer and fall of each year.

1. The site design includes construction of housing including 24 attached cluster units and 244 detached villas, 15 stormwater ponds, and associated infrastructure. To construct this development, clearing of trees, grading, culverting streams, and filling of wetlands will be required. Currently, 37.182 acres of wetlands and 6,330.88 linear feet of streams exist on the project site. The development plan proposes placing approximately 7,060 cubic yards of clean earthen fill in 4.345 acres of wetlands for grading activities. Also, 1,228.64 linear feet of streams will be culverted, piped, or filled with approximately 685 cubic yards of clean earthen fill for home and infrastructure construction.
2. A Section 404 Department of the Army permit application was submitted to U. S. Army Corps of Engineers on October 11, 2006 and a Section 401 Individual Water Quality Certification application was submitted to Ohio Environmental Protection Agency (EPA) on November 27, 2006. Subsequent to a comment letter and meeting with USACE, changes to the site design have occurred to further minimize wetlands and stream impacts and provide a buffer zone around preserved natural features.

Due to the site design changes, only one of the fourteen potential maternity roost trees identified in both the maternity roost survey (Flickinger Wetland Services Group 2005) and the secondary survey will be impacted. Thirteen trees are enclosed either within wetlands to be preserved or the associated buffers. All wetland/buffer areas will be preserved in perpetuity under a conservation easement held by The Land Conservancy of Ohio. This is a conservation organization that was formed to facilitate the preservation of lands via conservation easements. A flat fee is charged for placing a conservation easement on a piece of property, holding the easement, inspecting the property annually to ensure compliance with the easement, and enforcing the easement as needed if someone violates the same. To deter encroachment, signs will be erected behind each lot that demarks the buffer zone and wetlands as protected areas.

Conservation measures the applicant intends to implement as part of the proposed project for the purposes of avoiding, minimizing, and mitigating the potential for incidental take are included below. Implementation of these measures will substantially limit mortality of the Indiana bat and help ensure that suitable habitat is maintained in perpetuity. Any adverse effects to the Indiana bat will be minimized to the maximum extent practicable.

1. Of the 125-acre site, 33 acres, which includes forest, wetlands and streams, will be preserved in a natural state. Stream preservation includes 5,102 linear feet, and wetland preservation totals 32.737 acres. The preserved areas will provide high quality Indiana bat habitat in perpetuity.
2. Included in the preserved areas are 13 potential maternity roost trees. Fifteen potential maternity roost trees were identified in the initial July 2005 potential maternity roost survey; however, four trees were determined to be outside the project boundary limits. A second survey conducted January 2007 identified three additional potential maternity roost trees. One tree, Tree 18, will be impacted. This tree is located in Phase 2 of the development plan and will be removed between November 15 and March 15.
3. A forested buffer will be maintained 50 to 100 feet total width along the preserved stream segments, depending on stream size and drainage area. A forested buffer with a minimum width of 50 feet will surround the preserved Category 3 wetlands, and a forested buffer of a minimum width of 30 feet will surround the preserved Category 2 wetlands. These forested buffer areas will preserve roosting and foraging habitat and provide connectivity between the preserved areas throughout the project site, which can serve as travel and foraging corridors. These areas will be included in a conservation easement placed on all preserved areas on-site and held by The Land Conservancy of Ohio.
4. Construction will occur in three phases, with the first phase to begin in 2007, and subsequent phases to occur in subsequent years. This phasing of construction will allow any Indiana bats using the site to gradually adapt to the loss of some forested habitat, and to gradually find new roosting, foraging, swarming, and/or staging habitat over a three-year period.
5. Silt fencing and orange construction fencing will be used to demark buffer areas and to keep construction equipment out of these areas.
6. All potential maternity roost trees identified will be clearly marked and surrounded with orange construction fencing to prevent accidental damage by machinery. Almost all of the identified maternity roost trees are currently incorporated into the forested buffers around the preserved wetlands and, therefore, will be protected within this zone.
7. Land clearing associated with Phase I of the development will occur prior to April 15, 2007, when Indiana bats would not be using the project area for roosting or foraging. Land clearing associated with Phases II and III of the development will occur between November 15 and March 15, when Indiana bats would not be using the project area for roosting, foraging, swarming or staging.
8. Construction of the buildings and infrastructure will not occur near buffer zones. The only time disturbance may occur within the immediate area of the potential maternity roost trees post-March 15 is during construction of the stormwater ponds, which are located directly adjacent to buffer zones. Every effort will be made to limit construction within the vicinity of the identified potential maternity roost trees during the summer

months. Furthermore, the individual lots adjacent to Category 3 wetland buffers will have the rear of the lots maintained in a forested state, which will provide additional buffers around a number of potential maternity roost trees.

9. Where possible, trees used for post-construction landscaping will be chosen from the Service's list of "Suggested Native Tree Species for Indiana Bat Habitat".
10. Davey Resource Group will develop educational pamphlets for the Homeowners Association describing the preserved wetlands, land-use restrictions, and Indiana bat description, status, and habitat. At the rear property lines of homes that are immediately adjacent to preserved wetlands, informational signs that designate wetland boundaries and define land-use restrictions (e.g., no vehicles, mowing, vegetation clearing, dumping, herbicide, or fertilizer use), will be installed.
11. Impacts to water quality due to construction activities will be minimized through implementing the following measures:
 - maintaining erosion control (e.g., silt fencing, clearing and grading during drier periods, silt ponds to trap sediment prior to construction) throughout the construction process;
 - staggering construction activities to minimize exposure time of cleared surfaces;
 - stripping and stockpiling of top soil;
 - establishing permanent vegetative cover of exposed soils through planting, seeding, or sodding with both native and ornamental plants;
 - creating provisions for surface and stormwater runoff controls including retention ponds, curbs, and gutters;
 - completing all in-stream work during low-flow conditions and installing straw bales downstream of the active construction area within the project area boundaries to capture sediment; and
 - creating no borrow or waste areas within preserved wetlands, along streams, or within upland buffers.
12. To comply with Corps and Ohio EPA permitting requirements, restoration of five acres of forested wetlands will occur to mitigate for impacts to 4.345 acres of wetlands that will be filled during construction of the proposed project. Through a collaborated effort involving Metro Parks Serving Summit County (MPSSC), the City of Twinsburg, the Village of Reminderville, and Wetlands Resource Center, a large, agency-approved, consolidated mitigation project will restore wetlands in Liberty Park. This five-acre mitigation site is located less than one-half mile from the project site and is adjacent to Pond Brook, an area where Indiana bats are known to occur. This wetland mitigation site is part of a larger, 12.3-acre, consolidated mitigation project. The proposed mitigation project will restore wetlands within the northeastern corner of Liberty Park. It will restore hydrology to the area by reversing decades of hydrologic alterations and impacts on the site. Wetland plantings and invasive species control measures will occur. The goal will be to restore the area to a forested wetland community, providing additional habitat and foraging areas for the Indiana bat. Construction for this mitigation project is scheduled to

occur August through November 2007. This area is under MPSSC ownership and will be preserved in perpetuity.

Additionally, the onsite preservation of 33 acres of on-site wetlands, 5,102 linear feet of on-site streams, and associated buffers, as described above, is included as part of the mitigation plan.

The Applicant is responsible for ensuring implementation and/or compliance with the above conservation measures. Corrective actions will immediately be taken to remedy any non-compliance.

At the completion of the project, it is expected that a total of 61.7 acres will be cleared and graded for development, 33 acres including wetlands, streams, and associated buffer zones will be preserved, and the other 21 acres will be turned over to the Homeowners Association as open area. These 21 acres include the stormwater areas and land between lot lines and buffer areas. These 21 acres may be used for passive or active recreation or left untouched as woodland or open field. They will serve as additional foraging and, if forested, potential roosting areas. This acreage, however, will not be included in the conservation easement as it exists in small pieces that are scattered around the site.

Action Area

Within a set action area, all activities that can cause measurable or detectable changes in land, air, and water or to other measurable factors that may elicit a response in the species or critical habitat are considered. The action area is not limited to the footprint of the action and should consider the chemical and physical impacts to the environment resulting from the action.

The action area for this project has been determined to be the 125-acre site, which includes areas of construction and preserved areas, as well as 3,200 feet surrounding the site (Figure 1). The total acreage for the action area is determined to be 1,675 acres. The area directly affected by the action is the 125-acre project area where all construction, operation, and maintenance will occur. The additional 3,200 feet surrounding this project area will be indirectly affected by noise, vibrations, and impacts to surface water resources. The entire 1,675-acre action area is comprised of approximately 44 percent developed land, 46 percent non-developed land, and 10 percent open water (Aurora Lake).

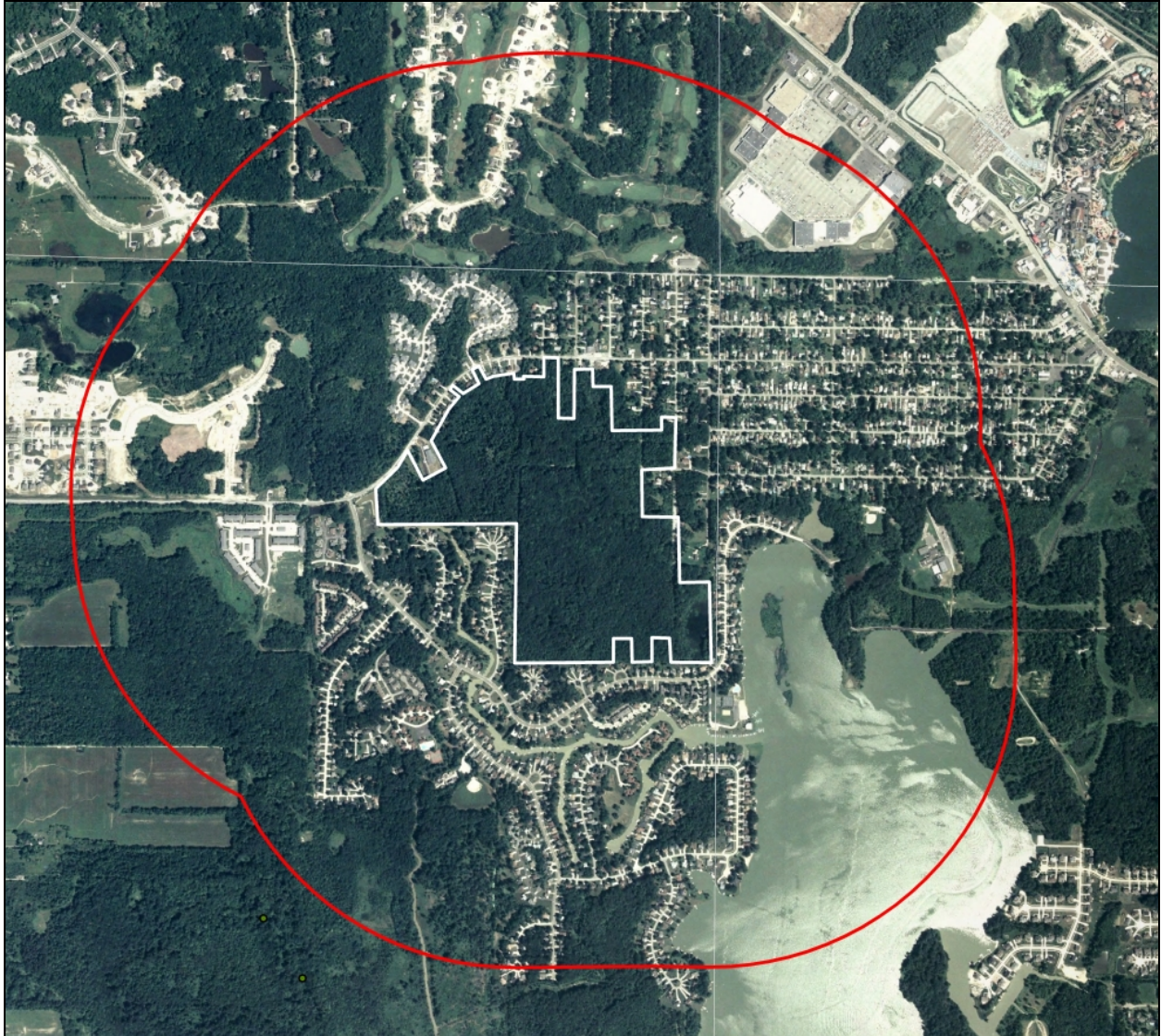


Figure 2. Action area. The action area includes the 125-acre project site (bordered in white) and a 3,200 foot buffer (bordered in red).

Noise and vibrations are physical impacts to the environment that will be caused by construction on-site with variable intensity, depending on the source. Initially, tree-clearing will generate noise in the pre-construction phase. Chainsaws generate an estimated noise level of 110dBA, which is louder than typical construction equipment at an average of 85dBA (Federal Highway Administration (FHWA) website). The level of noise generated from the different construction and maintenance activities will vary depending upon the methods and equipment being used. Operational noise will be generated by vehicles during construction, and daily activities will generate low levels of noise after construction is complete. These low levels of noise will be those associated with day-to-day activities within a residential community.

Current ambient noise within the proposed 125-acre site varies depending on the proximity to roads, waterways, and bordering residential communities. The lowest noises expected would be in the center of the property, near Wetland H. The loudest noises expected would be along the

northern border, adjacent to Glenwood Boulevard. The estimated current ambient noise levels are approximately 50dBA at the quietest location on-site (FHWA website). The current ambient noise levels on-site are influenced by, but not limited to, road traffic, recreational usage, and nearby residential communities.

The highest project noise levels are expected to occur during the clearing and construction activities. The equipment that will be used at these phases is estimated to range from 85dBA to 110dBA at 50 feet from the source. To put these noise levels into perspective, normal human conversation measures about 60dBA. In general, human sound perception is such that a change in sound level of 3dBA is just noticeable, a change of 5dBA is clearly noticeable, and a change of 10dBA is perceived as a doubling or halving of sound level (FHWA website).

The effects of noise are expected to occur approximately 3,200 feet outside of the 125-acre project area, based on the following assumptions:

- The noise level at the quietest location on the property (Wetland H) is estimated to be 50dBA (FHWA website)
- Noise level of construction equipment is estimated at 85dBA at 50 feet from the source (FHWA website)
- Noise decreases by approximately 5dBA per doubling of distance from source over soft ground with heavy vegetative ground cover (FHWA website)

Based on these assumptions, construction noise of 85dBA at the edge of the property line would travel up to 3,200 feet beyond the property line before the distance traveled by the noise reduces it to 50dBA.

In conclusion, the action area for the proposed Herrington Place subdivision includes the 125-acre project area and an additional 3,200 feet (1,675 acres) surrounding the property, which incorporates the area that will be affected by construction noise. Once construction is complete, noise in the immediate area will increase from current conditions resulting from car traffic, lawn maintenance, and human activity.

Temporary and permanent impacts to surface waters on and off the project site are anticipated from this project. Both wetlands and streams within the project area will be directly and indirectly affected during construction. Surface waters within the action area may also be affected by alteration of surface drainage patterns, changes in stream dynamics, and an increase in pollutants from construction equipment, grading, increased impervious area, and lawn chemicals.

As a result of this project, 4.345 acres of wetlands will be filled and graded to construct the housing units and infrastructure for this development. Indirect impacts to two wetlands that continue off-site are likely. The physical, chemical, and biological nature of these wetlands will be altered by the filling and grading of on-site portions. Some changes include decreased water absorbance capacity, increased flow, and increased sedimentation.

Impacts to on-site streams are not likely to impact downstream sources with sediment or pollutants. Streams within the project area, proposed to be impacted, flow to one major on-site stream. This stream then flows off-site towards Pond Brook. The distance from this stream at the southwestern boundary of the project area to Pond Brook is less than 0.1 mile. Impacts to streams will be localized. Utilizing sediment traps (*i.e.*, straw bales) placed directly downstream of the impact zone during construction and re-vegetation of stream banks immediately after

impact will help lessen sediment flow downstream. Increased sediment influx into the streams should be kept within the project area and very little, if any, pollutants or sediment will travel off-site.

Once the development is constructed, runoff from lawns and impervious surfaces will be captured in storm drains and sent to the 15 stormwater basins located on-site. This filtered water will then be sent into the preserved wetland systems. These wetlands will absorb some of this water and the overflow will go into the on-site drainages. This will improve on-site water quality with multiple filtering prior to entering the drainages. Currently, the on-site drainageways contain marginal to poor in-stream habitat and large amounts of silt. This pre-treatment will help to control silt influx into the drainageways and possibly improve in-stream habitat.

Status of the Species

The Indiana bat was officially listed as an endangered species on March 11, 1967 (32 FR 4001) under the Endangered Species Preservation Act of October 15, 1966 (80 Stat. 926; 16 U.S.C. 668aa[c]). The Endangered Species Act of 1973 extended full protection to the species. Thirteen winter hibernacula (11 caves and two mines) in six states were designated as critical habitat for the Indiana bat in 1976 (41 FR 187). The Service has published a recovery plan (USFWS 1983) that outlines recovery actions. Briefly, the objectives of the plan are to: (1) protect hibernacula; (2) maintain, protect, and restore summer maternity habitat; and (3) monitor population trends through winter censuses. The recovery plan is currently under revision.

Description and Distribution

The Indiana bat is a medium-sized bat, closely resembling the little brown bat (*Myotis lucifugus*) but differing in coloration. There are no recognized subspecies. The Indiana bat has been found in 27 states throughout much of the eastern United States (USFWS 1999). More specifically, NatureServe (2004) describes its summer and winter range as including eastern Oklahoma, north to Iowa, Wisconsin, and Michigan, east to New England and south to western North Carolina, Virginia, and northern Alabama. It is virtually extirpated in the northeastern United States. Major populations of this species hibernate in Indiana, Kentucky, and Missouri, with smaller populations reported in Alabama, Arkansas, Georgia, Illinois, Maryland, Mississippi, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Virginia, and West Virginia. The majority of maternity colonies are located in the glaciated Midwest.

The Indiana bat is a member of the *Myotis* genus, and is quite small, weighing only three-tenths of an ounce (USFWS 2002). In flight, it has a wingspan of 9 to 11 inches. The fur is dark brown to black and the bat is similar in appearance to many other related species (USFWS 2002). The most well recognized difference between Indiana bats and other similar *Myotis* species is that Indiana bats have a distinctly keeled calcar (cartilage that extends from the ankle to support the tail membrane). There are other minor differences, such as Indiana bats having smaller, more delicate feet, shorter feet hairs that do not extend past the toenails, and a pink nose.

Life History and Population Dynamics

The lifespan for Indiana bats is generally between 5 and 10 years (Thomson 1982), but individuals may live much longer, with the oldest known bat captured 20 years after it was first banded (LaVal and LaVal 1980).

The key stages in the annual cycle of Indiana bats are: hibernation, spring staging, pregnancy, lactation, volancy/weaning, migration, and swarming. While varying with weather and latitude, generally bats begin winter torpor in mid-September through late October and begin emerging in April. Females depart shortly after emerging and are pregnant when they reach their summer area. Birth of young occurs between mid-June and early July and then nursing continues until weaning, which is shortly after young become volant in mid to late July. Migration back to the hibernacula may begin in August and continue through September. Males depart later from the hibernacula and begin migrating back earlier than females.

Hibernation

Generally, Indiana bats hibernate from October through April depending upon local weather conditions. Bats cluster on cave ceilings during hibernation and are capable of clustering in densities ranging from 300-484 bats per square foot. Hibernation facilitates survival during winter when prey are unavailable. However, the bat must store sufficient fat to support metabolic processes until spring. Substantial risks are posed by events during the winter that interrupt hibernation and increase metabolic rates.

Temperature and relative humidity are important factors in the selection of hibernation sites. During the early autumn, Indiana bats roost in warm sections of caves and move down a temperature gradient as temperatures decrease. In mid-winter, Indiana bats tend to roost in portions of the cave where temperatures are cool (2.7-6.1° C). Long-term data suggest an ideal temperature range for hibernacula is between 3-6°C (USFWS 1999). A recent study of highly populated hibernacula documented a temperature range of 3-7.2°C (Tuttle and Kennedy 2002). Relative humidity in Indiana bat hibernacula is usually above 74% but below saturation (Hall 1962; Humphrey 1978; LaVal et al. 1976), although relative humidity as low as 54% has been observed (Myers 1964).

Spring Staging

After hibernation ends in late March or early April, most Indiana bats migrate to summer roosts. Female Indiana bats emerge from hibernation prior to males. The period after hibernation and just before spring migration is typically referred to as “staging,” a time when bats forage and a limited amount of mating occurs (Hall 1962; Cope and Humphrey 1977). During staging, both male and female bats may return to their hibernacula to roost after foraging, or may roost individually in nearby trees (Hobson and Holland 1995, 3D/International 1996). Most bats leave their hibernacula by late April. Migration is stressful for the Indiana bat, particularly in the spring when their fat reserves and food supplies are low and females are pregnant. As a result, adult mortality may be highest in late March and April (Thomson 1982).

Female Maternity Colony and Summer Roosting Habitat

Upon emergence from the hibernacula in the spring, females seek suitable habitat for maternity colonies (USFWS 1999). Coloniality is a requisite behavior for reproductive success. Females usually start grouping into larger maternity colonies by mid-May and give birth to a single young between late June and early July (Humphrey et al. 1977). These colonies are typically located under the sloughing bark of live, dead and partially dead trees in upland and lowland forest (Humphrey et al. 1977; Gardner et al. 1991). Colony trees are usually large-diameter, standing dead trees with direct exposure to sunlight. The warmer temperature from sunlight exposure helps development of fetal and juvenile young (USFWS 1999). A maternity roost may contain 100 or more adult females and their pups.

Roost trees often provide suitable habitat as a maternity roost for only a short period of time. Roost trees are ephemeral in nature; suitable trees fall to the ground or lose important structural characteristic such as bark exfoliation (Gardner et al. 1991; Britzke et al. 2003). Dead trees retain their bark for only a certain period of time (about 2-8 years). Once all bark has fallen off a tree, it is considered unsuitable to the Indiana bat for roosting. Gardner et al. (1991) found that 31% of Indiana bat occupied roost sites were unavailable the summer following their discovery; 33% of the remaining occupied roost sites were unavailable by the second summer.

However, female Indiana bats have shown strong site fidelity to their summer maternity grounds, and will use suitable roost trees in consecutive years, if they remain standing and have sloughing bark (Gardner et al. 1991; Callahan et al. 1997; Kurta and Murray 2002). Traditional summer sites are essential to the reproductive success of local populations. It is not known how long or how far female Indiana bats will search to find new roosting habitat if their traditional roost habitat is lost or degraded. If they are required to search for new roosting habitat, it is assumed that this effort places additional stress on pregnant females at a time when fat reserves are low or depleted and they are already stressed from the energy demands of migration.

It is unknown how many roosts are critical to the survival of a colony, but the ephemeral nature of the roost trees dictates that several must be available in an area if the colony is to return to the same area and raise their young successfully. Indiana bats require many roost trees to fulfill their needs during the summer (Callahan et al. 1997). In Michigan, Indiana bats used two to four different roost trees during the course of one season (Kurta and Williams 1992). In Missouri, each colony used between 10-20 roost trees, and these were not widely dispersed (all within a circle ranging in size from 0.81 to 1.48 km) (Miller et al. 2002). The important factor associated with roost trees is their ability to protect individuals from the elements, and to provide thermal regulation of their environment. Maternity colonies have at least one primary roost, which is generally located in an opening or at the edge of a forest stand (USFWS 1999). Maternity colonies also use multiple alternate roosts, which are located in the open or in the interior of forest stands (USFWS 1999). Exposure to sunlight is important during development of fetal and juvenile young. In Missouri, use of dead trees in the forest interior increased in response to unusually warm weather (i.e., shading provided a cooler thermal environment), and use of live trees and snags in interior forest increased during periods of precipitation (Miller et al. 2002). Maternity colonies in North Carolina and Tennessee used roosts located above the surrounding canopy (Britzke et al. 2003).

Roost trees vary in size. The minimum diameter reported for a female Indiana bat roost tree is 4.3 inches dbh (Britzke 2003), though such small trees have not been documented as primary roosts. The average diameter of roost trees used by maternity colonies (primary and alternate) is 24, 22, and 16 inches for Indiana, Missouri, and Michigan, respectively (Callahan et al. 1997, Kurta and Rice 2002, Whitaker and Brack 2002). The smallest mean diameter of roost trees used by a colony is 11 inches, which is for five trees in Pennsylvania; however, the primary roost for this colony was a building, and no tree sheltered more than four bats (Butchkoski and Hassinger 2002). Kurta (2005) analyzed 393 roost trees from 11 states and found that the average diameter of maternity roost trees is 18 inches.

Larger-diameter trees presumably provide thermal advantages and more spaces for more bats to roost. As with most tree-roosting bats (Hayes 2003, Barclay and Kurta in press), female Indiana bats probably select trees, especially primary roosts, that are larger in diameter than nearby apparently suitable, but unoccupied trees (Kurta et al. 1996, 2002; Britzke et al. 2003; Palm 2003; Sparks 2003).

Indiana bats have been found roosting in several different species of trees, and it appears that they choose roost trees based on their structural composition. Therefore, it is difficult to determine if one particular species of tree is more important than others. However, 12 tree species have been listed in the Habitat Suitability Index Model as primary species (class 1 trees) (Rommé et al. 1995). These trees include silver maple (*Acer saccharinum*), shagbark hickory (*Carya ovata*), shellbark hickory (*C. laciniosa*), bitternut hickory (*C. cordiformis*), green ash (*Fraxinus pennsylvanica*), white ash (*F. americana*), eastern cottonwood (*Populus deltoides*), red oak (*Quercus rubra*), post oak (*Q. stellata*), white oak (*Q. alba*), slippery elm (*Ulmus rubra*), and American elm (*Ulmus americana*). In addition to these species, sugar maple (*A. saccharum*), shingle oak (*Q. imbricaria*), and sassafras (*Sassafras albidum*) are listed as class 2 trees (Rommé et al. 1995). The class 2 trees are those species believed to be less important, but that still have the necessary characteristics to be used as roosts. These tree species are favored by the Indiana bat, since as these trees age, their bark will slough.

During a fall survey in Kentucky in 1994 and 1995, female Indiana bats utilized sourwood (*Oxydendrum arboreum*) and pignut hickory as roost trees and were found to roost singly (Kiser and Elliott 1996). The females' trees were between 6 and 10 inches in diameter and contained bark cover between 54 and 70 percent. Females tended to roost within 0.75 miles of the hibernacula, whereas males roosted anywhere from 0.95 to 2.35 miles from the hibernacula. Both males and females were found to use 2 to 3 roost trees for 2 to 3 days at a time (Kiser and Elliott 1996). Britzke et al. (2003) documented the use of conifers by maternity colonies in the mountains of Tennessee and North Carolina.

Male Roosting Habitat

Some adult males use mature forests around and near their hibernacula for roosting and foraging from spring through fall. However, some male bats have been found to leave the hibernacula area completely (USFWS 1999). Male Indiana bats have been found to use the same habitat in subsequent years (USFWS 1999).

Roost trees are primarily dead snags on upper slopes or ridgetops, however live shagbark hickory and pignut hickory (*Carya glabra*) trees have been recorded as roost trees. Male Indiana bats have been found to roost singly during autumn in scarlet oak (*Quercus coccinea*), Virginia pine (*Pinus virginiana*), red maple (*Acer rubrum*), shagbark hickory, and red oak. These trees ranged in diameter from 4.6 to 26 inches, with an average diameter of 13 inches, and had bark coverage ranging from 1 percent to 100 percent. However, the majority of the roost trees had bark coverage of at least 60 percent (Kiser and Elliott 1996).

During a 1999 radio telemetry survey on the Athens District of the Wayne National Forest, males were found roosting in American elm, red maple, shagbark hickory, and sugar maple trees. The average dbh of these trees was 11.8 inches and the average length of time each tree was used was 2.3 days (Schultes 2002). In 2000, two male Indiana bats were found roosting in American elm, red maple, black oak (*Quercus velutina*), white oak, pignut hickory and shagbark hickory. The average dbh of these trees was 11.9 inches and the average length of time each tree was used was 1.9 days (Schultes 2002).

Foraging

Indiana bats feed exclusively on flying aquatic and terrestrial insects. Although there are no consistent trends, diet appears to vary across their range, as well as seasonally and with age, sex and reproductive-status (Murray and Kurta 2002; Belwood 1979). Murray and Kurta (2002) found that diet is somewhat flexible across the range and that prey consumed is potentially affected by regional and local differences in bat assemblages and/or availability of foraging habitats and prey. For example, Lee (1993) and Murray and Kurta (2002) found that adult aquatic insects (Trichoptera and Diptera) made up 25-81% of Indiana bat diets in northern Indiana and Michigan. However, in the southern part of the species range terrestrial insects (Lepidoptera) were the most abundant prey items (as high as 85%) (Brack and LeVal 1985; LaVal and LaVal 1980; Belwood 1979). Kiser and Elliot (1996) found that Lepidopterans (moths), Coleopterans (beetles), Dipterans (true flies) and Homopterans (leafhoppers) accounted for the majority of prey items (87.9% and 93.5% combined for 1994 and 1995, respectively) consumed by male Indiana bats in their study in Kentucky. Diptera, Trichoptera, Lepidoptera, and Coleopterans also comprised the main prey of Indiana bats in Michigan (Murray and Kurta 2002), however, Hymenopterans (alate ants) were also taken when abundant.

Foraging habitat for male and female Indiana bats in the core of their range is assumed to include forest habitats with open understories and canopy closures of 50 to 70 percent (Romme et al. 1995). However, other foraging habitat includes upland, bottomland, and riparian woodlands, as well as forest and cropland edges, fallow fields, and areas of impounded water (Kiser and Elliott 1996). Other studies are showing that summer roosting and foraging areas, in parts of the range, can contain diverse cover types, including agricultural lands, residential areas, and open woodlands (Carter et al. 2002; Farmer et al. 2002; Miller et al. 2002).

Females tend to use larger foraging areas than males during the summer. One study recorded a post-lactating female as having a foraging range of approximately 530 acres; males had an area of approximately 140 acres (Kiser and Elliott 1996). New information from a Michigan study

documented pregnant and lactating females traveling up to 2.6 miles from the day roost to foraging areas (Murray and Kurta 2004). Observations by Murray and Kurta (2004) indicated that female Indiana bats would not fly over open areas between foraging areas on the northern edge of its range in Michigan, but appeared to follow wooded corridors described as a narrow fence line of mature trees. This data indicates that wooded corridors, even narrow ones, may provide an important link between roosting and foraging areas for the Indiana bat.

During summer months, some males remain near the hibernacula and forage along floodplain pastures, within dense forests and on ridge tops. Male Indiana bats generally travel between 1.2 and 2.6 miles from their summer roosts to summer foraging areas (USFWS 1999). A separate study indicated male Indiana bats have a minimum foraging area size of about 400 acres and a high use area size of 115 acres (Kiser and Elliott 1996).

During the fall, male bats were found to forage in upland, ridgetop forest as well as valley and riparian forest areas (USFWS 1999). Male Indiana bats tend to use larger foraging areas during autumn than in summer. However, female bats use even larger autumn foraging areas than males. During October, males were observed to be traveling between 0.89 and 1.5 miles to forage (Kiser and Elliott 1996).

Home Range

Indiana bats are known to occupy distinct home ranges, particularly in the summer (Garner and Gardner 1992). However, relatively few studies have determined the home ranges of Indiana bats, and these studies based their calculations on a small number of individuals. Further, direct comparison of the home range estimates between studies is difficult due to different methodologies used in collecting the data, inconsistency in terminology, and different methods of calculating home range size (Lacki et al. 2006). Home range size varies between seasons, sexes, and reproductive status of the females (Lacki et al. 2006). Standardized methodology and terminology as well as additional research will be necessary in order to further refine home range estimates.

Kiser and Elliot (1996) identified minimum foraging areas for 15 Indiana bats (14 males, 1 female) at a hibernaculum in Kentucky. Their estimates ranged from approximately 28 to 267 ha (69 to 734 acres) (excluding the cave in the estimate), with a mean of 156 ± 101 ha (385 ± 249 acres). Romme et al. (2002) calculated a mean home range near a hibernaculum in Missouri of 667 ± 994 ha ($1,648 \pm 2456$ acres) for spring and fall (based on pooled data for nine bats-male and female) and $1,584 \pm 1,424$ ha ($3,825 \pm 3,518$ acres) for fall home range (based on three males). In Virginia, Brack (in press) calculated average active areas for three females and eight males near a hibernaculum as 250 ± 100 ha (618 ± 247 acres) ($n=1$ 1) using mean convex polygons and 361 ± 259 ha (892 ± 640 acres) ($n=10$) using adaptive kerneling (core areas).

Menzel et al. (2005) tracked seven female and four male Indiana bats from May to August in Illinois. No significant differences in home ranges between males and females were observed and home range estimates were subsequently grouped. Menzel et al. (2005) determined the mean summer home range size of Indiana bats to be 145 ha (357 acres). Watrous et al. (in press) calculated a mean home range of 83 ha (205 acres) for 14 female Indiana bats in Vermont.

Fall Swarming and Mating

From late-August to mid-October, prior to entering the hibernacula, large numbers of Indiana bats fly in and out of cave or mine openings from dusk till dawn in a behavior called swarming. Swarming usually lasts for several weeks and mating occurs toward the end of this period. During swarming, male and female Indiana bats may roost in the hibernacula, or may roost individually in trees nearby (Kiser and Elliott 1996). Male Indiana bats tend to be active for a longer period of time than females during swarming and will enter the hibernacula later than the females (USFWS 1999). Adult females store sperm through the winter thus delaying fertilization until early May.

Range-wide Status

The Indiana bat geographic range includes most of the eastern and Midwestern United States. It occurs from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida (Barbour and Davis 1969). The majority (85%) of the range-wide population hibernates in ten Priority 1 (P1) hibernacula (sites that contain more than 30,000 individuals), which are located in Indiana (three sites), Kentucky (four sites), and Missouri (three sites). Priority 2 (P2) colonies (containing between 500 and 30,000 bats) are located in Arkansas, Illinois, New York, Ohio, Tennessee, Virginia, and West Virginia as well as in the Priority 1 States (USFWS, 1999).

Range-wide estimates of species numbers over the three most recent survey periods do not show the same declining trend seen in estimates spanning 1965-2000 (Figure 2). There is a 15% increase from the 2003 estimate of 393,000 bats to the 2005 rounded estimate of 457,000 bats (USFWS, unpublished data, 2006). Unfortunately, the interpretation of this apparent increase is somewhat confounded at this point in time because there has yet to be developed and implemented a standardized approach of measuring sources of variability and observer error in association with the standard winter survey methodology. Therefore, the different time frames, changes in methodology over time, and insufficient information on accuracy and variability of individual cave estimates make statistical testing of these differences inappropriate. Even so, because the individual biologists that have been conducting the winter bat surveys at high priority hibernacula have been very consistent over the past 20 years, there is some basis for believing the recent upward trend may in fact reflect reality. We anticipate that planned improvements in hibernacula survey methodology will soon provide for a greater level of confidence in population estimates.

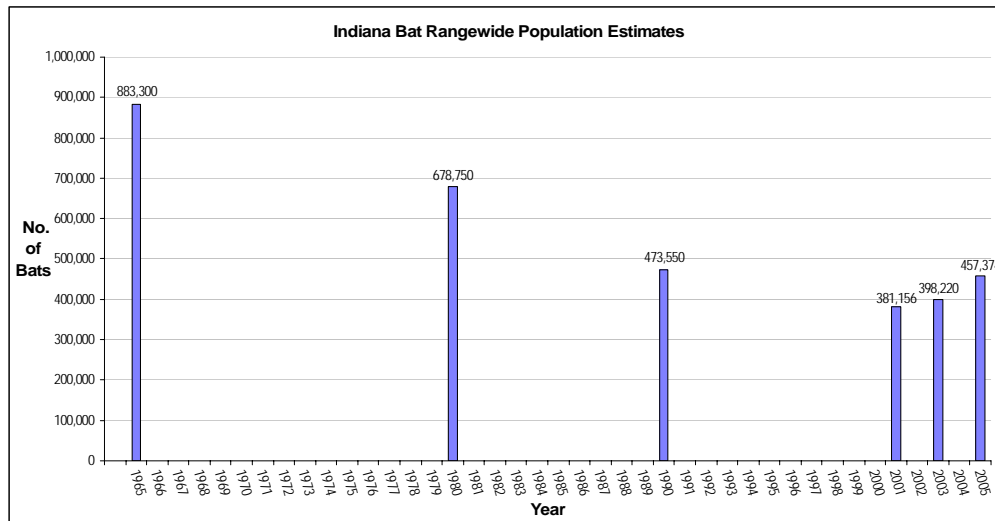


Figure 3. Indiana bat rangewide population estimates (King 2006)

Threats to the Species

The causes for the population decline of the Indiana bat have not yet been definitively determined. However, the documented and suspected reasons for decline include disturbance and vandalism; improper cave gates and structures; natural hazards; microclimate changes; adverse land use practices; and chemical contamination.

Human disturbance of hibernating bats led to a decline in Indiana bat populations from the 1960s to the 1980s (USFWS 1999). Disturbance from recreational cavers and researchers entering hibernacula can cause bats to expend crucial fat reserves before they are able to forage in the spring. If disturbance occurs too often, fat reserves can be depleted before the species can begin foraging in the spring.

Changes in the microclimate of a cave or mine can affect temperature and moisture level, thereby affecting suitability of the hibernaculum or affecting bat physiology (Richter et al. 1993; Tuttle and Kennedy 2002). Blockage of entry points can alter airflow in a cave or mine. This poses serious consequences when a hibernaculum is on the warm edge of the species hibernating tolerance, or has less stable temperatures. In northern areas, changes in airflow could lead to areas of the mine or cave being too cold for the bat. In either case, changes in airflow and the microclimate could result in individuals having to use less optimal locations in the hibernaculum. This could leave them vulnerable to predation, freezing, or exhaustion of fat reserves. Improper gates have either rendered hibernacula unavailable to the Indiana bat, or have altered air flow causing hibernacula temperatures to be too high for bats to retain fat reserves through the winter (USFWS 1999). Cave entrances essential to proper cooling of key hibernating sites must be identified and protected from inadvertent closures, including those that may occur naturally (Tuttle and Kennedy 2002).

Natural hazards including flooding, freezing during severe winters, and ceiling collapse have caused the loss of Indiana bats (USFWS 1999). Indiana bats have been drowned by flooding of caves or mines, either by river flooding or changes in subsurface and surface hydrology. Severe weather can affect bats roosting in summer habitat. There has been a documented occurrence of strong winds and hail stripping bark from a tree, forcing the bats to move to another roost (USFWS 1999). This could occur during summer roosting, or during migration.

Land use practices, fire suppression, and agricultural development have reduced available roosting and foraging habitat as well as reduced the abundance of insects for bat prey across its range. Ongoing research and monitoring is helping to enhance the understanding of habitat use and characteristics. When done properly, experts consider forestry practices to be compatible with Indiana bat conservation; however silvicultural methods need to maintain structural features important for roosting and foraging (BCI 2001).

Bioaccumulation of environmental contaminants is suspected as a potential factor in the decline of the Indiana bat (USFWS 1999). Organochlorine insecticides became widely used after World War II; they are neurotoxic, synthetic chemicals of which many are resistant to metabolism in mammals (O'Shea and Clark 2002). Organochlorine insecticides may have resulted in chronic mortality of Indiana bats (O'Shea and Clark 2002). For example, guano collected from an Indiana bat roost in Indiana, in the 1970s, had concentrations of dieldrin in their guano comparable to the levels found in colonies of gray bats that suffered mortality from dieldrin poisoning (O'Shea and Clark 2002). Schmidt et al. (2002) measured levels of Polycyclic Aromatic Hydrocarbons (PAH) and organochlorine pesticides in surrogate bat species to ascertain potential effects to the Indiana bat. At low concentrations, these chemicals cause cancer and cellular mutations in mammals, and may affect reproductive success by reducing viability of gametes or offspring. In this Missouri study at Fort Leonard Wood, all red bats and eastern pipistrelles had detectable concentrations of DDE, heptachlor epoxide and PAHs, and many had measurable amounts of dieldrin

Environmental Baseline

The action area is located in a mixed-use area of Summit County, Ohio, and includes the 125-acre project area, plus 3,200 feet (1,675 acres) surrounding the property. This action area includes residential private property, roads, and parking lots, Metro Park land, and privately owned wooded parcels. Wooded parcels within the action area are generally fragmented, with the exception of the 125-acre project area, the approximately 100 acres of Metro Park property, and a privately-owned property approximately 40 acres in size in the northwest portion of the action area.

The 125-acre project area contains a predominance of woodland and a combination of successional woods and lowland wood wetlands, with some smaller areas of scrub/shrub and emergent wetlands. The following community characteristics are located in two wetland delineation reports prepared for the site: *Wetlands Investigation Abutting of Glenwood Boulevard, Reminderville, Ohio*, dated December 11, 1997 (Flickinger Wetland Services Group, Inc., 1997) and *Wetlands Investigation Balance of Reminderville Property-Revised, Reminderville, Ohio*, dated April, 2, 2004 (Flickinger Wetland Services Group, Inc., 2004). The successional wooded community consists of canopy species such as: *Acer rubrum* (red maple), *Quercus alba* (white oak), *Q. bicolor* (swamp white oak), *Prunus serotina* (black cherry), *Fagus grandifolia* (American beech), *Populus grandidentata*

(big-tooth aspen), *Crataegus macrosperma* (hawthorn), and understory species, such as *Vaccinium corymbosum* (high bush blueberry), *Rubus allegheniensis* (blackberry), *Juncus effusus* (soft rush), *Phalaris arundinacea* (reed canary grass), and *Solidago* sp. (goldenrod).

The lowland woods consists of *A. rubrum*, *Q. bicolor*, *Fraxinus pennsylvanica* (green ash), *P. deltoides* (eastern cottonwood), *Salix nigra* (black willow), *Cornus amomum* (silky dogwood), *Rosa palustris* (swamp rose), *Viburnum recognitum* (northern arrow-wood), *Cephalanthus occidentalis* (buttonbush), *J. effusus* (soft rush), *Scirpus cyperinus* (wool-grass), *Glyceria striata* (fowl manna grass), and *Carex stricta* (tussock sedge).

Small areas of emergent wetland consist of *P. arundinacea*, *G. striata*, *Phragmites australis* (tall reed grass), *J. effusus*, *Onoclea sensibilis* (sensitive fern), *Leersia virginica* (whitegrass), *Typha* spp. (cattails), and *S. cyperinus*.

Small areas of mesophytic shrub/scrub consist of *Rhamnus frangula* (European buckthorn), *C. crus-galli* (cockspur hawthorn), *R. allegheniensis*, *R. multiflora* (multiflora rose), *P. serotina*, and *Ligustrum vulgare* (privet).

Small areas of hydrophytic shrub/scrub consist of *R. frangula*, *Ulmus americana* (American elm), *A. rubrum*, *C. amomum*, *R. palustris*, *Toxicodendron vernix* (poison sumac), *J. effusus*, *V. recognitum*, *Spiraea alba* (narrow-leaf meadow-sweet), *T. radicans* (poison-ivy), and *C. stricta*.

Approximately 80 percent of the study area has a mature closed canopy and open understory. Suitable Indiana bat habitat trees exist throughout the site. Several potential maternity roost trees exist near the drainageway that crosses Maryland Road and at the northern tip of the large wetland in the southwestern portion of the property.

Several channelized ditches and small streams cross the property. Together these drainageways total 6,330.88 linear feet. Despite the ditching, large wetlands are still associated with the drainageways. These wetlands provide breeding grounds for insects and good foraging areas for the bats. All-terrain vehicle (ATV) trails cross through the woodlots on what were former logging roads. Potential flight corridors are numerous, existing over drainageways, ATV trails, and the cleared grassy roadway at the end of California Street.

There are 37.182 acres of palustrine forested, emergent, and scrub/shrub wetlands located within the project area. Of this, three areas, totaling 28.380 acres, are considered high-quality Category 3 wetlands.

The 125-acre project area is nearly level to gently sloping. Relief across the site is approximately 6 feet. The predominant soil type on the site, Canadice Silty Clay Loam (Ca), is listed as a hydric soil.

The portion of the action area outside of the 125-acre property is composed of a mix of residential developments, recreational areas such as golf courses and parkland, open water (Aurora Lake), undeveloped forested areas, commercial developments, and a small amount of agricultural fields (Figure 1).

The vast majority of the 125-acre project area is surrounded immediately by existing residential development. A small section of the project area's northwest corner is adjacent to another block of privately-owned forested habitat that extends north through and out of the action area and is approximately 40 acres in size. A golf course exists on the northern portion of the action area, and has scattered wooded areas interspersed between the greens. In the far northeast corner of the action area is a large commercial development. In the southeast portion of the action area is Aurora Lake, which is bordered to the east by forested areas. To the southeast of the project area, beyond the existing housing development is Liberty Park, a large forested property owned by MPSSC, and of which approximately 100 acres is within the action area.

Status of the Species within the Action Area

An Indiana bat habitat survey (Flickinger Wetland Services Group 2005) and a potential maternity roost survey (Davey Resource Group 2005) indicate that suitable roosting and foraging habitat exist within the project area. Due to the predominance of habitat and a potential Indiana bat hibernaculum located within approximately one mile of the project area, a mist-net study was conducted in August, 2005. This study identified 13 bats from four different species—four female and two male big brown bats, three female and one male little brown bat, one female and one male northern long-eared bat, and one female red bat. No Indiana bats were captured during this survey. The mist-net study report, *Indiana Bat (Myotis sodalis) Mist Net Survey Reports—163 acres, Glenwood Boulevard, Reminderville, Ohio*, was submitted to USFWS on August 31, 2005 (Davey Resource Group, 2005). Based on the results of the survey the Service determined that the presence of a high density of Indiana bats within the area to be developed was not confirmed and the presence of a primary maternity roost tree on the 125-acre project site was unlikely.

Although Indiana bats were not documented within the action area during the 2005 mist-net survey, this highly mobile species has been documented in close proximity to the action area. A post-lactating Indiana bat was captured 2 miles west of the action area in August 2004 (Mike Johnson, MPSSC, pers. comm.), indicating the likely presence of a maternity colony within close proximity to the action area. In addition, 8 male and female Indiana bats have been captured swarming near two sandstone ledges within Liberty Park approximately 1/2 mile south of the action area in the fall of 2004 (Mike Johnson, MPSSC, pers. comm.). Swarming and staging surveys of bats at the entrances to the sandstone ledges during spring 2004 and fall 2003 and 2004 have documented a variety of bat species utilizing the ledges for hibernation. Little brown bats, northern long-eared bats, big brown bats, and eastern pipistrelle bats have been documented by emergence surveys at the ledges in April and May, 2004, indicating that the ledges are serving as a hibernaculum for these species (Mike Johnson, MPSSC, pers. comm.). Because Indiana bats have only been captured during the fall and not during the spring, and because the interior of the ledges cannot be accessed, the Service cannot definitively state that these ledges are serving as a hibernaculum for Indiana bats, although we assume that they are based on the presence of Indiana bats swarming in the fall (Mike Johnson, MPSSC, pers. comm.), the presence of visibly suitable hibernation habitat, and the presence of other hibernating bat species that are commonly found to share hibernacula with Indiana bats at other locations (Brack et al. 2003).

Interpretation of mist net survey results

Although a mist-net survey following accepted protocol did not detect Indiana bats in the action area, this highly mobile species has been detected nearby during summer and fall (Mike Johnson, MPSSC, pers. comm.), and a suspected hibernaculum exists within 1/2 mile of the action area (Mike Johnson, MPSSC, pers. comm.). Indiana bats have been documented within portions of Liberty Park that lie outside of, but contiguous with, the action area. In order to assess the potential for the Indiana bat to occur within the action area, the Service must formulate reasonable assumptions. These assumptions must be made in order to analyze the potential effects of the action. It is important to note that the Service has been mandated by Congress to provide the benefit-of-the-doubt to federally-listed species (H.R.Conf. Report No. 697, 96th Cong., 2d Session, 1979). That is to say, the Service must err on the conservative side; the side of the species, when making reasoned assumptions.

High quality roosting and foraging habitat, comprised primarily of second growth beech, maple, and oak forest, has been documented within the 125-acre property. Similar habitat exists at Liberty Park, in the southwest portion of the action area, and Indiana bats are known to occur here. Aerial photographs of the action area from 2005 indicate portions of the action area with forest cover similar to that in the 125-acre project area and Liberty Park. Therefore, the Service believes it reasonable to assume that the remaining forested habitat within the action area is comparable to the habitat found within the 125-acre property and Liberty Park and that all forested habitat in the action area is high quality habitat for the Indiana bat.

The Service assumes that the Indiana bats occurring two miles west of the action area include a maternity colony based on the following factors: (1) The capture of a post-lactating Indiana bat during the summer of 2004 (Mike Johnson, MPSSC, pers. comm.); and (2) Other female Indiana bats have been documented swarming at the ledges southeast of the female capture location, indicating that landscape conditions within this region are suitable for Indiana bat roosting and foraging. Therefore, the Service believes it is logical and reasonable to assume that a maternity colony is present two miles west of the action area.

The Service estimates that the maternity colony west of the action area is comprised of approximately 80 adult female Indiana bats. This estimate is based upon the following factors: (1) most documented maternity colonies are typically made up of 50 to 100 adult female bats, and (2) Whitaker and Brack (2002) estimated the average size of a maternity colony is approximately 80 adult female Indiana bats. Therefore, for the purposes of this analysis, the Service has selected the average number of 80 female bats per maternity colony as a reasonable estimate of the size of the maternity colony west of the action area. Additional young (up to one juvenile per year per female bat) are likely present west of the action area during the summer maternity season.

Female Indiana bats have been documented to travel up to 2.6 miles from their roosting habitat to forage (Murray and Kurta 2004). The female Indiana bat west of the action area was captured while foraging, therefore we assume that the primary and secondary roost trees for the maternity colony are located within a 2.6-mile radius from the capture location. This 2.6-mile radius would include the action area (Figure 1). Portions of the action area have been documented to

provide high quality Indiana bat roosting habitat. Because the Indiana bat survey did not detect Indiana bats onsite, and because the level of the survey is usually sufficient to detect the presence of the Indiana bat (USFWS 1999), we assume that the primary maternity roost tree is not located on the 125-acre property, however we find it reasonable to assume that one or more alternate maternity roost trees may be located within the action area. It is also likely that at least some of the colony's roost trees would occur outside of the action area.

As previously discussed in the Life History section of this BO, female Indiana bats have been found to travel up to 2.6 miles from their day roost(s) to forage (Murray and Kurta 2004). A female Indiana bat was captured while foraging two miles west of the action area. This capture indicates that the day roost(s) could be anywhere within a 2.6 mile radius of the capture location, and this radius would include the action area (See Figure 1). Because a maternity colony is assumed to exist within two miles of the action area, and the action area provides high quality foraging habitat, we assume that female Indiana bats are using the action area for foraging. Because the mist net survey did not detect Indiana bats, we assume that only small numbers of female bats are using the 125-acre property for foraging, and that their use may be sporadic.

The Service believes it is reasonable to assume that male Indiana bats are using the action area to forage, and may also roost singly or in small numbers within the action area, based on the following information: 1) Male Indiana bats have been captured swarming at the ledges 1/2 mile from the action area (M Johnson, MPSSC, pers. comm.), 2) A Priority III hibernaculum is assumed to exist within 1/2 mile of the action area (see above assumption), 3) As discussed in the Life History section of this BO, male Indiana bats often roost near their hibernacula all summer (Whitaker and Brack 2002, USFWS 1999), using multiple roost trees in one season to fulfill their thermoregulatory requirements, 4) Males may travel up to 2.6 miles from their summer roosts to forage (USFWS 1999), 5) Males may travel farther to forage in the fall than in the summer, and 6) The action area supports high quality roosting and foraging habitat. Because the mist net survey did not detect Indiana bats, we assume that only small numbers of male bats are using the site for roosting and foraging, and that their use may be sporadic.

The presence of Indiana bats at the sandstone ledges in Liberty Park in the fall provides evidence that the ledges are important for one or more of the following reasons: (1) they are used during migration, (2) they serve as a location for swarming, or (3) that they are used for hibernation. There is generally no way to determine the precise reason that Indiana bats were located at the portals. However, some reasonable assumptions can be made based upon the available data. These assumptions will assist the Service in analyzing the potential effects of the action.

The Service considers it reasonable to assume that an Indiana bat Priority III hibernaculum, supporting several hibernating Indiana bats, occurs at the ledges at Liberty Park. The assumption that these ledges serve as a potential hibernaculum is based on the following factors; (1) Indiana bats have been captured during the fall swarming and migratory period at both ledge locations (M Johnson, MPSSC, pers. comm.), (2) Four other species of bats were captured and/or detected at these portals during spring *and* fall sampling, indicating that the ledges may provide suitable conditions for bat hibernation (M Johnson, MPSSC, pers. comm.), (3) The four species detected are often found within the same hibernacula as Indiana bats in other locations, (4) Bat swarming activity was noted by qualified bat biologists at these ledges (M Johnson, MPSSC, pers. comm.), (5) Indiana bat swarming activity typically occurs at hibernacula (USFWS 1999), (6) The low

number of Indiana bats detected at these ledges (eight) is indicative of a hibernaculum currently supporting a small number of hibernating Indiana bats, (7) Known Indiana bat hibernacula in Ohio are Priority III (hibernacula with < 500 Indiana bats) with the exception of the Priority II hibernaculum (≥ 500 to 30,000 Indiana bats) containing approximately 10,000 Indiana bats in Preble County (BHE 2004), and (8) The ledges were surveyed for bats because they exhibited a combination of conditions that are considered as general indicators that they could support hibernating bats.

The Service believes it reasonable to assume that the action area including the project site provide spring staging and fall swarming habitat due to the following reasons: 1) A suspected Indiana bat hibernaculum exists within $\frac{1}{2}$ mile of the action area; 2) staging and swarming activities usually occur within proximity to hibernacula; and 3) high quality foraging and roosting habitat exist within the action area that could support swarming and staging Indiana bats.

In summary, high quality Indiana bat roosting and foraging habitat has been documented throughout the action area. Male Indiana bats likely occur throughout the action area during the summer in low densities, and likely use the action area for roosting and/or foraging. Data also supports the assumption that a maternity colony, comprised of 80 adult females and their young (up to one juvenile per year per female bat), occurs near the action area, and that a small number of members of this colony may use the action area for foraging and/or for secondary roosting habitat. It is also likely that individual male and female Indiana bats use the action area, including the project site, for spring staging and fall swarming activities.

Factors affecting species environment within the Action Area

Development

Much of the action area outside of the proposed site is already dedicated to permanent uses. The entire 1,675-acre action area is comprised of approximately 44 percent developed land, 46 percent non-developed land, and 10 percent open water (Aurora Lake). Much of the 44% of developed land is composed of dense residential communities located north, south, and east of the project area. Several commercial facilities are also found in the northeast portion of the action area.

It is likely that these past developments resulted in a loss of suitable Indiana bat roosting and/or foraging habitat, and the potential future development at the 125-acre property will result in the loss of additional 61.7 acres of suitable roosting and foraging habitat for the Indiana bat.

Recreation

Several recreational facilities exist within the action area. These include a golf course in the northern portion of the action area, and Liberty Park in the southeast portion. The golf course is composed of the mowed grass fairways interspersed with wooded rough areas. The wooded areas may provide some fragmented roosting and/or foraging habitat for Indiana bat. Liberty Park is owned by MPSSC and is managed to promote healthy forest habitat, and to restore and enhance streams and wetlands (MPSSC et al. undated). This area provides high quality Indiana

bat habitat that is protected in perpetuity and is contiguous with forested habitat outside of the action area.

Effects of the Action

In evaluating the *effects of the action*, section 7 of the Endangered Species Act and the implementing regulations (50 CFR §402) require the Service to consider both the direct and indirect effects of the action on the species, together with the effects of other activities that are interrelated or interdependent with the action that will be added to the environmental baseline. *Direct effects* are those effects that have immediate impacts on the species or its habitat while *indirect effects* are those that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur. *Interrelated actions* are those that are part of a larger action and depend on the larger action for project justification. *Interdependent actions* are those actions that have no independent utility apart from the action under consideration.

The *effects* evaluation is necessary to make the required determination under 7(a)(2), of insuring the Federal action does not jeopardize the continued existence of the species, or result in the destruction or adverse modification of designated critical habitat. *Jeopardize the continued existence* of a species means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species. The following analysis will evaluate the effects of the proposed project in relation to the reproduction, numbers and distribution of the Indiana bat within the action area, and then further evaluate these effects in the context of the overall range-wide species status and cumulative effects to the species.

Beneficial Effects

Reminderville Investment Company, LLC proposes to preserve in perpetuity via a conservation easement, approximately 32.881 acres of wetlands and associated buffers, and 5.102 linear feet of streams and associated buffer. These areas also include 13 out of the 14 identified potential maternity roost trees on-site. Preservation of stream and wetland areas is critical to ensure Indiana bat foraging habitat in perpetuity.

Where possible, trees included in the Suggested Native Tree Species for Indiana Bat Habitat list will be planted along streets and in individual lot yards and may eventually provide suitable roost trees.

Fifteen stormwater ponds will be constructed within the project area. Of these, nine will be directly adjacent to preserved wetland areas. These ponds can provide foraging habitat for bat species in the immediate area as well as in the surrounding action area.

The mitigation presented by the applicant includes the restoration of wetlands less than 0.5 mile from the proposed footprint, within Liberty Park and directly adjacent to Pond Brook, where Indiana bats are known to occur. This mitigation project will increase foraging habitat, and as trees die from standing water it may increase potential roosting habitat as well. The proposed mitigation is part of a consolidated wetlands mitigation project. Once constructed, the entire mitigation project will restore approximately 12 acres of forested wetlands.

Direct Effects

Direct adverse effects to the bat have been largely avoided by the proposed timeframe for tree clearing. The Applicant proposes to remove trees in Phases II and III of the development only between November 15 and March 15, when the bats would be hibernating in caves and/or mines, and not using the forested habitat within the action area for roosting, foraging, swarming, or staging. The direct effects of the action (ie., noise, vibrations) are not expected to reach the suspected Indiana bat hibernaculum, as it is located outside of the action area. Therefore, the Service anticipates that no direct adverse effect to Indiana bats will occur from noise or vibrations associated with tree clearing operations.

Some limited direct adverse effects may occur from tree clearing associated with Phase I of the development. The Applicant has proposed to perform tree clearing activities for Phase I before April 15, 2007, before the summer maternity season but during the spring staging period. Phase I of the development includes clearing seven acres of wooded habitat, but no potential maternity roost trees will be impacted. Between March 15 and April 15, both male and female Indiana bats may be using suitable habitat within the project area for spring staging, which includes feeding and resting prior to migrating to their summer range. We assume that if they are using the project area, it is only in limited numbers, since no Indiana bats were captured during the mist net survey.

Potential direct effects to the limited number of Indiana bats that may be using the seven acres of suitable habitat within Phase I that are proposed to be cleared prior to April 15, 2007 include mortality, injury, and displacement from roosting, foraging, and staging habitat.

Mortality could potentially occur if individual male or female Indiana bats were using the project area for spring roosting. It is likely that tree clearing activities would occur during the day, when bats would be roosting in trees. As roost trees are cleared with mechanized equipment, they may fall on top of roosting bats, injuring or killing the bats. While this is possible, considering the small amount of habitat to be cleared (seven acres) and the assumed small number of bats using the project area, it is likely that only a small number of Indiana bats could possibly be killed. The Service estimates that up to one male and one female Indiana bat could be killed by tree clearing activities associated with Phase I of the project.

Further adverse effects from tree clearing in April 2007 could take the form of displacement from seven acres of spring roosting, foraging, and staging habitat. As Indiana bats emerge from their hibernacula, they forage in nearby wooded areas and build up fat reserves for migration to their summer habitat. If the project area serves as spring staging habitat, bats would be displaced from this area once it has been cleared. The effects on the bat from loss of this habitat could include expending more energy to look for foraging areas elsewhere. As the seven acres to be cleared represents only a small portion of the available habitat in the action area and Indiana bats likely only use this area sporadically and in small numbers, adverse effects from displacement of staging male and female bats is expected to be insignificant.

Indirect Effects

Indirect adverse effects to the Indiana bat are anticipated to occur, and would primarily take the form of harm and/or harassment due to loss of roosting and foraging habitat and decreased prey availability within the action area. These effects are discussed further below.

Loss of roosting habitat: Indirect effects on female Indiana bats

As described above, we assume that, because no Indiana bats were captured during the mist net survey, that a primary maternity roost tree does not exist onsite. It is possible, however, that female Indiana bats use the site sporadically for secondary roosting, and that one or more alternate roost trees exist onsite. Secondary roost trees need not be as large as the primary roost tree, and so smaller trees with peeling bark, cracks, or crevices may serve as secondary roosting habitat for female Indiana bats. One indirect effect from the proposed activities will be the loss of multiple potential secondary maternity roost trees. Approximately 61.7 acres of clearing and grubbing will occur when all phases of construction are complete. Within the 61.7 acres of clearing, one potential maternity roost tree (greater than 16 inches dbh) was identified and will be cleared. The Service assumes that multiple other smaller potential secondary roost trees that were not specifically identified will also be lost. It is plausible that at least some, and probably most, of the colony's alternate roosts occur outside of the footprint of forest impacts. The availability of a considerable amount of suitable roosting habitat in the surrounding landscape and the likelihood that some, if not most, of the colony's alternate roosts will remain standing outside the footprint of tree clearing following clearing activities suggest that individuals of the colony may successfully locate new alternate roosts shortly after returning from their hibernacula.

The effects of the loss of traditional secondary roosting habitat may be amplified by the poor thermoregulatory abilities of pregnant and lactating females (Studier and O'Farrell 1972 in Humphrey 1975). Pregnant bats not only need to secure sufficient food to maintain their body weight and temperature, they also need to support a growing fetus or pup. In spring, maintaining an energy balance is complicated by the need for pregnant bats to migrate to their traditional roosting areas after completing six to seven months of hibernation, and hence, having depleted or low fat stores, and during a time when temperatures are low and food is scarce (Kurta and Rice 2002). Consequently, during this period pregnant females are less able to maintain their current energy input and are likely unable to easily increase energy gain (increase food intake) in response to low temperatures. Hence, females face a delicate energy balance through rearing of young. The removal of multiple secondary roosts within the 61.7-acre footprint of tree clearing may cause some females to alter roosting and/or foraging areas somewhat; however, the footprint of clearing comprises only a small amount of the average foraging range area of a female Indiana bat (Kiser and Elliott 1996, Murray and Kurta 2004), and the presence of high quality Indiana bat habitat within the action area makes it likely that any displaced female bats will be able to quickly locate other traditional secondary roosts.

As previously described, harassment, a form of take, is defined as 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 (50 CFR § 17.3).

Therefore, based on the above information, the Service believes that take in the form of harassment due to the disruption of roosting areas for a few individual female bats is reasonably certain to occur.

Loss of roosting habitat: Indirect effects on male bats

The project area is assumed to sporadically support small numbers of adult male Indiana bats. During the summer, male Indiana bats typically roost alone or occasionally in small groups. Based upon the 2006 survey of the property, information from the nearby capture records of Indiana bats, the suitability of habitat on the 125-acre property, and Indiana bat life history, male Indiana bats are likely roosting and/or foraging in the project footprint sporadically and in small numbers. Therefore it is anticipated that the indirect effects to male Indiana bats will likely be similar to effects on reproductive females. Therefore, based on the above information, the Service believes that take in the form of harassment due to the disruption of roosting areas for a few individual male bats is reasonably certain to occur.

Loss of foraging habitat: Indirect effects on female Indiana bats

Another indirect effect of the proposed project on the Indiana bat will be the loss of foraging habitat. A total of 61.7 acres of high quality foraging habitat will be permanently lost due to implementation of the proposed action. Indiana bats exhibit strong site fidelity to their traditional summer colony areas and foraging habitat, that is, they return to the same summer range annually to bear their young (Kurta et al. 2002; Garner and Gardner 1992; Gardner et al. 1991; Humphrey et al. 1977; Gardner et al. 1996; Cope et al. 1974). Telemetry studies on a maternity colony in Indiana have indicated that Indiana bats continue to return to areas that previously served as foraging habitat, even after those areas have been developed and no longer provide suitable habitat (USFWS 2003).

This information indicates that when the females of the maternity colony in and near the action area return to their summer range, individuals will attempt to use the same foraging areas that were used in previous years. After clearing is completed on the project area, 61.7 acres of high quality foraging habitat will no longer be available.

In general, Indiana bats are reluctant to cross open areas (Brack 1983; Menzel et al. 2001). Once the project footprint area has been cleared, some Indiana bats whose foraging and commuting areas have been altered may avoid flying across this area. These individuals would be subject to an increase expenditure of energy to establish a new roosting area as well as travel corridors between roosting and foraging. Bats in this scenario would be subject to take in the form of harm or harassment as they are displaced from their home range. Some connectivity of forested areas is being maintained onsite to minimize forest fragmentation. Thirty-two acres of forests and wetland are being preserved in the northwest portion of the parcel, as are streams and associated forested riparian areas. Furthermore, the forested wetland on the northwest portion of the property is contiguous to other privately-owned forested areas offsite, so its preservation will maintain connectivity and travel corridors. The Service anticipates that these conservation measures will minimize potential adverse effects to individual female Indiana bats from

fragmentation by maintaining forested connectivity between the 125-acre property and adjacent forested parcels.

The destruction and/or degradation of 4.345 acres of wetlands and 1,228.64 linear feet of streams within the 61.7-acre footprint will eliminate foraging areas and drinking sources for the Indiana bat. In addition, the Indiana bat's prey base will be reduced due to the loss of insects associated with the stream, wetland, and upland forest within the construction footprint.

The effects to individual bats from the loss of foraging habitat are likely to vary based upon each bat's usage of this area. As stated in the Environmental Baseline above, we assume that only low numbers of Indiana bats use the project area for foraging, and that Indiana bat use of the project area is sporadic. Because it is likely that Indiana bats only forage in the project area occasionally, they would be familiar with other nearby foraging areas and should be able to quickly adjust their foraging habitats by spending more time foraging in other portions of their range. For bats that foraged more extensively within the project area, the effect may be more severe. Furthermore, due to the phasing of the project, Indiana bats that may use the project area will have three years to adapt to the gradual loss of foraging habitat, and so any effects may be lessened as they are spread out over time.

In addition to the Indiana bat, five other species of bats (little brown, northern long-eared, red, eastern pipistrelle, and big brown) were recently captured in and around the action area during mist-net surveys (Davey Resource Group 2005, Mike Johnson, MPSSC, pers. comm.). Therefore, the potential for the project to increase inter- and intra-specific competition during foraging must also be considered. Although very little literature is available to assess the impact of this effect, interspecific competition has been identified as an area of concern by researchers monitoring maternity colonies subject to habitat alterations in Indiana (USFWS 2003). Feeding habits for Indiana bats are similar to those of the little brown bat, the northern long-eared bat, and to a lesser extent the eastern pipistrelle (Whitaker 2004). Therefore competition between those species could occur as all species within the 61.7-acre footprint could potentially be displaced and forced to move quickly into other foraging habitat. However, the effects to individual bats from the loss of foraging habitat and increased competition may be somewhat offset by the availability of a significant amount of suitable foraging habitat in the surrounding landscape and the likelihood that most bats, regardless of species, do not forage exclusively or extensively in the 61.7-acre area to be cleared. The quantity and quality of the habitat that will remain outside the 61.7-acre footprint suggests that individual Indiana bats may have little difficulty successfully locating and establishing modified or new foraging areas and that adverse effects from competition may not be detectable.

It is also important to consider the potential effects to reproductively active females in concert with other life history and environmental factors. Indiana bats that are already subject to the energy demands of hibernation, migration, and pregnancy may be displaced from their preferred foraging ranges. They will then have to expend energy to search for new areas to forage while at the same time being subject to an increase in competition for prey. In addition, environmental factors, such as an unseasonably cool spring, could limit the availability of prey while at the same time increase the energetic cost of thermoregulation. When combined, these factors could reduce the fitness of pregnant Indiana bats to the extent that some may not successfully bear a

pup and/or some pups may be born with lower birth weights resulting in delayed development. However, due to the limited footprint of tree clearing, available adjacent forested habitat, and the likelihood that the 61.7-acres to be cleared is only a small part of the traditional foraging range of a female bat, individual Indiana bats may have little difficulty successfully locating and establishing modified or new foraging areas and adverse effects from competition may not be detectable.

Because insects associated with aquatic habitats make up part of the diet of Indiana bats, water quality can affect the prey base of the species. Approximately 4.345 acres out of a total of 37.182 acres of wetlands and 1,228.64 linear feet out of a total of 6330.88 linear feet of streams will be filled due to project implementation, thereby eliminating a portion of the total potential sources of aquatic insects on the 125-acre site. In response, bats will seek alternate food sources in other upland and riparian areas. However, upland food sources within the 61.7-acre footprint will also be reduced after forested habitat is removed by clearing and grubbing activities. Bats of other species will also be displaced, thus compounding interspecies competition. The Applicant has proposed conservation measures (see “Description of the proposed action” above) to minimize the impact of sedimentation and runoff on wetlands adjacent to the 61.7-acre footprint. These measures will serve to avoid and minimize any water quality impacts outside of the 61.7-acre footprint, and hence minimize impacts to the aquatic insect prey base.

Indiana bats that remain loyal to foraging areas and/or travel corridors may continue to cross the project area following the clearing activities. These Indiana bats would be subject to an increased risk of predation because they would be more visible to predators. Yet, there is no way to meaningfully measure this increased predation risk. If any predation of Indiana bats occurs indirectly as a result of the project, it is not likely to be detected.

Overall, the effect of the loss of 61.7-acres of high quality foraging habitat on individual bats from the maternity colony will range from insignificant and discountable effects to take in the form of harm and harassment. Due to the small footprint of the project, the foraging areas for many of the bats would likely be entirely or mostly outside the project footprint. The effects on these individuals are anticipated to be minimal. Individual bats that may use the 61.7-acre footprint for foraging may have to expend an increased amount of energy to establish new foraging areas, thereby further reducing their fitness for successful reproduction. Additionally, the effects on individual bats will differ depending upon variable factors such as the weather and the condition of individuals upon emergence from hibernation.

Loss of foraging habitat: Indirect effects on male bats

As predicted with the maternity colony, most males are likely utilizing foraging areas that lie entirely or mostly outside the tree clearing footprint due to the limited footprint of the forest impacts. Effects to these individuals are anticipated to be minimal, although they may be forced to find new foraging areas or forage more heavily in other portions of their established foraging range. However, these effects would not be complicated with the energy demands of pregnancy and rearing of pups and are therefore anticipated to be minimal.

Individuals seeking modified or new foraging areas will be subject to an increase in inter- and intra-specific competition. As with the reproductive females, the effects to individual male bats from the loss of foraging habitat and increased competition may be somewhat offset by the availability of suitable foraging habitat in the surrounding landscape. The quantity and quality of the habitat that will remain outside the project footprint suggests that males may have little difficulty successfully locating and establishing modified or new foraging areas.

In general, Indiana bats are reluctant to cross open areas (Brack 1983, Menzel et al. 2001). Once the project footprint has been cleared, some Indiana bats whose foraging and commuting areas have been altered may avoid flying across this area. These individuals would be subject to an increase expenditure of energy to establish a new roosting area as well as travel corridors between roosting and foraging. Bats in this scenario would be subject to take in the form of harm or harassment as they are displaced from their home range. Some connectivity of forested areas is being maintained onsite to minimize forest fragmentation. Large areas of forested wetland are being preserved, as are streams and associated forested riparian areas. The forested wetland on the northwest portion of the property that is contiguous to other forested areas offsite is being permanently preserved. The Service anticipates that these conservation measures will minimize potential adverse effects to individual male Indiana bats from fragmentation by maintaining forested connectivity between the 125-acre property and adjacent forested parcels.

Due to the availability of suitable roosting and foraging opportunities in the surrounding landscape, it is likely that displaced male bats will have little difficulty in establishing new home ranges within a few days of returning to their summer areas. Under this scenario, take of male bats is anticipated to be short term in the form of harassment. The effect on pregnant bats is likely to be more severe (as discussed previously).

Indiana bats that remain loyal to foraging areas and/or travel corridors may continue to cross the project area following the clearing activities. These Indiana bats would be subject to an increased risk of predation because they would be more visible to predators. Yet, there is no way to meaningfully measure this increased predation risk. If any predation of Indiana bats occurs indirectly as a result of the project, it is not likely to be detected.

Indirect effects of decreased water quality

The Service believes that the loss of 4.345 acres of wetlands and 1,228.64 linear feet of streams within the 61.7-acre footprint will cause a reduction in aquatic insect prey base and drinking sources for the Indiana bat. Conservation measures will be implemented to avoid and minimize any potential impacts to adjacent wetlands outside of the 61.7-acre footprint due to sedimentation and runoff. Indirect adverse effects to Indiana bats from this decrease in aquatic insect prey and drinking sources is likely to be undetectable due to the small footprint of the project combined with the availability of suitable habitat in the surrounding landscape and the assumption that bats will use or seek alternate areas for foraging and drinking as some areas become unsuitable. The Service presumes that the remaining forest in the action area will continue to provide an abundant prey base of both terrestrial and aquatic insects during project construction, operation and maintenance. Therefore, any potential indirect adverse effects on Indiana bats from a reduction in water quality are anticipated to be insignificant and/or discountable.

Indirect Effects caused by disturbance

In addition to the actual habitat removal in the project footprint and the indirect effects associated with that removal, the proposed project may also indirectly decrease the quality of habitat surrounding this area. Indiana bats remaining in the action area but outside of the clearing footprint during construction will be subject to noise disturbance from clearing, grading and construction activities. As a result, Indiana bats in the action area will be exposed to noise levels, or intensity of noise and vibrations that they may not have experienced in the past, depending on the proximity of their roost sites to other human activities nearby.

The current ambient noise within the action area varies greatly depending upon the proximity of the given area to existing activities. Portions of the action area are heavily developed with roads, parking lots, or residential or commercial structures, and the noise surrounding these areas would be significantly greater than the noise at the center of the 125-acre property. Given the variable nature of the habitat within the project area, the lowest existing noise levels would be expected near Wetland H, which is farthest away from roads and structures.

As discussed in the action area section above, the impact of increased noise would be felt approximately 3200 feet from the operation of construction machinery on the 125-acre property. Within 3200 feet of the eastern and southern property boundaries, most of the land is developed with existing residences or is comprised of Aurora Lake. This area does not provide suitable habitat for the Indiana bat, therefore no indirect effects are anticipated at this location. The outermost portions of the action area in the northwest and southwest support suitable high quality Indiana bat habitat, and indirect effects to the Indiana bats that use this area for roosting and/or foraging can be anticipated. Increased noise and vibrations during construction could cause disturbance to Indiana bats unaccustomed to these impacts while roosting and thereby lower the suitability of habitat adjacent to the project footprint.

Noise generated during daily activities once construction of the housing development is complete should not be significant, as most of the activities will occur indoors. In addition, Indiana bats have been found to roost in residential settings in Ohio (Belwood 1996). Therefore, noise during daily activities within the subdivision should not elicit any response from Indiana bats in the action area.

Indirect effects caused by loss of staging and swarming habitat

Once construction is complete, 61.7 acres of high quality spring staging and fall swarming habitat will be lost. When Indiana bats emerge from hibernation, they have typically depleted most of their fat reserves and must forage to have sufficient energy to migrate to summer habitat. Upon finding that former spring staging habitat within the project area has been lost, bats may have to travel to alternate areas to forage. Decreased fitness of a small number of both male and female Indiana bats may result. Similarly, when bats find that fall swarming habitat has been lost, they may have to find alternate areas to forage and mate, prior to hibernation, and decreased fitness of some individuals may result. Adverse effects will be minimized by the phased clearing of the project area over three years. In addition, large amounts of high quality forested

habitat will remain in the action area, including portions of the project area and all of Liberty Park, therefore the Service anticipates that any adverse effects will be insignificant.

Effects on Numbers

For the reasons detailed above, we believe that it is likely that up to one adult male and one adult female Indiana bat may be taken by the proposed project due to the direct effects of tree clearing in April 2007. We do not anticipate that the level of harassment of females, as described above, will result in females aborting or terminating their pregnancy. Therefore, we expect a very minimal reduction in numbers of Indiana bats due to the proposed action.

Summary of Effects

The Service anticipates that Indiana bats will incur both direct and indirect effects from the proposed construction of a residential subdivision in Reminderville, Ohio. The intensity of effects will differ by activity, season, and condition and home range of individual bats. Indirect effects to Indiana bats are anticipated from the removal of habitat and due to noise disturbance.

Direct take (killing or injuring) of Indiana bats may occur during clearing of seven acres of suitable habitat in April 2007, but will be avoided during the remainder of clearing and construction activities due to project specifications that avoid cutting of trees between March 15 and November 15, when bats are most likely to occur within the action area. The suspected hibernaculum is outside of the action area, therefore no effects on hibernating Indiana bats are anticipated.

Indirect effects on Indiana bats are anticipated from the project due to the loss and fragmentation of roosting, foraging, swarming, and staging habitat and disturbance from construction related noise. Some bats will be subject to take in the form of harm or harassment due to displacement from traditional roosts and foraging areas that are cleared. The effect upon individuals of the maternity colony would likely be more severe than males since pregnant females may be forced to alter their home ranges in the spring when they return to the area at a time when they are already stressed from the physical demands of pregnancy in addition to the decreased fitness following hibernation and migration. Noise associated with construction activities is anticipated to temporarily reduce the suitability of roosting habitat in portions of the action area. Take due to indirect effects is anticipated to range from harm or harassment caused by habitat loss to effects which may be insignificant or discountable, and will differ depending upon the home range and condition of individual bats as well as the tolerance of individual bats to noise disturbance.

Cumulative Effects

Much of the action area outside of the proposed site is already dedicated to permanent uses including residential communities and commercial facilities, and these areas generally would not be considered suitable Indiana bat habitat. Furthermore, additional activities within these areas that could significantly impact the Indiana bat or its habitat are unlikely.

MPSSC's Liberty Park comprises most of the forested property in the southwest portion of the action area (See Figure 3, "development unlikely" areas), and this will remain as suitable Indiana bat habitat in perpetuity. Liberty Park is managed to promote healthy forest habitat, and to restore and enhance streams and wetlands (MPSSC et al. undated). This area provides high quality Indiana bat habitat that is protected in perpetuity and is contiguous with forested habitat outside of the action area. The Service anticipates that the disposition and management of this property will have beneficial effects on the bat.

There are several forested areas within the developments in the south of the action area that are owned by the Aurora Shores Homeowner's Association (See Figure 3, "development unlikely" areas). These are also likely to remain forested for the foreseeable future, and likely provide Indiana bat habitat.

A large parcel in the western portion of the action area is currently being developed into Willowbrook Subdivision, Phase 5. This project is a current action (not a future action) and therefore would not contribute to cumulative effects.

The Service has reviewed one residential development proposal in the far western portion of the action area (See Figure 3, "likely development area"), and provided technical assistance in advance of section 7 consultation with the US Army Corps of Engineers. This project may result in clearing of up to 20 acres of forest habitat. This would not be considered a cumulative effect, as it is a separate federal action that is being consulted on.

Much of the remaining forested habitat within the action area is privately owned and may be developed at some point in the future, though no proposals are imminent (See Figure 3, "potential development areas"). Based on a March 26, 2007 conversation with Larry Fulton, Village of Reminderville Engineer, no additional developments, other than those described above, are currently proposed within the portion of the action area in Reminderville.

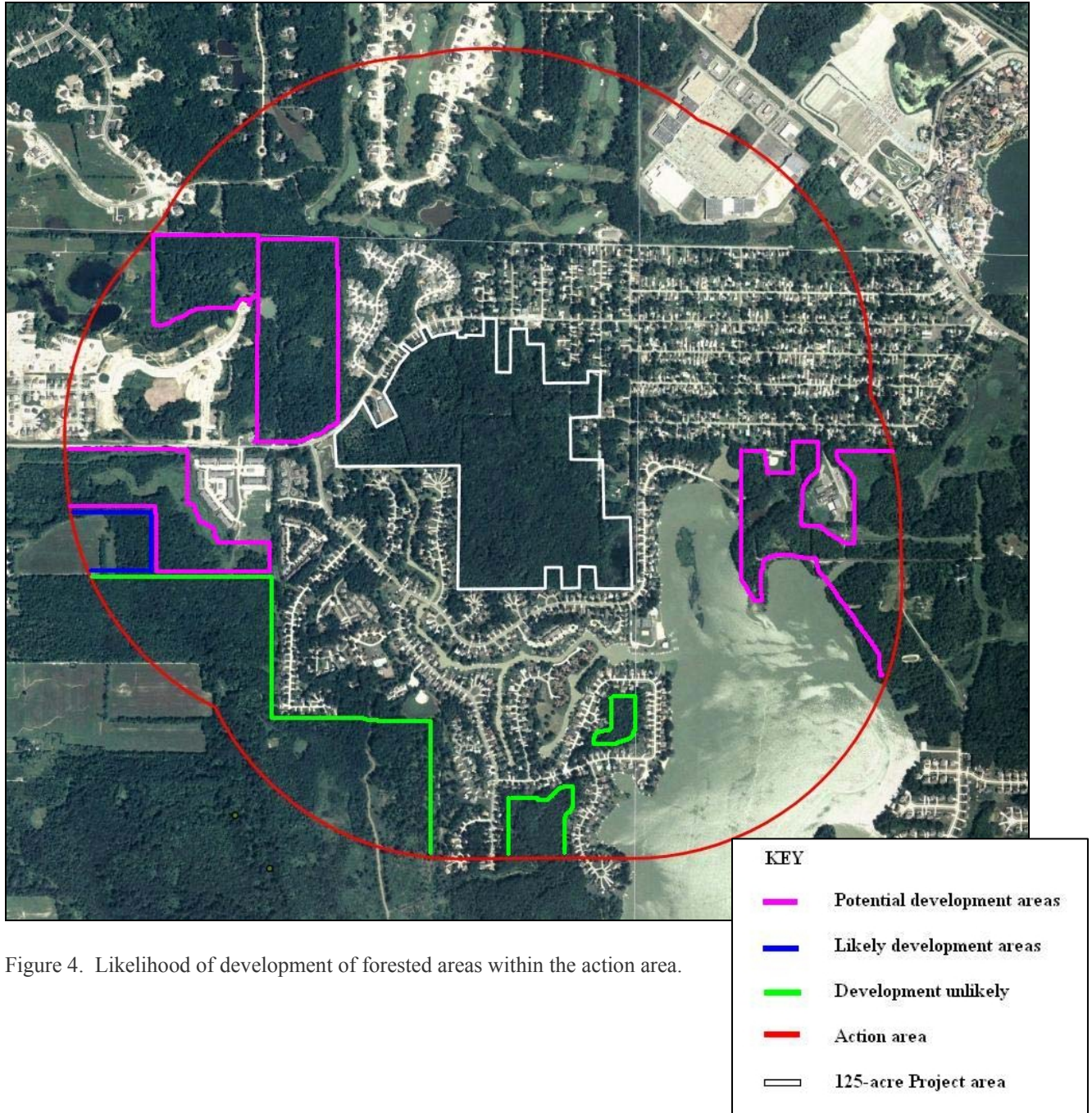


Figure 4. Likelihood of development of forested areas within the action area.

Based on the above information, the Service, Applicant, and the Corps have not been able to detect any future State or local actions that are reasonably certain to occur in the action area.

Conclusion

After reviewing the current status of the Indiana bat, the environmental baseline for the action area, the effects of the proposed Herrington Place Subdivision, and the cumulative effects, it is the Service's biological opinion that the construction and operation of the Herrington Place

Subdivision, as proposed, is not likely to jeopardize the continued existence of the Indiana bat, and is not likely to destroy or adversely modify designated critical habitat. Critical habitat for this species has been designated at hibernacula in Illinois, Indiana, Kentucky, Missouri, Tennessee, and West Virginia; however, this action does not affect these areas, thus, no destruction or adverse modification of that critical habitat is anticipated.

Based on the past rates of decline, the expected continued rate of decline, and lack of knowledge of the causes of the decline, it is reasonable to conclude that the species' survival is in serious question. As explained earlier, Indiana bats continue to decline. Although their absolute numbers are seemingly high, the Indiana bat life history strategy renders this species especially susceptible to population declines. As a result of these past and anticipated continued declines, the Indiana bat is increasingly highly endangered. Improving the reproductive success of Indiana bats is paramount for their continued survival. Maternity colonies represent an important population structure that is crucial to the survival of the Indiana bat.

In order to slow down and reverse the rate of decline, and get to survival and recovery, the Indiana bat not only needs to maintain its current rate of reproduction, but also increase its reproduction and decrease its mortality rates. Nevertheless, based on the Service's analysis of effects, it does not appear that the proposed action will significantly affect reproduction of Indiana bats or increase the species' vulnerability of extinction.

The Service concludes that overall the project will not contribute a measurable decrease in reproduction or numbers of the Indiana bat. The Service has also determined that the loss of 61.7 acres of high quality roosting and foraging habitat, the fragmentation of the suitable habitat on the 125-acre property, and the loss of 4.345 acres of wetlands and 1228.64 feet of streams is not likely to result in an appreciable reduction to the distribution of the species given the availability of the remaining suitable habitat in the surrounding landscape and the availability of the nearby potential hibernaculum.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act 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 taking under the Act 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 the Applicant and/or the Corps for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps fails to assume and implement the terms and conditions of the incidental take statement the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [150 CFR §402.14(i)(3)].

Amount or Extent of Take Anticipated

Based on the proposed project as described within and the conservation measures provided, we anticipate that incidental take of Indiana bats will occur in the form of mortality of one adult male and one adult female Indiana bat, and in the form of harm or harassment of both male and female Indiana bats through habitat loss and fragmentation.

Based on our analysis of the environmental baseline and effects of the proposed action, the Service anticipates that one maternity colony of Indiana bats and individual male Indiana bats sporadically occupy the action area in small numbers and may be impacted as a result of the proposed project. Collectively, the effects of the action are expected to result in behavioral or physiological effects which impair essential behavioral patterns. Decreased fitness of individuals may result.

Construction of the Herrington Place subdivision is expected to result in the permanent loss of 61.7 acres of high quality roosting and foraging habitat and the fragmentation of the suitable habitat on the 125-acre property.

The Service anticipates that incidental take of Indiana bats will be difficult to detect for the following reasons: the species is highly mobile; the species occurs in habitat (e.g., trees) that makes detection difficult; and finding dead or moribund bats is unlikely due to a small body size

and the likely scavenging of specimens by predators. However, the Service anticipates that up to one adult male and one adult female Indiana bat will be taken based on (1) the loss of 61.7 acres of high quality roosting and foraging habitat, including 4.345 acres of wetlands and 1,228.64 feet of streams for project construction and (2) the fragmentation of suitable habitat on the 125-acre property. In addition, we expect that reduced fitness of a small number of both male and female Indiana bats may result from displacement due to habitat loss, and that adjacent habitat may temporarily decrease in value due to construction noise.

Effect of the incidental take

In the accompanying biological opinion, the Service determined that, based on the proposed project and the conservation measures described within, this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

Reasonable and prudent measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of Indiana bats. These measures are nondiscretionary:

1. The implementation status of all the proposed conservation measures, mitigation efforts, and terms and conditions will be monitored and clearly communicated to the Service on an annual basis.
2. Develop and implement an Indiana bat education program for all personnel involved in the construction of the project

Terms and conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

1. Monitoring Requirements:

A. The Corps will provide an annual report detailing the status of all conservation measures proposed by the Applicant in the Biological Assessment dated February 2007, mitigation efforts, and these terms and conditions that have been initiated, are ongoing, or completed during the previous calendar year, as well as those yet to be completed. The report will be submitted to the Service's Reynoldsburg Ohio Field Office (ROFO) by 31 January each year (the first report will be due January 31, 2008) and reporting will continue until the construction phase of the project is completed.

B. Any dead bats located within the construction limits, regardless of species, should be immediately reported to ROFO [(614) 469-6923], and subsequently transported (frozen

or on ice) to ROFO. No attempt should be made to handle any live bat, regardless of its condition; report bats that appear to be sick or injured to ROFO. ROFO will make a species determination on any dead or moribund bats.

2. All project engineers, construction personnel (includes logging personnel), equipment operators, etc. shall attend a mandatory environmental awareness training to learn about the Indiana bat and its habitat requirements, and the conservation measures required onsite to protect this species. This training will provide personnel with an increased awareness about the species and should increase the likelihood of compliance with conservation measures.

In conclusion, the Service anticipates that up to one adult male and one adult female Indiana bat will be taken. Furthermore, we believe that the Herrington Place Subdivision project will result in the permanent loss of 61.7 acres of high quality Indiana bat roosting and foraging habitat and will permanently fragment suitable habitat on the 125-acre property. Temporary disturbances due to construction noise are anticipated within 3200 feet of the property boundary. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Corps must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Expand on scientific research and educational outreach efforts on Indiana bats in coordination with ROFO.
2. In coordination with ROFO, MPSSC, and other local conservation organizations, purchase or otherwise protect suitable Indiana bat roosting, foraging, and hibernation habitat in northeastern Ohio.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation with the Corps on the construction and operation of the proposed Herrington Place subdivision in Reminderville, Summit County, Ohio. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or 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 considered 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, any operations causing such take must cease pending reinitiation.

For this biological opinion the incidental take would be exceeded when any of the following occur: 1) more than one adult male Indiana bat has been taken; 2) more than one adult female Indiana bat has been taken; 3) the impacts to forested habitat exceed 61.7 acres; 4) the impacts to wetlands exceed 4.345 acres; or 5) the impacts to streams exceed 1,228.64 linear feet. These activities have been exempted from the prohibitions of section 9 by this opinion. The Service appreciates the cooperation of the Corps, the Applicant and their representatives during this consultation. We would like to continue working with you and your staff regarding the construction and operation of the proposed project. For further coordination please contact Megan Seymour, (614) 469-6923 ext. 16 of this office.

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