BIOLOGICAL OPINION

on the

CONSTRUCTION, OPERATION, AND MAINTENANCE OF THE U.S. 24 NEW HAVEN, INDIANA TO DEFIANCE, OHIO PROJECT

FOR THE FEDERALLY-LISTED ENDANGERED INDIANA BAT (*Myotis sodalis*)

Submitted to the Federal Highway Administration

September 30, 2005

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INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion (BO) based on our review of the Federal Highway Administration's (FHWA) proposed U.S. 24 New Haven, Indiana to Defiance, Ohio project, located in Allen County, Indiana, and Paulding and Defiance Counties, Ohio, and its effects on the Indiana bat (*Myotis sodalis*) in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). On May 20, 2005, the Service received FHWA's request for formal consultation along with the Biological Assessment of Federally-Listed Species for the Ohio Department of Transportation's U.S. 24 New Haven, Indiana to Defiance, Ohio project (ALL [Indiana]/PAU/DEF [Ohio]-24-0.00 (PID 18904)) (BA). Formal consultation was initiated between the Service and FHWA on May 20, 2005, and the Service provided a letter to FHWA, dated June 16, 2005, notifying them of the initiation date.

This Biological Opinion is based on information provided in the BA, the Draft Environmental Impact Statement, ODOT Project PAU/DEF-US24-24.00/0.00, PID 18904, September, 2003 (DEIS), numerous letters, meetings, telephone conversations, and e-mail exchanges among the Service, FHWA, and Ohio Department of Transportation (ODOT), field investigations, and other sources of information. A complete administrative record of this consultation is on file at the Service's Reynoldsburg, Ohio Field Office (ROFO).

CONSULTATION HISTORY

Table 1 presents a summary of the primary points in the consultation history between the Service's Ohio Field Office and FHWA

Table 1. Summary of consultation for the U.S. 24 New Haven, Indiana to Defiance, Ohio project.

Date	Event/Action
Jan. 11, 2001	FHWA submits Preliminary Draft Environmental Impact Statement (PDEIS) to Service for review
Feb. 9, 2001	Service submits comments on PDEIS to Parsons Brinckerhoff, Ohio, Inc.
Dec. 6, 2001	ODOT submits survey results for eastern massasauga and copperbelly watersnake to Service for review
Dec. 13, 2001	Service submits letter to ODOT agreeing that copperbelly watersnake and eastern massasauga are absent from the project area
Sept. 24, 2003	FHWA provides the Draft Environmental Impact Statement (DEIS) to the Service for review
Dec. 4, 2003	U.S. Department of the Interior submits comments on the DEIS to FHWA
Sept. 17, 2004	ODOT requests species list from Service for preparation of a Biological Assessment (BA)
Sept. 23, 2004	Service provides species list in response to ODOT's request
Jan. 25, 2005	FHWA submits Draft Biological Assessment (DBA) to Service for review
Feb. 17, 2005	Service submits comments on DBA to FHWA
May 20, 2005	FHWA submits revised BA to Service, and requests initiation of formal consultation for the Federally endangered Indiana bat (*Myotis sodalis*)
June 16, 2005	Service submits response to request for initiation; Formal consultation was initiated on May 18, 2005.
June 16, 2005	FHWA and Service meet to discuss contents of BAs, additional information needed for

	Pau/Def 24, and proposed site visit to project area.
July 29, 2005	Service submits email to FHWA, asking for more information to define Action Area
Aug. 8, 2005	Service, FHWA, ODOT, and consultants participate in site visit to project area
Aug. 12, 2005	ODOT submits email to Service providing some answers to 7/29/05 email and answers to questions posed at site visit
Aug. 23, 2005	Service calls ODOT to check on status of additional information requested in 7/29/05 email. ODOT is gathering information currently, will provide soon.
Aug. 26, 2005	Service sends e-mail to ODOT/FHWA checking on status of information requested in 7/29/05 email
Aug. 29, 2005	FHWA provides email response with additional information requested
Aug. 30, 2005	FHWA provides another email response with additional information, as requested
Sept. 16, 2005	Service provides draft biological opinion to FHWA and ODOT for review and comment
Sept. 22, 2005	FHWA provides comments on draft Biological Opinion to Service
Sept. 27, 2005	ODOT provides comments on draft Biological Opionion to Service
Sept. 30, 2005	Service submits final Biological Opinion to FHWA and ODOT

In their request for formal consultation received by the Service on May 20, 2005, FHWA determined that activities associated with the U.S. 24 New Haven, Indiana to Defiance, Ohio project are likely to adversely affect the Indiana bat (*Myotis sodalis*) and are not likely to adversely affect the bald eagle (*Haliaeetus leucocephalus*). Furthermore, FHWA determined that the project would have no effect on the clubshell mussel (*Pleurobema clava*) or the copperbelly watersnake (*Nerodia erythrogaster neglecta*). Two candidate species, Rayed bean (*Villosa fabalis*) and eastern massasauga (*Sistrurus catenatus catenatus*) are listed for the project area, and FHWA concluded that no effects to either of these species are anticipated.

FHWA requested our concurrence on these effect determinations. In a letter dated June 16, 2005 the Service: (1) concurred with FHWA's determination that the project is likely to adversely affect the Indiana bat, (2) concurred with FHWA's determinations that the project is not likely to adversely affect the bald eagle, and (3) agreed to implementation of formal consultation, effective May 18, 2005.

The Service concurred with FHWA's effect determination of "not likely to adversely affect" for the bald eagle based on the following: (1) suitable habitat for this species may occur in the action area, but there are no summering or wintering populations of bald eagles, and only rare occurrences of transient bald eagles, (2) although transient bald eagles could potentially be affected by vehicular strikes, it would not reach the extent of take, as the maximum estimate of 0.00001 deaths per year, per lane mile in Ohio, and (3) the potential for water quality degradation from contaminants or sedimentation to impact the bald eagle through decreased or contaminated food sources will be mediated by erosion control methods, and thus, no detectable reduction or contamination of food will occur. Therefore, the possibility of an impact occurring to the bald eagle from an accidental spill is not quantifiable or predictable. Based upon this information, potential adverse affects to the bald eagle from the U.S. 24 New Haven, Indiana to Defiance, Ohio project, as proposed, are insignificant and discountable.

Consultation on the bald eagle for this project, as proposed, has concluded. This species will not be considered further in this Biological Opinion. Should, during the term of this action, additional information on listed or proposed species or their critical habitat become available, or

if new information reveals effects of the action that were not previously considered, FHWA should consult with the Service to determine whether this determination is still valid.

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

The following summary of the proposed action is drawn from project description in the Biological Assessment for Federally-Listed Species for the Ohio Department of Transportation's (ODOT) U.S. 24 New Haven, Indiana to Defiance, Ohio project (ALL [Indiana]/PAU/DEF [Ohio}-24-0.00 (PID 18904)) (BA) and the Draft Environmental Impact Statement, ODOT Project PAU/DEF-US24-24.00/0.00, PID 18904, September, 2003 (DEIS). Additional information has been provided by ODOT and FHWA staff.

The project is the proposed construction/upgrade of U.S. 24 on a new alignment between the cities of New Haven, Indiana and Defiance, Ohio, to be located in Allen County, Indiana, and Paulding and Defiance Counties, Ohio. The proposed project corridor is approximately 36.4 miles (64 km) long and includes three interchanges in Indiana, and three interchanges in Ohio. The Indiana interchanges will be located at Ryan/Bruick Road, Webster Road, and State Route 101. The Ohio interchanges will be located at State Route 49 and U.S. Route 127 in Paulding County, and State Route 424 in Defiance County. A new connector road within the City of Defiance at the eastern project terminus is also included. Finally, the complete project also includes stream and wetland mitigation areas, which are in preliminary stages of design. The project will affect primarily private lands, although approximately 45% of the project is located along existing transportation corridors (railroads and portions of the existing U.S. 24).

The U.S. 24 corridor right-of-way is approximately 300 ft (91 m) wide, 36.4 miles long, and collectively with the interchanges, connector roads, service roads, drainage ways, and the wetlands and stream mitigation areas, comprises approximately 2015 acres (David Snyder, FHWA pers. comm.). In addition to the above areas, staging, waste, and borrow areas will be identified adjacent to the right-of-way. It is anticipated that construction and operation of the highway will actually impact less area than is currently being considered. However, the final project design continues to be refined, including specific location of developments within the corridor. Therefore, the analysis in this BO will consider that the impact is to the entire area.

The project will provide a 4-lane limited access highway. From its western terminus, the project corridor begins at the I-469 bypass in New Haven, Indiana. It proceeds northeast along the existing U.S. 24 corridor until its intersection with Berthaud Road, then diverges from the existing corridor to run roughly parallel and south of the existing U.S. 24. It proceeds northeast, running north of Woodburn, Indiana, and parallel and south of the existing U.S. 24, and continues northeast across the Indiana/Ohio State line, again running parallel and approximately 1 mile south of the existing U.S. 24 corridor south of the Villages of Antwerp and Cecil and into Defiance County. Once in Defiance County, the project corridor meets up with the existing U.S. 24 at its intersection with State Route 424, just west of Defiance, Ohio, and the project continues along the existing U.S. 24 corridor for another 2.5 miles.

Six interchanges will also be constructed on the new U.S. Route 24: Three in Indiana including Ryan/Bruick Rd., Webster Rd., and State Route 101, and three in Ohio including State Route 49, U.S. Route 127, and State Route 424.

The Ohio portion of the project will be constructed in three segments. Section I is from the Indiana state line to U.S. 127; Section 2 is from U.S. Route 127 to State Route 424; Segment 3 is from State Route 424 to State Route 15/18. Construction of the Segment 3 will begin in 2006. Construction of the two western segments will be simultaneous and will being in 2007. All construction will be complete by autumn 2009. The Indiana portion of the project will be constructed in one segment.

The action consists of 3 project elements: construction, operation, and maintenance.

Construction Activities

Project construction activities include land acquisition and exchange, clearing and grubbing, and earthwork. Each of these activities is discussed below.

Land Acquisition and Exchange: Properties within the project right-of-way will be purchased prior to the commencement of construction work. Properties to be acquired include agricultural, commercial, community/public use, and residential properties. Natural areas to be impacted include streams, wetlands, and woodlots. The project right-of-way is primarily composed of agricultural areas (1583 acres), with some small areas of woods (199 acres, including mitigation areas) and residential, community/public use, and commercial properties (128 acres) impacted as well. Portions of the new road will be constructed adjacent to an existing railroad right-of-way, and portions of the new road at the eastern and western termini of the project include only widening of the existing U.S. 24.

Clearing and Grubbing: Clearing will be performed to prepare the project area for construction activities. Clearing consists of cutting and removing above-ground vegetation such as weeds, grasses, brush, and trees; removing downed timber and other vegetative debris; and salvaging marketable timber. Grubbing will follow clearing operations to remove any remaining surface vegetation and buried debris, including tree stumps and roots.

Clearing and grubbing will be required prior to earthwork in order to remove vegetative and other debris from work areas so that design specifications (e.g., for compaction) can be met. Trees, stumps, and large roots will be removed from excavation areas to a depth sufficient to prevent such objectionable material from becoming mixed with the material being incorporated in the embankment. Areas to be excavated will require grubbing to remove small bushes, vegetation, and any rubbish. Within excavation and embankment limits, tree stumps, roots, and other vegetation will be removed. All extraneous matter will be removed and disposed of in designated waste areas by chipping, burying, or other methods of proper disposal, including burning. Various methods and equipment will be used for this work.

Earthwork: Earthwork is all earth moving activities that will occur for road and interchange construction, access roads, utility placement and relocation, construction of drainage structures, and preparation of staging, maintenance, waste, and borrow areas. Earthmoving activities will

include excavating, filling, grading, and borrowing and wasting of materials. Earthmoving equipment to be used includes haul trucks, dozers, excavators, scrapers, and backhoes. Earthwork will require approximately 2 years for each segment. Drainage culverts and buried structures will be placed first, followed by bridge structures and paving.

Staging and maintenance areas will be used to assemble and store the construction vehicles that are too large to travel on the highway in one piece (e.g., haul trucks, earthmovers, large dozers, large excavators, hoes, etc.). These areas are also used to store supplies (erosion control materials, steel rebar and mesh, small diameter culverts, traffic signs and posts, office trailers, etc.). Waste and borrow areas are used to dispose of and obtain materials for earthwork. For this project, borrow areas will be dominant over waste areas, and will be located outside of the right-of way. Based on information provided by ODOT District 1 personell, the project will require 3,344,298 cubic yards of embankment fill, which will need to be excavated from borrow areas in close proximity to the right-of-way. According to the BA, equipment staging, maintenance, waste, and borrow areas will be located in cleared upland habitat, which is generally unsuitable for any listed species (specifically the Indiana bat and bald eagle). Borrow areas are generally located adjacent to the right-of-way, and ODOT will require contractors to utilize areas that are upland and are not forested (Kirk Slusher, ODOT, pers. comm.). The exact size and location of these areas have yet to be identified, however, based on the information presented in the BA, we assume that they will not be located within stream, wetland, or forested areas.

Stream and Wetland Mitigation: FHWA is required under sections 404 and 401 of the Clean Water Act to provide mitigation for stream and/or wetland impacts. While the mitigation plan is still draft in nature, the current proposal includes the following:

As mitigation for direct impacts to 7,944 linear feet of stream in the state of Ohio, ODOT proposes to incorporate natural stream channel design techniques into approximately 2,025 linear feet of the relocated Stevens Ditch. The reconstructed stream channel would incoprorate meanders, a two-stage channel, riffle/pool complexes, gradual sloping benches, and vegetated riparian corridors planted with native tree, shrub, and herbaceous plants. In addition, ODOT proposes to preserve 3,268 linear feet of Stevens Ditch, and 1,060 linear feet of an unnamed tributary of Stevens Ditch. This stream preservation is located on the Plumer property, a 163-acre property within the new road right-of-way located just southwest of the proposed interchange in Defiance, Ohio. Additionally, ODOT proposes to preserve through permanent conservation easment 4,932 linear feet (average width 310 feet) of stream habitat on the Smith Property. The Smith Property Conservation Area will include approximately 35 acres of wooded riparian habitat along the Maumee River in Paulding County, Crane Township.

As mitigation for direct impacts to 22.05 acres of wetlands in the state of Ohio, ODOT proposes to preserve 60.6 acres of Category 3 forested wetland (the highest quality of wetland under the Ohio Environmental Protection Agency's Rapid Assessment Method (ORAM) for wetlands), to restore 26 acres of forested, shrub-scrub, and emergent wetland, and to preserve 72 acres of mature woodland and 9.0 acres of agricultural buffer areas. All wetland mitigation will also occur on the 163-acre Plumer property.

Construction Minimization Measures

The following provides a description of measures incorporated into the project design that may avoid and/or minimize potential impacts to the Indiana bat during construction.

Clearing and Grubbing:

1. FHWA will ensure that all construction activities are confined to the construction right-of-way as described above, in order to minimize the loss of woodland habitat.

2. As described above, ODOT will include constraints on the locations of staging, maintenance, waste, and borrow areas, indicating that they are not to be located in stream, wetland, or forested areas.

3. Tree cutting will occur between September 15 and April 15 to avoid direct take of Indiana bats during the summer maternity season. The following exception applies: If a limited number of trees must be removed between April 15 and September 15, the contractor will be required to obtain the service of a qualified bat scientist to investigate trees for the presence of Indiana bats. The results of said investigation must be coordinated with the Service.

4. Maintenance that involves tree removal (unsafe trees), limbing/pruning, or similar activities will be scheduled from September 15 to April 15 to avoid disturbing roosting bats.

5. A comprehensive sedimentation and erosion control plan will be developed and implemented during tree-cutting operations to avoid downstream impacts to waterways.

6. Strict guidelines dictating the use and handling of hazardous materials and other contaminants will be implemented by ODOT, INDOT, and their contractors to minimize the potential for downstream impacts to water quality.

Earthwork:

1. Best Management Practices (BMPs) will be utilized during construction activities in accordance with ODOT's Construction and Material Specification 207 (Temproary Sediment & Erosion Control), Supplemental Specification 832 (Temproary Sediment & Erosion Control), and the U.S. Army Corps of Engineers special conditions to the 404 permit.

2. The ODOT Office of Construction Administration's Handbook for the Removal of Regulated Wastes will be adhered to during all phases of construction.

3. A project-specific emergency spill response protocol will be developed and implemented dictating the use and handling of hazardous materials and other contaminants to prevent and control spills during construction.

4. The following provisions will be developed and implemented to protect and enhance surface and ground water quality by using erosion control practices appropriate for the terrain and approved best management practices:

(a) Contractors will develop and incorporate provisions for implementation of a post-construction re-vegetation plan to control erosion and maintain water quality.

(b) Construction of stormwater detention/treatment facilities will be designed to minimize the impact of highway contaminants on surface water quality.

(c) Culverts for stream crossings will be properly sized and engineered to provide unobstructed, continuous flow for aquatic biota whenever possible.

(d) A comprehensive sedimentation and erosion control plan will be developed and implemented during construction activities to avoid down-stream impacts to waterways.

(e) Construction will employ standard and state of the art erosion control techniques including the use of silt fences, sediment detention basins and ponds, and temporary revegetation as appropriate.

(f) A post-construction re-vegetation plan to control erosion and maintain water quality will be developed and implemented.

(g) The project footprint has been minimized to reduce impacts to streams and wetlands.

(h) Mitigation for stream impacts will be accomplished through specific negotiations with the U.S. Army Corps of Engineers, the Ohio Environmental Protection Agency, and the Indiana Department of Environmental Management during the Clean Water Act 404/401 permitting process.

(i) Wetland impacts will be mitigated in accordance with the Ohio EPA and Indiana Wetland Water Quality Standards.

(j) Natural stream channel design features will be incorporated in areas where the relocation of existing streams is necessary, and feasible, with a goal of establishing long-term channel stability. These features will include the establishment and maintenance of streamside vegetation potentially used as travel corridors by Indiana bats.

Operation and Maintenance Activities

Project operation and maintenance will involve a variety of activities. The following is a list and description of the operation and maintenance activities.

Lighting: Roadway lighting may be used at some locations along the road, particularly at intersections. Based on coversations with ODOT personnel during the August 8, 2005 site visit to the project area, high pressure sodium lights will likely be used. Partial lighting will be installed at the interchanges, and will average twenty-four 40-foot tall cobrahead lights at each interchange (Kirk Slusher, ODOT pers. comm.).

Vegetation Management: Mowing will be conducted to provide a clear sight distance, clear area for vehicle recovery, visible and clear ditches, and control of noxious weeds. Mowing will generally occur four times per year. In addition to mowing, herbicidal spraying will be used to manage herbaceous groundcovers around roadway fixtures (i.e., guardrails and road signs). Use of herbicides prevents obscuring of roadway fixtures and simplifies mowing. Application is specified for once per year.

Snow and Ice Control: Snow removal and ice control activities involve plowing, de-icer or abrasive application to ensure public safety during snow and ice events. The roadway will be treated with de-icing agents and/or salt during specific winter weather events. This activity will vary depending on local weather conditions.

Road Maintenance: Road repair will be conducted as needed. Repair activities include resurfacing, pothole repair, striping, bridge and culvert repair, and guardrail repair/replacement. Emergency repairs may include slide abatement, bank stabilization, and flood damage repair. Emergency work may occur at any time and could utilize any method appropriate to the situation.

Spill Management: Spill response targets containment and remediation to avoid and minimize the potential for adverse impacts to human health and the natural environment.

Operation and Maintenance - Minimization Measures

The following provides a description of measures incorporated into the project design to avoid and/or minimize potential impacts to the Indiana bat during road operation and maintenance.

Lighting: Roadway lighting may be used at some locations along the road, particularly at intersections. Based on coversations with ODOT personnel during the August 8, 2005 site visit to the project area, high pressure sodium lights will likely be used. Partial lighting will be installed at the interchanges, and will average twenty-four 40-foot tall cobrahead lights at each interchange (Kirk Slusher, ODOT pers. comm.).

In general, sodium lamps attract fewer insects because of the wavelengths of light emitted. In general, fewer insects would then attract less bats, which forage on the insects.

Vegetation Management:

1. Mowing and herbicide applications will follow guidelines set by the ODOT Roadside Vegetation Management – Mowing and Herbicide Application Policy (ODOT 1997). Specifically, herbicide use will be restricted to ends of guardrails and roadway clear zones and will always be applied by a State Licensed Practitioner.

2. A maintenance schedule that involves tree removal (unsafe trees), limbing/pruning, or other activities that may disturb tree-roosting bats will be limited to the period from September 15 to April 15 to avoid direct take of Indiana bats during their maternity period.

Snow and Ice Control:

1. Winter de-icing agents will be applied at minimum effective rates.

Spill Management:
1. A Spill Prevention, Control and Countermeasure Plan will be developed and implemented thus reducing the potential for spills to impact the Indiana bat and its habitat.

Action Area

The action area includes all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area is defined by 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. The action area is not limited to the "footprint" of the action and should consider the biotic, chemical, and physical impacts to the environment resulting from the action.

The FHWA has delineated the action area for this project in their BA as the project footprint plus all lands within 2.5 miles on either side of the footprint. FHWA included the 2.5 mile area on either side of the footprint based upon (1) several studies indicate that 2.5 miles may be the upper end of typical movement by members of an Indiana bat maternity colony (Gardner et. al. 1991; Butchkoski and Hassinger 2002; Murray and Kurta 2002) and (2) there is a precedence for use of this area in other BAs (e.g., I-69 in Indiana).

The action area provided in the BA was based upon the area to be directly impacted by the project (project footprint) and the typical area of movement for an Indiana bat maternity colony. However, as this delineation is not fully consistent with the regulatory definition of action area, the Service delineated the action area differently than the method decribed in the BA.

The action area for this project is the area that encapsulates the reach of all the direct and indirect environmental impacts of the project. That is, the area in which the biotic, chemical, and physical impacts to the environment are anticipated to occur.

The area directly affected by the action is the project footprint where all construction, operation and maintenance activities will occur. The project footprint is linear and includes a 300-foot wide, 36.4 mile long right-of-way, plus 6 interchanges, connector and service roads, drainage ways, and mitigation areas, totaling 2015 acres. In addition, the project footprint will also incorporate staging, maintenance, waste, and borrow areas located outside and immediately adjacent to the road right-of-way, and will incorporate those areas needed to provide approximately 3,500,000 cubic yards of embankment fill.

The area indirectly affected by the action includes the area affected by noise and vibrations, surface water impacts, and secondary development due to proximity to the new road and/or interchanges.

Noise and vibrations are physical effects to the environment that will be caused by the road construction, operation, and maintenance and will vary in intensity depending upon the source. Logging and earthmoving activities will generate noise during site preparation and road construction. The level of noise generated from the different construction and maintenance

activities will vary depending upon the methods and equipment being used or operated. Operational noise will be generated by vehicle traffic and will vary depending upon the type and volume of vehicles. Noise and vibrations are expected to increase in the area along the new corridor whereas noise and vibrations are expected to decrease in the area along abandoned portions of the existing U.S. Route 24 alignment as traffic patterns through and around the existing road are changed.

The current ambient noise along the proposed construction corridor varies greatly depending upon the proximity of the corridor to existing activities. Given the rural, agricultural nature of much of the project area, the lowest existing noise levels along the corridor should occur in the areas that are farthest away from roads (e.g., the existing U.S. 24 corridor), structures, towns, and active railroads.

Considering the positioning of the corridor within a predominantly rural area, the lowest existing noise levels should be occurring along the central portion of the corridor, where land use is predominantly agricultural. Noise monitoring conducted in 1999 by ODOT personnel within the study area found that the average existing noise level in this area is 52.8 dBA (D. Snyder, FHWA, pers. comm.). The highest existing noise levels occur adjacent to the existing railroad corridor, which produces noises at levels in excess of 100 dBA at crossings where train horns are required, and produce typical operation noise levels in excess of 85 dBA (D. Snyder, FHWA, pers. comm.).

The highest project-related noise levels are expected to occur during the clearing and construction activities. Most construction equipment operates in the 85-90 dBA range (D. Snyder, FHWA, pers. comm.). Construction equipment produces point source noise, rather than a line source noise, and has a faster dispersion rate. A point source noise has a reduction of 6.0 dBA per doubling of distance. The contribution from construction noise will reach 45.0 dBA approximately 3,140 feet from a noise source (FHWA 1973). Based on the Service's calculations, a point source construction noise of 90 dBA would decrease to approximately 48 dBA (just below the average existing noise level within the study area) over a distance of 3,200 feet.

Operational noise once the road is constructed is expected to range from 72.1 dBA at 189'/261' from the project centerline to 52.4 dBA at 2141' from the project centerline (D. Snyder, FHWA, pers. comm.). Noise levels on the facility are a function of distance, traffic volume, vehicle mix, and speed. Operational noise is expected to increase overall noise levels from the project centerline to 2,141 feet away, or for a distance of 1,991 feet from the edge of the road right-of-way (FHWA 2003).

Impacts to surface waters are anticipated from the project. Wetlands and streams will be directly and indirectly affected within the project footprint during all phases of the project. Also, some surface waters outside the actual project footprint could be indirectly affected from the project due to the anticipated change in the volume of pollutants entering the environment (e.g., sediment, de-icing agents) and the alteration of surface water drainage patterns. The physical, chemical, and biological nature of wetlands and streams will be altered by various activities such as ditching, culverting, and filling.

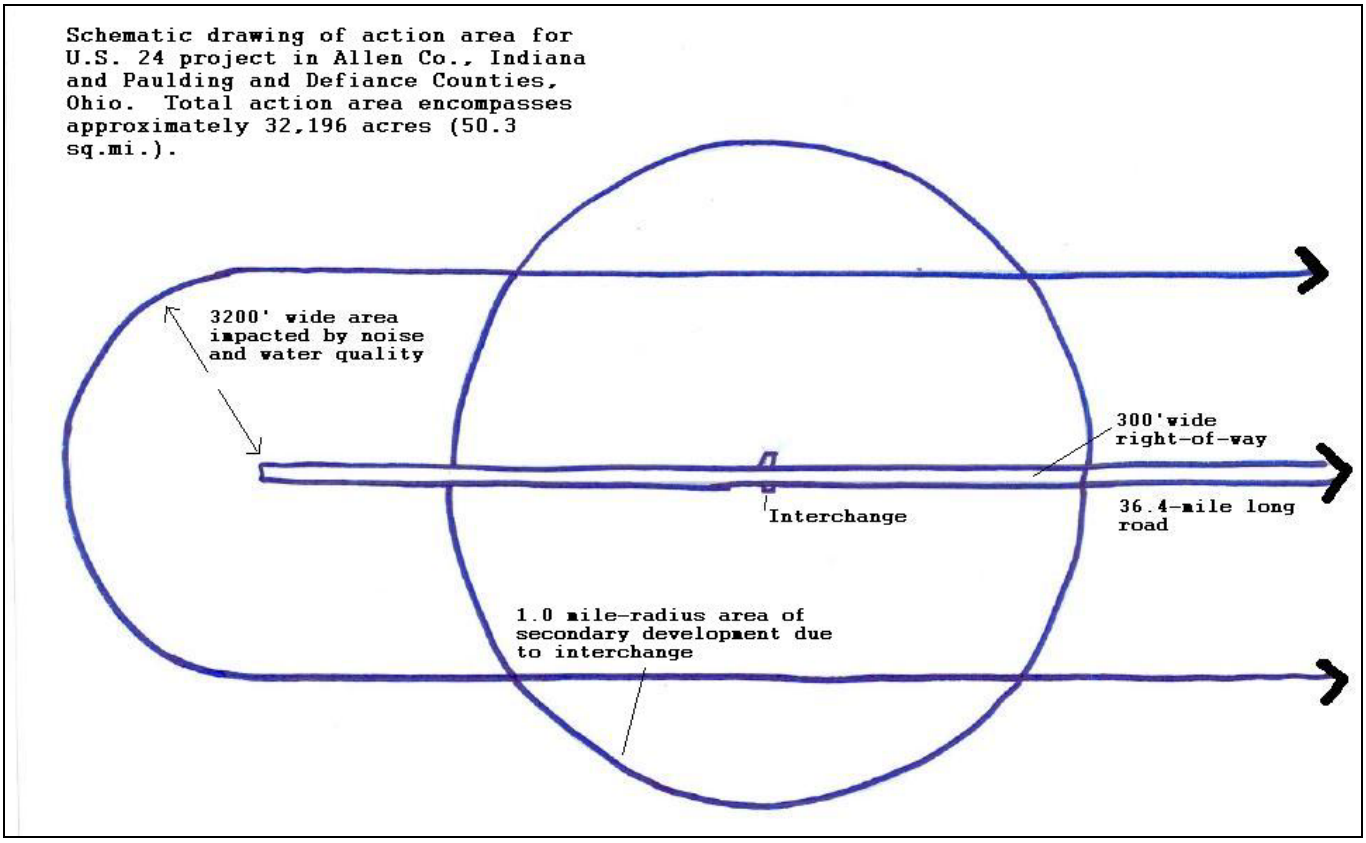
FHWA and ODOT estimate that up to 5.03 miles (26,425 feet) of streams and 23.84 acres of wetlands will be directly or indirectly impacted by the project (including mitigation areas). Impacts include filling, culverting, bridging, relocating, placement of channel protection along banks, and installation of temporary crossings. Specifically in Ohio, 7,944 linear feet of streams will be bridged, culverted, relocated, or temporarily dewatered, and 22.05 acres of wetlands will be filled (HCOE 2005). In Indiana, 1.8 acres of wetlands will be filled, and 18,481 linear feet of stream will be bridged, culverted, or temporarily dewatered. All streams and wetlands that will be impacted occur within the Maumee River watershed, and most are direct tributaries to this large, warmwater habitat river. Most of the impacted streams are small and many have been channelized or modified for agricultural uses and receive runoff from farming operations (FHWA 2003). Furthermore, the vast majority of these streams scored as low to moderate when ranked with the Qualitative Habitat Evaluation Index. Most of the streams also support only intermittent flow, carrying water only during and soon after precipitation events. Therefore, it is unlikely that much project-related sediment will be carried outside of the project right-of-way, or beyond the 3,200 feet of area outside of the right-of-way that will be affected by noise. Futhermore, ODOT and FHWA propose a number of methods to avoid and minimize impacts to water quality associated with construction and operation of the U.S. 24 project. These include the following: implementation of a sediment and erosion control plan; construction of stormwater detention/treatment facilites to minimize the impact of highway contaminants on surface water quality; properly sized and engineered culverts for stream crossings to minimize impacts attributed to flood height and flood duration; culverted stream crossings which are properly sized and engineered to provide unobstructed, continuous flow for fish and macroinvertebrates; perpendicular stream crossings; utilization of BMP's in accordance with ODOT's *Construction and Materials Specifications* (2002) and INDOT's *Part V Design Manual* (1999); and utilization of an environmental monitor during construction (FHWA 2003). Implementation of these measures will serve to further ensure that project-related sediment will not be carried outside of the project right-of-way, or beyond the 3,200 feet of area outside of the right-of-way that will be affected by noise. Finally, due to the small size of the streams that will be impacted, any sediment that is carried outside of the immediate construction area is expected to be quickly diluted by water flowing in from other downstream locations, and the Service anticipates that any water quality impacts due to construction and operation of the U.S. 24 project will not be detectable outside of the 3,200 linear foot area beyond the right-of-way, that will be affected by noise.

The project area is part of the eastern lake and till plains and glacial lake plain, which are underlain by limestone and dolomite bedrock of the Devonian or Silurian age. Thus, groundwater transport and storage in these rocks ranges from fair to good. Portions of both the Indiana and Ohio segments of the project area obtain potable water from groundwater sources (FHWA 2003). Construction for the U.S. 24 project will not involve blasting or deep ground impacts, and impacts are generally limited to the ground surface. Drainage design limitations may be imposed to ensure protection of groundwater in the well head protection area that currently exists in the Village of Antwerp, and restrictions through zoning codes may limit the type of development that can occur ancillary to the construction of the roadway and proposed intersection with State Route 49 (FHWA 2003). Overall, changes to groundwater from the project are anticipated to be minimal, and will not impact areas beyond the 3,200 area outside of the right-of-way that will be affected by noise.

According to the BA, assuming worst-case conditions, secondary development for transportation-related services (e.g., gas stations, restaurants, etc.) is expected to occur on all land within 1.6 km (1.0 mile) of all six interchanges, despite the fact that the project area is predominantly agricultural. While the Service agrees that it is generally reasonable to assume that secondary development will likely occur at interchanges, we provide the following clarification: The U.S. 24/State Route 424 intersection is the location at which the new U.S. 24 will join with the existing U.S. 24. There is an existing intersection here that will be converted to an interchange; therefore, any associated secondary development at the U.S. 24/S.R. 424 interchange would likely occur regardless of whether or not the proposed project is implemented, due to the presence of the existing U.S. 24. Furthermore, much of the forested habitat within 2.5 miles of the S.R. 424 interchange includes the Plumer Property, much of which will be permanently preserved for stream and wetland mitigation Therefore, in defining the action area for the proposed U.S. 24 project, the Service believes that it is reasonable to assume that secondary development will occur within 1.0 mile of the five westernmost interchanges, including all three Indiana interchanges and the S.R. 49 and U.S. 127 interchanges in Ohio.

Based on the discussion above, we determine the action area for the U.S. 24 New Haven, Indiana to Defiance, Ohio project to be the 300-foot wide project footprint right-of-way, which traverses 36.4 miles, plus an additional 3,200-foot (0.61-mile) wide area surrounding the entire footprint which will be temporarily affected by construction noise and surface water quality impacts. In addition, the action area includes all areas within a 1.0 mile radius of the five westernmost interchanges. Much of the 1.0 mile radius area is already incorporated within the action area via the 3,200 foot wide area beyond the right-of-way that will be affected by noise and water quality; however an approximate 2,000 acres outside of these locations will also be affected. Overall, the total action area encompasses approximately 32,196 acres, or 50.3 square miles (Figure 1). The action area is generally a linear corridor measuring 6,900 feet wide and 37.7 miles long, and also incorporating 1.0 mile radius circles of impact at each of the five westernmost interchanges. Once construction is completed and the new highway is operational, traffic noise will permanently affect an estimated 1,991-foot area on either side of the right-of-way.

Figure 1. Schematic Diagram of Action Area.



II. STATUS OF THE SPECIES

The Indiana bat is a species that continues to decline since being listed as an endangered species in 1967. Recovery of this species faces several challenges and there are multiple biological reasons why the outlook for this species may be unfavorable. The following issues will be discussed throughout this Biological Opinion as they pertain to the project impacts on the species.

- Indiana bats exhibit colonial behaviors in virtually every stage of their life history
- Male and female Indiana bats exhibit strong site fidelity to their summer grounds
- Resilience of Indiana bats is limited by the species' low reproductive capability
- The declining trend in Indiana bat numbers is both long-standing and widespread

The well-documented philopatric behavior of Indiana bats suggests that loss of roosting habitat alone can have adverse consequences (Kurta and Murray 2002; Gumbert et al. 2002). Healthy female bats start breeding their first fall and can produce one pup per year for up to 14-15 years (Humphrey et al. 1977). However, this current reproductive capacity has been insufficient to offset mortality rates over the last 40+ years. Indiana bat populations continue to plummet, with

population decreases of 23 percent from 1960/70 – 1980, 30 percent from 1980 – 1990, and 19 percent from 1990 – 2000. The highest declines have been observed in the southern part of the species' range.

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 recongnized 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 range as going from 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. The Indiana bat is migratory, and the above described range includes both summer and winter habitat. 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.

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 & LaVal 1980). Based on a 13-year study, Humphrey and Cope (1977) found that the adult period of life is characterized by two distinct survival phases. The first is a high and apparently constant rate from 1 to 6 years after marking with 76% and 70% annual rates of survival for females and males, respectively. The second phase is a lower, constant rate after 6 years, with annual survival rates of 66% for females up to 10 years and 36% for males. In one study in Indiana, survival of pups was found to be very high at 92% from birth to weaning (Humphrey et al. 1977). Post-weaning to age 1 survival is unknown, but believed to be low.

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 the area shortly after emerging from the hibernacula 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, 37-43° F (2.8-6.1° C). Long-term data suggest an ideal temperature range for hibernacula is between 37.4-42.8° F (3-6° C) (USFWS 1999). A recent study of highly populated hibernacula documented a temperature range of 37.4-45°F (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).

After hibernation ends in late March or early April, most Indiana bats migrate to summer roosts. Female Indiana bats emerge from hibernation in late March or early April, followed by the males. The period after hibernation but, prior to migration, is typically referred to as staging. Most populations 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. As a result, adult mortality may be the highest in late March and April.

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 characteristics 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 temporary nature of the use 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 2-

4 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 factors 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 (USWFS 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).

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.

At a landscape level, maternity colonies of Indiana bats have been found in predominantly forested landscapes, such as Wayne National Forest in Ohio (Kiser and Bryan 1997), and in predominantly agricultural landscapes, leading researches to believe that the presence of Indiana bats is not correlated with high forest cover (Kurta 2004). In Missouri, landscapes which supported 19-30% forest cover and 58-81% agricultural cover supported maternity colonies of Indiana bats (Callahan 1993). Indiana bats in Michigan used habitats composed of 55% agriculture, 19% wetland/wetland forest, 17% upland forest, 6% urban development, and 3% open water (Kurta et al. 2002). In Illinois, land near one maternity colony was composed of 33% forest and 67% agriculture (Gardner et al. 1991).

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 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).

Very similar to the habitat use of maternity colonies, at a landscape level, male Indiana bats have been found in predominantly forested landscapes, such as Waterloo State Wildlife Area in Ohio (T. Krynak, pers. comm. 2004), and in predominantly agricultural landscapes (Menzel et. al 2005, Kurta 2004), leading researches to believe that the presence of Indiana bats is not correlated with high forest cover (Kurta 2004).

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, 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 its 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 its 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 (215 ha); males had an area of approximately 140 acres (56.7 ha) (Kiser and Elliott 1996). Rommé et al. (2002) found that the home range of males in the Missouri Ozark region averaged 556 ac (225 ha), while the home range of females averaged 279 ac (113 ha). A recently published study by Menzel et al. (2005) showed that the home range of male and female Indiana bats did not differ significantly. This study indicated that the mean home range size for all bats was 358 ac (144.7 ha), for females was 348 ac (161.1 ha), and for males was 286 ac (115.9 ha). 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. These foraging areas included lakes, ponds, an area that was 50% wooded and 50% open fields, woodlands, and forested wetlands.

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 within which was a high-use area of about 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).

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. 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 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 6 states were designated as critical habitat for the Indiana bat in 1976 (41 FR 187). The Service has published a recovery plan

(USFWS 1983) which 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 being updated to reflect new information concerning summer habitat use.

Based on censuses taken at hibernacula, the total known Indiana bat population as of 2005 is estimated to number about 458,332 bats (A. King, USFWS, pers. comm.). More than 60% of the range-wide population occupies 11 Priority I hibernacula (hibernation sites with a recorded population >30,000 bats since 1960), although 2 of these currently have low numbers of bats. Kentucky and Missouri each contain 3 Priority I hibernacula, Indiana has 4 Priority I hibernacula, and Illinois has one. Priority II hibernacula (recorded population >500 but <30,000 bats since 1960) are known from the aforementioned states, in addition to Arkansas, Illinois, New York, Ohio, Tennessee, Virginia, and West Virginia. Priority III hibernacula, with recorded populations of <500 bats or records of single hibernating individuals, have been reported in 17 states (Alabama, Connecticut, Florida, Georgia, Iowa, Maryland, Massachusetts, Michigan, Mississippi, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Vermont, and Wisconsin).

Indiana bat numbers have declined in every 10-year census period: ~883,300 Indiana bats in 1960/1970; 678,700 in 1980; 473,500 in 1990; and 382,300 in 2000/2001 (Clawson 2002). At the time of European settlement, it is believed that Indiana bats were a very abundant mammal, with more than 10 million bats occupying 1 hibernaculum alone (Tuttle et al. 2004). Since the 1960s, the Indiana bat has declined by 57% (Clawson 2002). Despite recovery efforts, the populations in the southern part of the range (Alabama, Arkansas, Kentucky, Missouri, Tennessee, and Virginia) continue to decline, and cumulatively are down 80%. However, since the 1960s the northern part of the range (Illinois, Indiana, New York, Ohio, Pennsylvania, West Virginia) has experienced a population increase of 30%. Winter population numbers of Indiana bats in Ohio are based on 2 hibernacula, located in abandoned limestone mines in Preble and Lawrence counties. In Ohio, 2004/2005 hibernacula census detected 9,769 individuals, down from the 2002/2003 census of 9,996.

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 affects 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.

III. ENVIRONMENTAL BASELINE

The environmental baseline is the past and present impacts of all Federal, State, or private actions and other human activities in an action area, the anticipated impacts of all proposed Federal projects in a action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process (50 CFR 402.02).

The action area lies in the glaciated Eastern Lake and Till Plains section of the Central Lowlands physiographic province. This area is characterized by a covering of lake sediments over glacial tills that were originally formed in deep water. Topographic relief in Paulding County, Ohio is nearly level to gently undulating except along major drainageways, while the western portion of Defiance County has stronger relief and is composed mostly of gently sloping and sloping ground and end moraines deposited during the ice age (FHWA 2003). The portion of the project area in Indiana ranges in elevation from 207 to 216 meters, with the high areas corresponding primarily to beach ridges located around the ancient lake plain. Topographic relief in the study area varies by less than 1.5 meters (FHWA 2003).

The action area is predominately agricultural and rural in nature, with the exception of the cities of New Haven, Indiana and Defiance, Ohio at the project termini, and the towns of Antwerp, Cecil, Knoxdale, and Emmett, Ohio, and Five Points and Woodburn Indiana. Land ownership is primarily private with some commercial lands. The predominant land use is agriculture, with some residential and commercial properties (railroads). Scattered isolated woodlots also exist within the action area, and are typically located in areas too wet to farm or in areas adjacent to streams or drainageways. The Maumee River meanders parallel to the northern edge of the action area, occasionally entering into the action area primarily at the western and eastern ends of the project.

Historically this portion of Ohio and Indiana was part of the Great Black Swamp, and was primarily covered with wooded wetlands (FHWA 2003). During the 19th and 20th centuries, the land was cleared and drained to make way for agricultural uses. The resulting landscape now consists mainly of agricultural land used for the production of corn, soybeans, and wheat. The agricultural areas are sparsely populated with woodlots, which in many cases contain wooded wetlands (FHWA 2003).

Multiple forest ecological associations occur within the action area. These include the following: mixed swamp forest; oak-maple swamp forest, maple-cottonwood-sycamore floodplain forest; oak-maple forest; and oak-hickory forest. Small areas of scrub/shrub and big bluestem prairie ecological associations were also noted within the action area (FHWA 2003). Field investigations conducted on August 8, 2005 by Service, ODOT, and FHWA personnel revealed the dominance of oak, hickory, and maple species within the impacted woodlots in the central and eastern portion of the project right-of-way.

The action area lies entirely within the Maumee River watershed. Streams and agricultural ditches criss-cross the greater landscape of the project area, providing ample water sources. Most streams within the action area are direct tributaries to the Maumee River, a large, exceptional warmwater habitat river. Most of the impacted streams are small and many have been channelized or modified for agricultural uses and receive runoff from farming operations (FHWA 2003). Furthermore, the vast majority of these streams scored as low to moderate when ranked with the Qualitative Habitat Evaluation Index. Most of the streams also support only intermittent flow, carrying water only during and soon after precipitation events. The Maumee and Tiffin Rivers are the largest streams within the general area, and occur sporadically within the action area, with the Maumee primarily at the eastern and western ends of the project and the Tiffin at the eastern end. The only proposed impacts to the Maumee and Tiffin Rivers are due to the replacement of existing bridges.

Thirty-five streams/ditches will be crossed, for a total impact length of 26,425 feet (N. Alcala, ODOT pers. comm.). Of this stream impact, 3,453 linear feet will be culverted, 345 feet will be bridged, 10,585 feet will be relocated, and 12,042 feet will have additional impacts. Additional impacts may include rock channel protection along stream banks near bridge/culvert locations, and installation of temporary crossings (HCOE 2005).

Many of the wetlands within the project area are located within isolated wood lots which were historically too wet to farm, or are located adjacent to streams/drainage ways. Thirty-seven wetlands, comprising approximately 23.84 acres, will be filled to complete the proposed project (Noel Alcala, ODOT, pers. comm.). Several wetland forest ecological associations occur within the action area. These include the following: mixed swamp forest; oak-maple swamp forest, and maple-cottonwood-sycamore floodplain forest. Fourteen wetlands which are entirely or primarily palustrine forested broad-leaved deciduous will likely be impacted (FHWA 2003). Eleven wetlands which are entirely or primarily palustrine scrub-shrub broad-leaved deciduous will likely be impacted (FHWA 2003). Seven wetlands which are entirely or primarily palustrine emergent persistent will likely be impacted (FHWA 2003). Two ORAM Category 3 (the highest quality wetland category) wetlands in Ohio will be impacted, for a total of 0.28 acres of fill (HCOE 2005). The majority of the remaining wetlands in Ohio that will be filled are Category 2, and 2.83 acres of Category 1 wetland will also be filled (HCOE 2005).

Status of the Species within the Action Area

No quantitative surveys for bats were completed, and therefore the status of the Indiana bat within the action area is unknown, despite recommendations by the Service that quantitative Indiana bat surveys be conducted within the action area. Bat surveys have in the past been conducted within all three counties in the action area (FHWA 2005), however Indiana bats have only been detected within Paulding County, and were found approximately 30 miles from the city of Defiance, Ohio (ODNR 1977).

The Paulding County capture is from June 1976, and included one male and 2 pregnant female Indiana bats (ODNR 1977), indicating that Paulding County has supported at least one maternity colony of Indiana bats, as well as at least one male Indiana bat. U.S. Geological Survey (USGS) topographic maps from the Paulding County capture location indicate that in 1983, the area was dominated by agriculture, with scattered woodlots primarily located along stream corridors. The most current USGS aerial photos available (1994) confirm that this area remains primarily agricultural with only scattered woodlots adajacent to stream corridors. The landscape composition of the Paulding County Indiana bat capture location is similar to the landscape composition within the action area, thus, some inferences can be made between the action area and the Paulding County capture site. Furthermore, the capture location was on Dog Creek, a tributary to the Little Auglaize River, which flows into the Auglaize River, and eventually into the Maumee River, demonstrating that Indiana bats have been documented within the Maumee River watershed.

A site visit conducted by Service, ODOT, and FHWA personell on August 8, 2005 documented the presence of suitable roosting and foraging habitat within forested portions of the eastern and central portions of the action area. Multiple suitable roost trees were documented in all of the woodlots visited, and many of these trees are proposed to be impacted. In addition, forested

wetlands and riparian corridors, which could provide suitable foraging habitat for the bat, exist within the action area and are proposed for impact.

The Endangered Species Act of 1973, as amended, requires that, in the absence of conclusive evidence regarding the status of Federally listed species, the Service must err on the side of the species when assessing impacts of projects on listed species. The Service must formulate reasonable assumptions as to the potential for the Indiana bat and its habitat to occur throughout this area. These assumptions must be made in order to analyze the potential effects of the action. The Service has formulated assumptions which we believe to be reasonable, and these, along with their supporting rationale and documentation, are provided in the paragraphs below.

Based on the documented presence of suitable Indiana bat roosting and foraging habitat (ie, upland and bottomland forests supporting trees with peeling bark, cracks, and/or crevices, and streams with forested riparian corridors) within the action area, historic records of the Indiana bat within Paulding County and the Maumee River watershed (which the action area passes through), the similarity of landscape composition between the Paulding County capture location and the action area, and the documented presence of maternity colonies of Indiana bats as well as male and non-reproductively active female Indiana bats within similar agriculture-dominated landscapes in Illinois, Missouri, New York, and Michigan (Carter et al. 2002, Miller et al. 2002, Gardner et al., 1991, Kurta et al. 2002, Britzke 2003), the Service assumes that both male and female Indiana bats are present within the action area during the summer months (April-September).

A review of the Ohio Karst Area Map for the State of Ohio (ODNR undated), and the geologic composition and historic use of the action area indicate that caves and mines are not present in the action area. Furthermore, the study area is not within an Indiana karst region and no karst geologic features were observed during the field reviews (FHWA 2003). Therefore, the Service assumes that no Indiana bat hibernacula are located within the action area, and that Indiana bats would only be expected within the action area between approximately April 15 and September 15, which corresponds to the summer maternity season.

We must also attempt to quantify the number of Indiana bats within the action area. Within the action area, forested habitat is generally sparse, and widely fragmented, due to the agricultural nature of the action area. Forests within the action area are generally comprised of oak, maple, hickory, cottonwood, and sycamore trees, and are generally isolated blocks with scattered wetlands or riparian areas associated with streams/drainage ways. Based on the August 8, 2005 site visit, forests within the action area support numerous shagbark hickories, and additional live and dead trees with peeling bark, cracks, and crevices that could provide suitable roosting habitat. Forest habitat is found most often close to the Maumee River, associated drainage ways, and at the eastern end of the action area, while the western and central end of the action area support very few woodlands. As described above, within the project footprint 199 acres of woods exist (including mitigation areas), and of that 199 acres, 71.3 acres are proposed to be removed. Outside of the project footprint, but still within the action area, the following amounts of forest habitat exist: Allen County: 622.28 acres; Paulding County: 903.33 acres; and Defiance County: 1063.22 acres (D. Snyder, pers. comm.). In total, the action area supports 2,787.83 acres of wooded habitat.

Based on published studies documented above, maternity colonies of Indiana bats have a home range with a maximum size of 530 acres, and according to the BA, an assumed minimum size of 279 acres (FHWA 2005, Rommé et. al 2002). Furthermore, maternity colonies would be expected to occur only in areas that support some minimum level of suitable roosting and foraging habitat, including upland, bottomland, and riparian woodlots, as well as forest and cropland edges, fallow fields, and areas of impounded water (Kiser and Elliott 1996). Furthermore, Indiana bats have been documented flying up to 2.5 miles from their roost sites to forage. Therefore, within a given 2.5-mile radius circle, we surmise that a minimum of 279 acres of suitable forested habitat and associated water sources must exist to support a maternity colony.

Likewise, male Indiana bats have a home range with a maximum size of 555 acres (Rommé et. al 2002) and an assummed minimum size of 140 acres (Kiser and Elliot 1996). Furthermore, male and non-reproductively active female Indiana bats would be expected to occur only in areas that support some minimum level of suitable roosting and foraging habitat, including upland, bottomland, and riparian woodlots, as well as forest and cropland edges, fallow fields, and areas of impounded water (Kiser and Elliott 1996). Furthermore, Indiana bats have been documented flying up to 2.5 miles from their roost sites to forage. Therefore, within a given 2.5-mile radius circle, we surmise that a minimum of 140 acres of suitable forested habitat and associated water sources must exist to support male and non-reproductively active female Indiana bats.

Because the Service had to redefine the action area to be consistent with the regulations, the evaluation of suitable Indiana bat habitat within the action area defined in the BA (FHWA 2005) is not appropriate for this analysis. The action area defined in the BA (FHWA 2005) is roughly three times the size of the redefined action area. In order to estimate the amount of suitable Indiana bat habitat within the redefined action area, the Service used the best available information on amount of suitable habitat which was provided in the BA. In the BA (FHWA 2005) Appendix B, page 55 included a table with the amount of forested habitat present within the originally defined action area in each of 17 segments of the proposed road project. The Segments are each 2.5 miles long, and proceed in numerical order from west to east. In order to determine an estimate of the amount of suitable Indiana bat habitat in the redefined action area, the Service divided the amount of habitat decribed in the BA by three, because the action area defined in the BA is roughly three times the size of the action area defined by the Service. The acreage of forest habitat obtained using this method was visually compared to USGS topographic maps of the project area to ensure that the estimates did not greatly over- or under-estimate the amount of forest habitat visually available within the redefined action area. These visual observations indicated that dividing the total forest within the original action area by three appeared to give a good estimate of the amount of forest habitat within the redefined action area. The amount of forest habitat derived in this way was then compared to the minimum amount needed by maternity colonies, and males and non-reproductively active female bats to determine if each segment had enough habitat to support a maternity colony, or male or non-reproductively active female bats. The results of this comparison are presented in the table below:

Table 2. Assessment of suitable Indiana bat habitat within the redefined action area.

Segment	Forest habitat in BA action area (ac)	Estimate of forest habitat in redefined action area (ac)	Enough forested habitat to support a maternity colony?	Enough forested habitat to support male non-reproduc. bats?
1	538	179.3333333	no	yes
2	668.9	222.9666667	no	Yes
3	418.5	139.5	no	No
4	285.9	95.3	no	No
5	434.4	144.8	no	Yes
6	364.1	121.3666667	no	No
7	499.5	166.5	no	Yes
8	301.6	100.5333333	no	No
9	635.7	211.9	no	Yes
10	985.3	328.4333333	yes	Yes
11	1077.6	359.2	yes	Yes
12	1395	465	yes	Yes
13	1025.3	341.7666667	yes	Yes
14	1373.9	457.9666667	yes	Yes
15	2295.5	765.1666667	yes	Yes
16	815.3	271.7666667	no	Yes
17	1348.4	449.4666667	yes	Yes

As is apparent by the above assessment, the westernmost portion of the U.S. 24 action area, including segments 1-9 for a total of 22.5 miles, does not provide sufficient suitable forested habitat to support a maternity colony of Indiana bats. Most of the remaining segments, with the exception of segment 16, do provide enough suitable forested habitat to support a maternity colony of Indiana bats. When considering male and non-reproductive Indiana bats, all of the segments with the exception of segments 3, 4, 6, and 8 provide the minimum amount of forested habitat needed to support male and non-reproductive Indiana bats.

Based on the above information, the Service assumes that it is extremely unlikely that male or female Indiana bats occur within segments 3, 4, 6, or 8, and that it is extremely unlikely that maternity colonies of Indiana bats occur within segments 1-9. Based on the above information, the Service finds that Indiana bat use of segments 3, 4, 6, and 8 is insignificant, and that maternity colony use of segments 1-9 is also insignificant.

Although segments 5 and 7 provide just above the minimum amount of suitable forested habitat necessary to support male and non-reproductive Indiana bats, it is unlikely that male or non-reproductive Indiana bats are using these segments due to the widely scattered nature of the woodlots, their small size, the overall absence of large forested parcels within these segments and the surrounding segments, and lack of connectivity between these segments and significant riparian corridors. Based on the above information, the Service finds that it is very unlikely that male or non-reproductive Indiana bats occur within segments 5 and 7, and that use of these segments by Indiana bats is insignificant.

Based on the above information, the Service assumes that segments 1, 2, and 9-14 provide enough suitable habitat to support male and non-reproductive Indiana bats. Although these segments support enough suitable habitat to support male and non-reproductive bats, available habitat still remains in scattered isolated patches with limited connectivity. Because of this, the Service assumes that each of these segments support only a minimum number of male and/or non-reproductive Indiana bats, totaling one male or non-reproductive bat per segment, for a combined total of 8 male or non-reproductively active female Indiana bats.

Segments 15-17 at the eastern end of the project provide more than enough suitable habitat to support male or non-reproductive Indiana bats, and connectivity with other forested parcels and forested riparian corridors of relatively large streams/rivers is more readily available than in the other segments. Because of this, the Service assumes that these segments support more male and non-reproductive female Indiana bats than the other segments, and that two male or non-reproductive female Indiana bats occur within each of these segments for a combined total of 6 male or non-reproductively active female Indiana bats.

In total, the Service assumes that there are 14 male or non-reproductively active female Indiana bats within the action area.

As noted above, only segments 10-15 and 17 provide enough suitable habitat to support maternity colonies of Indiana bats. Segments 15 and 17 provide good connectivity to other forested parcels and forested riparian corridors of relatively large streams/rivers, increasing the value of the habitat for maternity colonies. Because these segments each provide a significant amount of high quality habitat, the Service assumes that each of these segments supports a maternity colony of Indiana bats.

As noted above, segments 10-14 each provide enough suitable habitat to support a maternity colony of Indiana bats, however available habitat still remains in scattered isolated patches with limited connectivity to other forested areas or forested riparian corridors of large streams/rivers, indicating that this habitat is likely lower quality than that found in segments 15 and 17. Because of this, the Service assumes that there is only one maternity colony of Indiana bats within all of the area encompassed by segments 10-14.

In total, the Service assumes that there are three maternity colonies of Indiana bats within the action area.

As explained in the Status of Species section, precisely determining the size of a maternity colony is difficult without long-term studies. Some Indiana bat studies indicate that the average maternity colony size is 80 reproductive females. Kurta and others (1996) found that, at a maternity colony in Vermontville, southcentral Michigan, 89% of 150 observed emergence counts involved between 2-21 individual bats. Because the existing suitable Indiana bat habitat within the action area is generally composed of isolated blocks of woods within a primarily agricultural landscape, the Service assumes that maternity colonies within the action area would be likely to support smaller populations than maternity colonies in a landscape with plentiful roosting and foraging opportunities. Therefore, for the purposes of our analysis, we have selected 21 female bats as a reasonable estimate of the size of the maternity colony within the

action area. Additionally, as each adult female is capable of having 1 pup annually, we also conclude that up to 21 young are likely present within each maternity colony. If there are an assumed three maternity colonies within the action area, and a total of 42 females and pups per maternity colony, the Service assumes that there are 126 adult females and immature Indiana bats within the redefined action area.

As previously discussed in the Life History section of this BO, Indiana bat maternity colonies require multiple roost trees to fulfull their thermoregulatory requirements. Maternity roost trees include at least one primary roost tree and several secondary roost trees. Without detailed ecological study, the extent to which the action area is used by Indiana bats is unknown. However, given the suitability of the wooded portions of the action area and the length of the corridor, it is likely that primary and secondary roost trees occur within the action area and possibly within the project corridor. It is also likely that, due to the linear nature of the action area, that many primary and secondary roost trees occur outside of the action area and/or project corridor.

Furthermore, both male and female Indiana bats may occur only within each specified segment, or may cross over into more than one of the defined segments; Bat use of a given area is primarily dependent on habitat features, and so they may use significantly more or less of each segment than we have defined here, depending on available habitat. But, for the purposes of this analysis, the Service finds that it is reasonable to assume that bats are occurring within those designated segments that provide enough suitable habitat, in close proximity to suitable water sources, and associated forested travel corridors. Despite that bats may travel across any of the identified segment lines, this should not significantly change the analysis of effects found later in this document.

Factors Affecting Species Environment within the Action Area

Numerous human-related and natural factors have affected the habitat and Indiana bat occupancy within the action area. A brief discussion of these factors is provided below.

Land Ownership and Management

The majority of the project area is in private ownership, and agriculture dominates the landscape. This portion of Ohio was historically wooded, prior to European settlement. Most of the woods that historically occurred within the project area were cleared, drained and converted to agriculture more than a century ago. The loss of these historical woodlots likely reduced the overall habitat available to Indiana bats significantly. Those woodlots that remain today are typically located adjacent to stream channels, and/or are too wet to farm. Most, if not all of these remaining woodlots are second growth woods, as the project area has been timbered many times over in the past. In Ohio, timber harvest on private land is not regulated. Some landowners in the action area may be performing logging operations at any time of the year. Timber harvest occurring between April 15 and September 15 could potentially cause the death or injury of Indiana bats when a tree they are roosting in is felled.

Existing Transportation Corridors
The existing U.S. 24 lies within the action area, as do active and abandoned railroad corridors. In addition, numerous state, county, and local roads also exist within the action area. These roads fragment the landscape, separating woodlots from one another, and disrupting travel corridors that the bats might otherwise use. Furthermore, mortality of Indiana bats due to vehicle strikes cannot be ruled out, although occurrence of this is likely extremely rare.

Residential Communities
Although the action area is predominately agricultural and rural in nature, several communities exist including the cities of New Haven, Indiana and Defiance, Ohio at the project termini, and the towns of Antwerp, Cecil, Knoxdale, and Emmett, Ohio, and Five Points and Woodburn Indiana. Loss of historically wooded habitat to residential development has resulted in a loss of overall available habitat for the Indiana bat, and when considered cumulatively with the loss of habitat to agricultural uses and transportation corridors, is significant.

In summary, high quality summer roosting and foraging habitat has been documented throughout the action area, although this habitat is fragmented by the many agricultural fields, multiple roads, and urban/suburban developments. Due to an absence of survey data, and based on the presence of suitable high quality habitat, the Service assumes that both male and reproductively active female Indiana bats and their offspring likely occur throughout the action area during the summer, with the majority of Indiana bats occurring in segments 10-17, at the eastern end of the action area. The action area does not support winter habitat for the Indiana bat, therefore the Service assumes that Indiana bats are only present in the action area from April 15 to September 15.

IV. 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 action*s 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

Stream and wetland mitigation may help to offset project impacts to these resources. In turn, these measures could help to offset impacts to the Indiana bat through habitat replacement and enhancement. As mitigation for direct impacts to 7,944 linear feet of stream in the state of Ohio, ODOT proposes to incorporate natural stream channel design techniques into approximately 2,025 linear feet of the relocated Stevens Ditch. The reconstructed stream channel would incoprorate meanders, a two-stage channel, riffle/pool complexes, gradual sloping benches, and vegetated riparian corridors planted with native tree, shrub, and herbaceous plants. In addition, ODOT proposes to preserve 3,268 linear feet of Stevens Ditch, and 1,060 linear feet of an unnamed tributary of Stevens Ditch. This stream preservation is located on the Plumer property, a 163-acre property within the new road right-of-way located just southwest of the proposed U.S. 24/S.R. 424 interchange in Defiance, Ohio. Additionally, ODOT proposes to preserve through permanent conservation easement 4,932 linear feet (average width 310 feet) of stream habitat on the Smith Property. The Smith Property Conservation Area will include approximately 35 acres of wooded riparian habitat along the Maumee River in Paulding County, Crane Township.

As mitigation for direct impacts to 22.05 acres of wetlands in the state of Ohio, ODOT proposes to preserve 60.6 acres of Category 3 forested wetland (the highest quality of wetland under the Ohio Environmental Protection Agency's Rapid Assessment Method (ORAM) for wetlands), to restore 26 acres of forested, shrub-scrub, and emergent wetland, and to preserve 72 acres of mature woodland and 9.0 acres of agricultural buffer areas. All wetland mitigation will also occur on the 163-acre Plumer property.

The Plumer Property woodlot is one of the largest contiguous woodlots within the action area, and is dominated by shagbark hickory trees, and so preservation of a majority of this woodlot will permanently preserve a significant amount of high quality Indiana bat roosting and foraging habitat. Furthermore, preservation of nearly a mile of stream and forested riparian habitat along the Maumee River on the Smith Property will also permanently protect Indiana bat foraging habitat as well as potential roosting habitat.

Stream mitigation could offset and even improve water quality and Indiana bat habitat in the action area. An improvement in water quality could replace or increase the productivity of aquatic insect prey and suitable drinking sources. Replanting of stream corridors with native riparian species will eventually provide high quality roosting and foraging habitat for the Indiana bat as the young plantings mature. In turn, stream mitigation could potentially have a beneficial effect on the Indiana bat at a later time.

Additional stream and wetland mitigation will likely also be proposed for stream and wetland impacts in Indiana, however this information is not readily available at this time. The Service assumes that any stream and/or wetland enhancement, restoration, or creation will improve habitat quality for the Indiana bat in the long-term by creating and/or enhancing roosting and/or foraging habitat, and creating associated increases in the aquatic insect prey base.

In summary, the Service anticipates that stream and wetland mitigation will, at a minimum result in the preservation of 9,260 linear feet of existing stream corridor, 60.6 acres of high quality forested wetland, 72 acres of mature upland woods, and 35 acres of wooded riparian corridor along the Maumee River. Based on the August 8, 2005 site visit, the entire Plumer property provides suitable Indiana bat roosting and foraging habitat, and hence a significant amount of suitable Indiana bat habitat will be permanently preserved. In addition, the location and composition of the Smith Property, a forested riparian corridor along the Maumee River, indicates that it likely provides suitable Indiana bat foraging habitat and potentially roosting habitat as well, that will be permanently protected. Furthermore, the Service anticipates that stream and wetland mitigation will, at a minimum result in the restoration of 2,025 linear feet of natural stream habitat, and 26 acres of forested, shrub-scrub, and emergent wetland habitat within the Plumer Property. This will further enhance the suitability and quality of Indiana bat roosting and foraging habitat on the Plumer Property.

Direct Effects

Loss of Roosting Habitat and Foraging Habitat when Bats are Present

As described above, Indiana bats are assumed to be present within the action area only during the summer active season, between April 15 and September 15. As one avoidance and minimization measure, FHWA has proposed to clear trees only between September 15 and April 15, when the bats would not be in the area. Therefore, the Service anticipates that no direct effects to the bat from tree removal are likely to occur.

Direct Effects of Decreased Water Quality

Water quality is expected to decrease in the action area for a variety of reasons. Road construction will result in the filling of up to 23.84 acres of wetlands, and direct and indirect impacts to 26,425 linear feet of stream habitat by culverting, bridging, relocating, or additional impacts (such as rock channel protection, temporary dewatering, temporary stream crossings). Sediment, herbicides, and other contaminants, could affect water quality through erosion, vegetation management, and accidental spills during any phase of the project from construction to operation.

Insects associated with these aquatic habitats make up part of the diet of Indiana bats. Therefore, a change in water quality can affect the prey base of the species. Decreases in water quality through contamination and the destruction of wetlands and stream habitats will reduce the availability of aquatic insects and reduce the availability or quality of suitable drinking sources. The project description includes a number of measures to be performed to both minimize and offset the impacts to water quality during all phases of the project. These measures can substantially reduce the extent of impacts to water quality from the project.

The Service believes that the water quality impacts will cause a reduction in prey base and drinking sources for the Indiana bat. Direct adverse effects to Indiana bats from this decrease in aquatic insect prey and drinking sources is likely to be undetectable due to the linear nature of the project combined with the availability of suitable riparian habitat (e.g., Maumee and Tiffin Rivers, numerous drainage ditches and small streams) and isolated forested wetland parcels 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 surrounding landscape will continue to provide a prey base of both terrestrial and aquatic insects during project construction, operation and maintenance. Therefore, any potential direct adverse effects to the Indiana bat from a reduction in water quality is anticipated to be insignificant and/or discountable.

Direct Effects of Construction Noise and Vibrations and Operational Road Noise when Bats are Active

In addition to the habitat destruction in the project footprint, the proposed project may result in a decrease in the quality of remaining habitat outside the actual project footprint. Increased disturbance in the action area is anticipated during construction from the use of heavy equipment. 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.

The highest project noise levels are expected to occur during the clearing and construction activities. The area that will experience the greatest increase in noise during construction will be the central portion of the project area where the current noise levels are the lowest. The Service estimates that the area affected by noise disturbance during construction could encompass an area up to 3,200 linear feet from the actual work limits/right-of-way. Operational noise once the road is constructed is expected to range from 72.1 dBA at 189'/261' from the project centerline to 52.4 dBA at 2141' from the project centerline (D. Snyder, FHWA, pers. comm.). Noise levels on the facility are a function of distance, traffic volume, vehicle mix, and speed. Operational noise is expected to increase overall noise levels from the project centerline to 2,141 feet away, or for a distance of 1,991 feet from the edge of the road right-of-way (FHWA 2003).

Much of the project area is composed of agriculture with scattered woodlots, which are typically subject to minimal noise and/or vibrations. In general, the increased noise and vibrations from construction could cause disturbance to Indiana bats unaccustomed to these effects while roosting and thereby lower the suitability of habitat adjacent to the project area. It is difficult to predict the degree to which Indiana bats would be disturbed by the noise and vibrations associated with construction activities. Some studies suggest that bats avoid noisy areas. Female bats in Illinois, for example, used roosts at least 1,640 feet from paved roadways (Garner and Gardner 1992).

Other studies suggest that bats may be able to tolerate disturbance from noise. Indiana bats were documented to use roosts near the I-70/ Indianapolis Airport area, including a primary maternity roost tree nouth of I-70 at the edge of the airport. This roost was not abandoned despite constant noise from the Interstate and airport runways; however, their proximity to the Interstate could also have been due to lack of a more suitable roosting area (USFWS 2002). On Crane Naval Surface Warfare Center in Indiana, a female Indiana bat used a roost tree only 436 ft from a two-lane road. In the Hoosier National Forest in Indiana, a male Indiana bat was located roosting on the edge of the Interstate 64 right-of-way.

Some studies indicate that Indiana bats may be somewhat tolerant of noise from busy roads. Yet, other studies indicate that bats may select roosts somewhat removed from these noisy areas. Any effects resulting from noise and vibrations related to construction activities would be

expected to result in bats selecting roost trees further from the disturbance in habitat. It is reasonable to assume that this will occur when taking the conservative analytical approach.

Indirect Effects

Loss of Roosting Habitat when Bats are Not Present

Indirect Effects on the Maternity Colony from the Loss of Roosting Habitat
One of the most significant indirect effects on the Indiana bat from the proposed activities will be the loss of Indiana bat maternity roosting habitat outside of the maternity season. Up to 73.1 acres of tree cutting for road construction will occur between September 15 and April 15 (FHWA 2005). Based on a site visit to the project area by ODOT, FHWA, and Service representatives, all of this area is suitable Indiana bat habitat. This means that approximately 73.1 acres of suitable Indiana bat maternity roosting habitat will be permanently eliminated by the project.

As explained in the Status of Species section, when female bats return to their summer maternity area in the spring after tree clearing activities have occurred, it is anticipated that they will attempt to use the same roosting areas that were used in previous years. The effect of loss of roosting habitat depends on the extent of loss and use of the area by the bats. We expect greater impact if the entire roosting area is destroyed and more yet if the surrounding area is not suitable for roosting. In this particular situation, we do not expect the entire roosting area to be affected and we expect that the portions of the surrounding landscape that provide similar suitable habitat to that which will be impacted will still be available. However, if a primary or several secondary roosts are destroyed, we fully anticipate that adverse impacts to those exposed females are likely. First, these pregnant females will suffer stress while searching for new roosting areas. It is not known how long or how far female Indiana bats will search to find new roosting habitat if their traditional roost tree is lost. Nonetheless, if they are required to search for new roosting habitat in the spring, this effort will place additional stress on pregnant females at a critical time when fat reserves are low or depleted, and they are already stressed from the energy demands of migration and pregnancy, and food availability is unpredictable.

It appears that when a primary roost tree becomes unsuitable, members of a colony may initially distribute themselves among several previously used alternate roost trees (USFWS 2002; Kurta et al. 2002). It is not known how long it takes for the colony to attain the same level of roosting cohesiveness that it experienced prior to the loss of an important primary roost tree. It is likely that due to the ephemeral nature of roost trees, the Indiana bat has evolved to be able to relocate replacement roosts, if available, when their previously-used roost trees become unsuitable. Considering the linear design of the project, it is plausible that at least some if not many of the colonies' alternate roosts will remain outside the project footprint. The availability of a considerable amount of suitable roosting habitat in the surrounding landscape and the likelihood that some of the colonies' alternate roosts will remain standing outside the project footprint following clearing activities suggest that the colonies may successfully locate new roosts within days of returning from their hibernaculum.

Despite the assumption that Indiana bats will likely regain colony cohesion within a few days, the poor thermoregulatory abilities of pregnant females (Humphrey 1975) pose problems. 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 6 to 7 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). Loss of primary and secondary roosts would cause a disruption of colonial behavior which may cause some females to abort or absorb their embryos.

Until the bats from the colonies locate another desirable primary roost tree and reunite, it is likely that individual members of the colonies will be subject to increased stress resulting from: (1) having to search for a replacement primary roost tree, which increases energy expenditure and risk of predation; (2) having to roost in alternate trees that are less effective in meeting thermoregulatory needs; and (3) having to roost singly, rather than together, which decreases the likelihood in meeting thermoregulatory needs, thereby reducing the potential for reproductive success. These effects are compounded because they will occur in the spring when fat reserves are low or depleted and they are already stressed from the energy demands of migration. This would place them at an increased risk of mortality and/or failed reproduction.

As previously described, harm, a form of take, is defined as an act which actually kills or injures wildlife; harm may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Therefore, based on the above information, the Service believes that take in the form of harm through habitat loss is reasonably certain to occur.

In addition to the loss that results from the action, we analyzed the potential for impacts from secondary development. History has shown that retail development (i.e., gas stations, restaurants, etc.) typically occurs around road interchanges. As described earlier, the project includes 6 interchanges: Three in Indiana including Ryan/Bruick Rd., Webster Rd., and State Route 101, and three in Ohio including State Route 49, U.S. Route 127, and State Route 424. As described in the Action Area section above, the Service anticipates that secondary development is anticipated to occur around each of five new interchanges, excluding the interchange at U.S. 24 and S.R. 424, because this is where the new U.S. 24 will connect to the existing U.S. 24, and any potential development at this intersection would likely occur regardless of whether or not the proposed project is implemented. Furthermore, much of the forested habitat within 2.5 miles of the S.R. 424 interchange includes the Plumer Property, much of which will be permanently preserved for stream and wetland mitigation. Assuming worst-case scenario conditions, secondary development would occur on all land within a 1.0 mile radius of all five western interchanges, and all suitable Indiana bat habitat within a 1.0 mile radius would be permanently lost. Based on maps provided in the BA (FHWA 2005), very little suitable Indiana bat habitat occurs within a 1 mile radius of the State Route 101 and State Route 49 interchanges, therefore, significant impacts to the bat are not anticipated from development at these two locations. However, significant amounts of suitable habitat do exist within a 1.0 mile radius of the Ryan/Bruick Road, Webster Road, and U.S. 127 interchanges. Loss of all forested habitat within 1 mile of these three interchanges could result in a significant reduction in total available Indiana bat habitat within this portion of the action area.

The loss of additional acres of suitable forested Indiana bat due to secondary development has the potential to adversely affect the bat in many ways. It is likely that secondary development would be composed of private development and in many cases would not be regulated, funded, or implemented by Federal government agencies, and therefore Section 7 consultation under the Endangered Species Act would not occur, and potential adverse effects to any Indiana bats inhabiting the area would proceed without significant avoidance and/or minimization measures. Trees would likely be cleared during the maternity roosting season, resulting in direct take of any Indiana bats using these areas for roosting and/or foraging.

During the summer maternity periods, female Indiana bats typically day roost in colonies of up to 100 adult female bats and one offspring per adult bat, while males typically roost singly. Tree cutting is an activity that typically occur during the daytime when Indiana bats would be roosting in trees. Limited information suggests that some Indiana bats would remain in their roost trees until after the trees are felled and that some bats will survive the impact of the fall and then attempt to crawl or fly out of the tree and seek cover elsewhere (Belwood 2002). Bats on the underside of the trees will likely be injured or killed when the trees fall to the ground. Unlike the situation in Goshen, Ohio (Belwood 2002) where the fallen tree was not immediately limbed and cut up for processing, bats at this project site will have little time to reorient and escape prior to the onset of additional impacts.

Additional tree felling and the operation of heavy equipment (log skidders) in the vicinity of felled trees will likely further reduce the survival of those bats. Therefore, those bats that survive the fall of their roost tree are likely to be killed or injured while attempting to escape and seek cover elsewhere. Those that move to a nearby tree for cover (*i.e.*, a tree located within the area to be cleared) will again be exposed within a short period of time to another repetition of risk of death or injury as that tree is also felled, limbed, and skidded. Due to the colonial and solitary roosting habits of the Indiana bat during tree clearing operations, death or injury to Indiana bats in trees that are cut is expected to occur to large groups of bats, as well as individuals in separate events, and to be sporadic across the project footprint.

During tree clearing operations, Indiana bats roosting outside the project footprint are not likely to be killed or injured as trees are felled. However, these bats may be exposed to noise and vibrations cause by tree clearing activites and equipment. Based on available information, the reponsiveness to these disturbances may range from no perceivable response to avoidance of the area.

Direct effects to the Indiana bat from tree cutting between April 15 and September 15 due to secondary development are expected to range from death or injury of Indiana bats roosting in the project footprint to harassment or even no adverse effects to some Indiana bats roosting outside the project footprint but within the action area.

Aside from the direct effects of secondary development on bats from clearing of trees during the summer maternity roosting season, similar other direct and indirect effects, as described above and below due to construction and operation of the road, are also likely to occur, and the effects of these actions are similar to the effects anticipated for road construction.

Indirect Effects on Non-reproductive Bats from the Loss of Roosting Habitat

In addition to the three maternity colonies, the project area is assumed to support non-reproductively active Indiana bats. This mainly includes adult males but may also include females which were either not reproductively active or not reproductively successful in a given year. In general, the indirect effects to non-reproductively active Indiana bats in the action area due to the loss of roosting habitat would be similar to the effects on Indiana bats associated with a maternity colony except that these bats are not typically associated with a colony during the summer months. Upon emergence from hibernation and during spring migration, these bats are not challenged with the energetic demands of pregnancy and rearing young.

During the summer, the life history strategy of male and non-reproductive female Indiana bats does not necessitate colonial roosting. Males and non-reproductive females typically roost alone or occasionally in small groups. When these individuals are displaced from roosts they must utilize alternative roosts or seek out new roosts. Because these individuals are not functioning as members of maternity colonies, they do not face the challenge of reforming as a colony. Suitable roosts for individual Indiana bats include trees of any size whereas maternity colonies must seek out larger trees to accommodate a colony. Therefore it is anticipated that the indirect effects to non-reproductive bats will likely be much less significant than the effects to a maternity colony. Indirect effects to non-reproductive Indiana bats are likely to be insignificant and discountable.

Loss of Foraging Habitat when Bats are Not Present

Another indirect effect of the proposed project on the Indiana bat in the action area will be the loss and fragmentation of foraging habitat. Of the up to 73.1 acres of forested habitat that may be cleared for the project, all is suitable Indiana bat foraging habitat. Furthermore, loss of additional acreages of suitable Indiana bat foraging habitat due to secondary development at the Ryan/Bruick Road, Webster Road, and U.S. 127 interchanges may also result in indirect effects to Indiana bats.

Indirect Effects to the Maternity Colony from the Loss of Foraging Habitat

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 colonies presumed to occur in 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, as much as 73.1 acres of foraging habitat will no longer be available. Additionally, several woodlots will be bisected by the road, resulting in foraging habitat being fragmented by a 4-lane divided highway. Finally, loss of additional acres of suitable Indiana bat foraging habitat due to secondary development at the Ryan/Bruick Road, Webster Road, and U.S. 127 interchanges will further exacerbate loss of forest habitat from road construction.

In general, Indiana bats are reluctant to cross open areas (Brack 1983; Menzel et. al. 2001, Murray and Kurta 2004). 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 increased 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.

The project will result in direct and indirect impacts to 26,425 linear feet (5.03 miles) of streams. In Illinois, Gardner et. al. (1991) found that forested stream corridors and impounded bodies of water were preferred foraging habitats for pregnant and lactating Indiana bats, indicating that streams likely provide an important source of prey for Indiana bat maternity colonies (Kurta and Whitaker 1998). In Pennsylvania, core foraging areas (where a bat spent 50 percent of its time foraging) were located along intermittent streams or within hollows containing an intermittent stream (Butchkoski and Hassinger 2002). This study indicates the importance of large blocks of contiguous forested habitat as well as small streams and their associated habitat to foraging female Indiana bats.

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 26,425 linear feet (5.03 miles) of streams may be directly and indirectly impacted by the project, reducing or eliminating potential sources of aquatic insects. In response, bats will seek alternate food sources in upland and other riparian areas. However, upland food sources may also likely 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 destruction and/or modification of 26,425 linear feet (5.03 miles) of streams, along with their associated riparian forested habitat, will eliminate and/or degrade bat flyways, foraging areas, and drinking sources. In addition, the Indiana bat's prey base will be reduced due to the loss of insects associated with the 73.1 acres of upland and riparian forests in the project footprint, as well as the loss of wooded habitat within 1 mile of the Ryan/Bruick Road, Webster Road, and U.S. 127 interchanges.

The effects to individual bats from the loss of foraging habitat are likely to vary based upon each bats usage of this area. According to Murray and Kurta (2004), Indiana bats appear to forage individually rather than in groups. Additionally, individual Indiana bats establish several foraging areas. Some bats may only forage in the project area occasionally and therefore would be familiar with other nearby foraging areas. These bats may be able to quickly adjust their foraging habitats by spending more time foraging in other portions of their range. For bats that foraged extensively or exclusively within the project area, the effect may be more severe. Due to the linear nature of the project, it is more likely that bats forage in the project area occasionally rather than extensively.

In addition to the Indiana bat, six other species of bats (little brown bat, northern long-eared bat, eastern pipistrelle, big brown bat, red bat, and silver-haired bat) are known to occur within Paulding and/or Defiance Counties, Ohio, based on previous bat surveys outside of the action area (3DI 1998, ODNR 1977). The Service assumes that, since land use and forest habitat is similar throughout much of both Paulding and Defiance Counties, these same bat species would

likely occur within forested habitat in the action area. 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; Lee and McCracken 2004). Therefore competition between those species may be pronounced as all species will be displaced and forced to move quickly into other foraging habitat. Displaced bats are likely to have a reduced foraging efficiency while competing against other bats that have already established territories and are familiar with the area, adjusting to altered travel routes to foraging areas in addition to seeking out new foraging areas to replace areas which were lost. However, the effects to individual 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 and the likehood that most bats, regardless of species, do not forage exclusively or extensivly in the area to be cleared. As much of the action area outside of the project footprint is composed of primarily agricultural land with scattered isolated woodlots that likely provides suitable foraging habitat, the quantity and quality of the habitat that will remain outside the project footprint suggests that individuals from the colonies may have moderate difficulty successfully locating and establishing modified or new foraging areas, and that take in the form of harm may result.

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 such that their pups may have delayed development.

FHWA has committed to carrying out the following measures which will minimize adverse indirect effects to the foraging habitat of the maternity colonies: (1) FHWA will insure that all construction activities are confined to the construction work limits defined in the project description which includes all staging, waste, and borrow areas, (2) Tree cutting within the project footprint will be minimized wherever possible, (3) Staging, waste, and borrow areas will not occur within forests or wetlands, and (4) A comprehensive sedimentation and erosion control plan will be developed and implemented during tree-cutting operations to avoid down-stream impacts to waterways which will minimize impacts to the aquatic prey base.

Overall, the effect of the loss of 73.1 acres of foraging habitat due to road construction and the loss of additional foraging habitat due to secondary development on individual bats from the colonies will range from insignificant and discountable effects to take in the form of harm. Due to the linear nature of the project and the isolated, scattered nature of the woodlots, the foraging areas for many of the bats would likely be entirely or mostly outside the project footprint. The effects to these individuals are anticipated to be minimal. Effects to a few individuals, those who

forage entirely or mostly in the project right-of-way or within one mile of the Ryan/Bruick Road, Webster Road, or U.S. 127 interchanges, or those who will have their foraging areas separated from their roosting areas, may be more significant. These individuals may have to expend an increased amount of energy to establish new foraging areas, thereby potentially reducing their fitness, and more likely, reducing their chance 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.

Indirect Effects on Non-reproductive Bats from the Loss of Foraging Habitat
As predicted with the maternity colonies, most males and non-reproductive females are likely utilizing foraging areas that lie entirely or mostly outside the project footprint due to the linear nature of the project. Effects to these individuals are anticipated to be minimal. It is also possible that a few individuals utilize foraging areas entirely or mostly in the project footprint. The effects to these individuals could be more severe as they are forced to establish new foraging areas. However, these effects would not be complicated with the energy demands of pregnancy and rearing of pups.

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 non-reproductively active 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. As much of the action area outside of the project footprint is composed of primarily agricultural land with scattered isolated woodlots that likely provide suitable foraging habitat, the quantity and quality of the habitat that will remain outside the project footprint suggests that individual males and non-reproductive females may have moderate difficulty successfully locating and establishing modified or new foraging areas, and that take in the form of harm may result.

<u>Indirect Effects of Fragmentation</u>
In addition to the effects from the permanent loss of trees, forest fragmentation is also anticipated and could impact the Indiana bat. Recent research by Murray and Kurta (2004) indicates that Indiana bats may prefer traveling along forested corridors rather than over large open spaces. Conversely, some data from maternity colonies in Indiana and Pennsylvania show that Indiana bats cross major roads routinely (Kiser et. al. 2002; Butchkoski and Hassinger 2002). Therefore, the Service deems it reasonable to assume that some bats may avoid crossing the project area and others may continue to routinely cross the area once it has been cleared.

The Service estimates that up to 80 acres of forested habitat on the Plumer property could become less suitable for roosting and foraging as the new highway divides this large forest block into two separate forested units. Likewise, the narrow riparian zone of Zuber Creek will be bisected by the new highway. Additionally, secondary develoment near the Ryan/Bruick Road, Webster Road, and U.S. 127 interchanges may fragement additional woodlots within the action area. However, as previously described, most of the forest parcels within the action area, and within this part of Ohio and Indiana are already isolated fragments within a predominantly agricultural setting. Therefore, any Indiana bats that use the action area for roosting and/or foraging would likely already be accustomed to crossing agricultural areas and associated roads, and therefore, any adverse effects to the bat from habitat fragmentation are likely to be discountable.

Indirect Effects of Decreased Water Quality

Potential indirect effects to the Indiana bat from a reduction in water quality from construction, operation, and maintenance of the highway are anticipated to be similar to direct effects. Water quality is expected to decrease in the action area for a variety of reasons. The project description includes a number of measures to be performed to both minimize and offset the impacts to water quality during all phases of the project. These measures should substantially reduce the extent of impacts to water quality from the project.

The Service believes that the water quality impacts will cause a reduction in prey base and drinking sources for the Indiana bat. Indirect adverse effects to Indiana bats from this decrease in aquatic insect prey and drinking sources is likely to be undetectable due to the linear nature 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 surrounding landscape will continue to provide a prey base of both terrestrial and aquatic insects during project construction, operation and maintenance. Therefore, any potential indirect adverse effects to the Indiana bat from a reduction in water quality is anticipated to be insignificant.

Indirect Effects of Disturbance

In addition to the actual habitat removal in the project footprint and within areas of secondary development, and the direct 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 during the operation of the highway will be subject to noise disturbance from traffic noise when the highway is operational. 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 along the proposed construction corridor varies greatly depending upon the proximity of the corridor to existing activities. Given the rural, agricultural nature of the project area, the lowest existing noise levels along the corridor should be occurring in the areas that are farthest away from roads, railroads, structures, and towns/cities. Considering the positioning of the corridor and existing land uses, the lowest existing noise levels should be occurring in the central portion of the project area, most of which is within a primarily agricultural setting. Noise monitoring conducted in 1999 by ODOT personnel found that the average existing noise level in the project area is 52.8 dBA (D. Snyder, FHWA, pers. comm.).

FHWA estimates that the noise level anticipated during project operation will range from 72.1 dBA at a distance of 189'/261' from the project centerline to 52.4dBA at a distance of 2141' from the centerline. This would noticably increase the noise at locations close to the project centerline by 19.3 dBA, however at locations greater than 0.41 miles from the project centerline, noise would expect to remain at currently existing levels. These figures are based upon the typical reduction level of 6.0 dBA per doubling of distance for noise (D. Snyder, FHWA, pers. comm.).

Assuming that locations within 0.41 miles of the project centerline will experience permanently increased noise levels, and knowing that the road corridor is 36.4 miles in length, an area of 14.9 square miles (650,089 acres) will be affected by vehicle noise during operation of the highway. Of this total area impacted, only a small portion of it provides suitable Indiana bat habitat.

Increased noise and vibrations could cause disturbance to Indiana bats unaccustomed to these effects while roosting and thereby lower the suitability of habitat adjacent to the project area. It is difficult to predict the degree to which Indiana bats would be disturbed by the noise and vibrations associated with operation activities. Any effect resulting from noise and vibrations related to operation activities would be expected to result in bats selecting roost trees further from the disturbance in habitat.

Indirect Effects of Vehicle Traffic

Once the highway is in operation, Indiana bats will be subject to the hazard of being struck by vehicles. Bats may cross roads while commuting between roosting and foraging areas and/or while foraging on insects attracted to road lighting. Although Indiana bats generally avoid crossing over open areas (Brack 1983; Menzel et. al. 2001), they have been documented flying over busy interstate highways (e.g., I-70 near the Indianapolis Airport; USFWS 2002). In Pennsylvania, Indiana bats have also been documented crossing U.S. Route 22 near the Canoe Creek Church (Butchkoski 2003). In both of these circumstances, the road lies between known roosting and foraging areas for members of the colonies (Butchkoski 2003; D. Sparks, IN State Univ., pers. comm. 2005). Thus, it is apparent that Indiana bats do cross over busy highways when they divide foraging from roosting areas. It should also be noted that through a radio telemetry study by Indiana State University, Sparks (pers. comm.) observed that individuals of the Indianapolis Airport colony avoided flying over I-70 where a bridge provided a 35-ft high corridor beneath the road. The results of this particular study indicate that bats may avoid flying over highways when an alternative corridor is present.

Since there is some evidence that Indiana bats will routinely fly across roads during the summer, the Service anticipates that the proposed road may not present a physical barrier to the movements of Indiana bats. However, limited information on the Indianapolis Airport colony suggests that Indiana bats may only do so when the road separates roosting and foraging areas and no other route between these areas is available or no other such areas are available that do not necessitate crossing the road (D. Sparks, IN State Univ., pers. comm.). The Service anticipates that individual home ranges of Indiana bats that occur in the action area will be impacted differently depending upon the extent to which the project will impact each bat's roosting, foraging, and commuting areas. The home ranges for some Indiana bats may be partially or even entirely divided by the project. These bats may modify their home ranges to avoid crossing the roadway or they may choose to cross the road to access roosting or foraging areas. Bats that do cross the road will be subject to the risk of being struck by vehicles traveling on the roadway. In fact, multiple bat mortalities from vehicle collisions, including at least one Indiana bat, have been documented at the Canoe Creek site in Pennsylvania where Indiana bats routinely cross U.S. Route 22 (Butchkoski 2002). However, as previously described, most of the forest parcels within the action area, and within this part of Ohio and Indiana are already isolated fragments within a predominantly agricultural setting. Multiple roads of varying sizes (including the existing U.S. 24) already exist within the action area, therefore, any Indiana bats that use the action area for roosting and/or foraging would likely already be accustomed to crossing roads,

and therefore, any adverse effects to the bat from habitat fragmentation by roads are likely to be discountable.

Although it has been documented that Indiana bats fly across roadways, there is no data specific to the Indiana bat for the use or avoidance of lighted areas that may or may not occur over these roadways. Research by Rydell and Baagoe (1996) indicates that bats in the genus *Eptesicus* (e.g. big brown bat) and Lasiurine bats (red and hoary bats) are the species typically noted foraging around artificial lights. In contrast, they also noted that bats in the genus *Myotis* seem to avoid open places most of the time preferring to feed in woodlands or low over water. It appears that the foraging strategies utilized by *Myotis* bats, including the Indiana bat, may be more suited to foraging in forested areas than out in open areas (Humphrey et. al. 1977; LaVal et. al. 1976; Brack 1983; Garner and Gardner 1992; Gardner et. al. 1996; Murray 1999).

FHWA has committed to only locating road lights for the new highway at the proposed interchanges. The lighting to be placed at the interchanges includes high pressure sodium lamps on 40-foot cobra head poles (Kirk Slusher, ODOT, pers. comm.). Approximately 24 lamps will be placed at each interchange. This type of lighting emits a color that is less visible to insects than standard lighting (GE 2005). Although data suggests that Indiana bats prefer to forage in forested areas (Humphrey et. al. 1977; LaVal et. al. 1977; Brack 1983; Garner and Gardner 1992; Gardner et. al. 1996; Murray 1999), there is still a slight probability that they could forage at artificial lights if these opportunities provided a concentration of their insect prey base. The use of high pressure sodium lights would minimize their attractiveness to insects, thus, reducing the likelihood of large insect congregations and hence less chance for bats to be attracted to the lighted area. Based upon these factors, the Service predicts that in general, Indiana bats will typically not forage at artificial lights installed for this project.

The Service anticipates that Indiana bats will run the risk of colliding with vehicles when the new highway is in operation when bats are commuting between roosting and foraging areas and that any bat that is struck by a vehicle will be directly killed or fatally injured. However, it is difficult to meaningfully quantify the risk of bat/vehicle collisions. Furthermore, any such strikes would likely go either unnoticed or unreported. Finally, any bats within the action area should already be accustomed to crossing roads, due to the numerous roads of varying sizes that currently exist within the action area. The Service anticipates that mortality outside of what is currently occurring from vehicle collisions would be unlikely.

Effects on Reproduction Success of the Maternity Colony

In general terms, the overall population decline of the Indiana bat is a result of mortality exceeding recruitment (*i.e.*, deaths are outpacing recruitment). The specific reasons for this dynamic remain unknown. Due to the energy demands of migration and hibernation, higher mortality rates can be expected during these events than during routine foraging and roosting activities in summer habitat. The annual cycle (for females) of hibernation → spring migration → birthing → lactation → fall migration → mating → hibernation, can be broken at any point, resulting in the loss of that female from the population, and her remaining reproductive potential from the population. At some point(s) in this annual cycle, the species is experiencing higher mortality rates, or lower reproductive success than it did historically, causing the species' population to continue to decline. Since bats are only capable of producing one pup per year, this limits their ability to rebound after these population losses. The vulnerable point(s) in this

cycle may differ by geographic area, and even within the same area. It is important to recognize that it is not necessarily the *events* in the annual cycle that are causing the species decline, rather, it may be a *change in the environments* (*i.e*., hibernacula, summer habitat, migration habitat) in which those events are occurring. Unless a change in these environments occurs to allow reproduction to exceed mortality, the species will continue to decline. The continuing population decline provides the context for the evaluation of the effects of the proposed action.

An important feature of Indiana bat behavioral biology that is integral to the discussion of effects of the proposed projects is the fact that female Indiana bats exhibit strong site fidelity to summer roosting and foraging areas. Removal of established foraging and roosting areas is expected to have an adverse effect on bats that rely upon these areas and features (Gumbert et al. 2002). Some researchers have stated that bats may not be able to compensate if a large number of trees used in previous years are missing, and that "destruction of many roost trees in a small area could be devastating when these bats faithfully return the following spring" (Kurta et al. 2002; Kurta and Murray 2002). Kurta et al. (2002) further suggests that the use of seasonal tree-clearing restrictions alone is not an appropriate measure for minimizing impacts to Indiana bats.

While very few site-specific data are available regarding the effects of summer habitat degradation or loss on maternity colonies of Indiana bats, information regarding basic life-history strategies can be of assistance, as well as, information from surrogate species that have a similar biology. For example, species that show high site fidelity usually occupy predictable and stable (in space and time) niches (McNicholl 1975; Blancher and Robertson 1985). Species adapted to niches that are unpredictable in space and time generally do not show high site fidelity. For a species showing high site fidelity, alteration of their foraging, roosting, or breeding habitat reduces the predictability of the habitat; therefore, disruption to various aspects of that species' ecology, particularly survival and reproduction are expected. Even if there is an ability to relocate, when individuals of species that normally exhibit high site fidelity move to different breeding locations, they may suffer decreased reproductive success following the movement (Dow and Fredga 1983). Species with high site fidelity occupying habitat that is undergoing changes may subsequently experience reduced productivity and substantial population declines (Takagi 2003).

A few bats either remaining in the action area or displaced from previously used foraging and roosting sites can be expected to have higher rates of reproductive failure, and have young that mature later. If the summer range is modified such that females are required to search and compete for new roosting habitat or foraging areas, this added energy expenditure may place 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 and gestation (Kurta, et al. 2002; Kurta and Murray 2002).

Juvenile female Indiana bats can attain sexual maturity in their first fall season (USFWS 1999). A delay in pre- and postnatal development can affect juvenile survival and reproductive potential. Slowed growth rates during pregnancy and lactation may mean later weaning dates and smaller young, both of which affect juvenile survival (Racey and Entwistle 2000). Later weaning dates leave less time for young to perfect their flying and foraging skills, which in turn, affects their ability to maintain their body condition and store fat and obtain adequate strength to successfully migrate in the fall. Further, as a minimum fat-to-lean mass ratio may be needed to

successfully reproduce, delays in weaning time may also, in a similar manner, affect the reproductive potential of the young. Lastly, delays in migration departure could subject bats (both young and adults) to unfavorable winter conditions along the way. Humphrey et al. (1977), for example, reported that young Indiana bats became volant 2 weeks later than the previous year because of cold temperatures and delayed migration to hibernacula a commensurate amount with the last migrants departing 3 weeks later than expected. These bats were then exposed to freezing weather at the nursery site and entered into torpor. When they finally arrived at hibernacula there was very little time for prehibernation fat storage and mating. Consequently, Humphrey and colleagues suspected that the delayed growth and subsequent delay in migration reduced the survival rates of affected young during migration and hibernation, and may have reduced natality the next year as fewer females were likely able to successfully mate. The decrease in foraging, roosting, and watering habitat available during and post-project may be significant given that the surrounding landscape supports only limited suitable forested roosting and foraging habitat to begin with.

The degree of habitat loss associated with the proposed road construction (73.1 acres), and the loss of additional bat habitat due to secondary development at three interchanges, when compaired to the environmental baseline, represents a noticable change in the summer environment for the maternity colonies in the action area. The biological question is whether these changes will affect the maternity colonies and if so, to what extent. The relevant biological and behavioral factors important to these evaluations are the species' population dynamics, life cycle, strong philopatric behavior, and foraging and roosting requirements.

The strong fidelity shown by this species to its summer habitat makes it likely that the maternity colonies will attempt to remain in their traditional summer habitat (i.e., the remaining portions of habitat) (Gardner et al. 1991; Humphrey et al. 1977; Kurta and Murray 2002). It is possible that the colonies would leave the area entirely and seek roosting and foraging habitat sufficient to support them elsewhere. However, it is more reasonable to assume that the colonies would utilize the surrounding forested parcels because they provide foraging and roosting habitat similar to that which will be lost due to the project. The displaced colonies will likely be subject to inter- and intra-specific competition from both resident and displaced bats for roosting and foraging habitat (Whitaker 2004; Foster and Kurta 1999). Due to the limited amount of suitable roosting and foraging habitat in the surrounding area, adverse effects to Indiana bats due to inter- and intra-specific competition is expected to occur, and would take the form of harm through disruption of feeding patterns and increased time spent finding new foraging grounds during a period where bats are already stressed from hibernation, migration, pregnancy and/or rearing of pups, and could likely result in decreased reproductive success.

The Service believes that loss of some foraging and roosting areas could temporarily disrupt the cohesive nature of the maternity colonies (Kurta and Murray 2002) for some time in the spring following clearing activities in the project area. Given the ability of the Indiana bat to adapt to the ephemeral nature of roost trees, and the assumption that not all of the colonies' roost trees and foraging areas will be lost, it is probable that the colonies will be able to reestablish a new primary roost and additional alternate roosts, and the individuals to reestablish and/or modify their foraging patterns within a few days to a week upon arriving in the project area. However, the limited availability of suitable roosting and foraging habitat in the surrounding landscape could result in difficulty finding suitable roosting and foraging habitat, and in travel of

significant distances outside of the former home range in order to find suitable habitat. Such disruption could decrease the reproductive advantages of colonial maternity roosting for some period of time.

The Service anticipates that some females of the colonies will successfully bear a pup. However, due to the higher short-term energy demands on individuals of the colonies at a time when their energy reserves are low, some bats may experience a delay in giving birth or fail to successfully produce a pup. Due to the likelihood that the bats will experience some difficulty in finding alternate foraging and roosting habitat, and that they will be competing with other bats for this limited amount of habitat, the Service anticipates that a some would experience too great an impact on their energy budget, which could, as a result, lead to termination of their reproductive effort for the year.

Effects on Numbers

Quantification of these project related losses at the population level (i.e., maternity colony) is difficult. We do not believe, for reasons detailed above, that the construction of the proposed road will result in the death of adult females; however, mortality due to vehicle strikes, once the road is operational, is possible, though unlikely, due to the presence of multiple existing roads within the action area. We also anticipate that some females may abort or terminate their pregnancy due to loss of their traditional foraging areas. We expect that some of the females in the project area will abort or terminate their pregnancy in the summer after tree clearing occurs due to loss of their traditional foraging areas and the inability to efficiently locate alternate roosting and/or foraging habitat within the fragmented agricultural nature of the project area. Finally, we believe that secondary development adjacent to three interchanges could result in tree clearing operations during the maternity season, which could lead to death and/or injury of some female Indiana bats.

Summary of Effects

The Service anticipates that Indiana bats will incur both direct and indirect effects from the proposed U.S. 24 project. The intensity of effects will differ by activity, season, and condition and home range of individual bats. Direct and indirect effects to Indiana bats are anticipated during clearing, construction, and operational activities from the removal of habitat for road construction and secondary development near three interchanges, and due to noise disturbance.

Direct take (killing or injuring) of Indiana bats during road construction should be avoided during the maternity period due to project specifications that avoid cutting of potential roost trees from April 15 to September 15.

Indirect effects on Indiana bats are anticipated from the project due to the loss and fragmentation of habitat, disturbance from traffic noise, and an increased risk of bat vehicle collisions. Some bats will be subject to take in the form of harm due to displacement from traditional roosts and foraging areas that are cleared. The effect upon individuals of the maternity colonies would likely be more severe than non-reproductive females and males since pregnant females will 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. Vehicle noise during operation of the new road is

anticipated to further reduce the suitability of roosting habitat in the area immediately surrounding the new roadway. Mortality of bats may also result indirectly from the project when the new road is in operation as bats that fly across the roadway to access roosting and/or foraging areas could be struck by vehicles, however this is unlikely due to the presence of multiple existing roads within the action area, to which the bats should be accustomed to crossing. The chance of vehicle collisions will further be reduced by using lighting that does not attract insects, the bats prey base, as much as traditional lighting. Take due to indirect effects from secondary development are anticipated to range from death and/or injury of some individuals over time to effects which may be insignificant or discountable for other individuals whose home ranges is mostly or entirely outside the action area.

Indirect effects due to secondary development within the action area are expected to be significant. The loss of a significant amount of forested habitat due to development at the Ryan/Bruick Road, Webster Road, and U.S. 127 interchanges is anticipated. This development is generally unregulated and could result in tree clearing during the maternity season, resulting in direct mortality of reproductively active females, their pups, as well as adult males and non-reproductive females. Furthermore, this activity is expected to result in the same indirect effects as loss of forested habitat from the construction of U.S. 24. The loss of habitat from secondary development will significantly compound the effects of the loss of habitat from the U.S. 24 project itself, and will likely be more significant, due to the extent of forest impacts in an area where forest is already scarce.

The direct and indirect effects to Indiana bats will vary greatly ranging from death or injury of some bats to effects which are insignificant and discountable and will differ depending upon the home range and condition of individual bats as well as the tolerance of individual bats of noise disturbance.

V. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Such future Federal actions include private developments that will require permit(s) from the U.S. Army Corps of Engineers due to proposed stream and/or wetland impacts.

Ten previously identified economic development projects, unrelated to the U.S. 24 project, are currently proposed within the action area, which could result in cumulative effects to the Indiana bat and its habitat. These projects are in various stages of design and planning, and may or may not be Federal actions, depending on whether streams and/or wetlands will be impacted or avoided. Because potential impacts to streams and/or wetlands are not currently known for these projects, the Service assumes that they will not be Federal actions, and so we include them in the cumulative effects analysis. The proposed economic development projects include the following: Doyle Road Industrial Site; New Haven Industrial Site; Woodburn Industrial Park; Antwerp School Expansion; Antwerp Industrial Park; Enterprise Industrial Park; Smith Zachrich Development Site; Olson Enterprise Park; Fox Run Executive Park; and Defiance Hospital (FHWA 2003). These projects cumulatively could impact 29.2 acres of wooded habitat (FHWA

2003) that the Service assumes to be suitable for Indiana bat roosting and/or foraging, and which we assume will be permanently lost once construction begins.

The Service assumes that the effects of these seven economic development actions within Ohio would be similar to the effects of the anticipated secondary development. We assume that 29.2 acres of tree clearing would be unregulated, and that it may occur during the summer maternity season, resulting in death of reproductively active female bats, their offspring, as well as adult male bats and non-reproductive female bats. We assume that indirect effects from loss of roosting and/or foraging habitat, competition, and fragmentation will occur. If a loss of streams and/or wetlands, which could provide suitable foraging habitat, from any of these projects was proposed, this would trigger federal jurisdiction through Sections 401 and 404 of the Clean Water Act; therefore, we assume that no stream or wetland impacts will occur on these projects, and that loss of aquatic foraging habitat would not occur.

VI. CONCLUSION

After reviewing the current status of the Indiana bat, the environmental baseline for the action area, the effects of the proposed U.S. 24 highway construction and operation, and the cumulative effects, it is the Service's Biological Opinion that the U.S. 24 highway project, 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 are an important population aspect 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 of the Indiana bat, either the rate of reproduction needs to increase, the rate of mortality needs to decrease, or a combination of both these factors needs to occur.

The direct and indirect loss of habitat due to this project will impact the Indiana bat maternity colonies within the action area causing short-term effects on individuals of the colonies. The Service anticipates that, during the summer after tree clearing, some females of the colonies will successfully bear a pup but some females may experience a delay in giving birth or fail to successfully produce a pup, thereby temporarily reducing the reproductive output of the colonies. The females expected to be most at risk to the loss of a pup or delayed birth are those whose fitness is already comprimised due to other environmental factors.

The Service concludes that overall the project will not contribute a measurable decrease in reproduction or numbers of the Indiana bat at the local level. The one-time loss of recruitment

from some of each of the three maternity colonies within the action area does not represent an appreciable reduction in the recruitment of the maternity colonies as a whole, nor does it represent an appreciable reduction in the overall number of future bats available to contribute towards the survival and recovery of the species rangewide. The Service also detemines that the loss of 71.3 acres of wooded habitat, the direct and indirect impact on 26,425 linear feet of streams, the filling of 23.84 acres of wetland, and the loss of additional woodland habitat due to secondary development at the Ryan/Bruick, Webster Road, and U.S. 127 is not likely to result in an appreciable reduction of the distribution of the species at the local or rangewide level, given the availability of the some remaining suitable habitat in the surrounding landscape. Thus, we conclude that the U.S. 24 highway project, as proposed, is not likely to jeopardize the continued existence of the Indiana bat.

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 FHWA so that they become binding conditions of any funding issued to ODOT, as appropriate, for the exemption in section 7(o)(2) to apply. FHWA has a continuing duty to regulate the activity covered by this Incidental Take Statement. If FHWA (1) fails to assume and implement the terms and conditions or (2) fails to require ODOT to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are applied to the funding, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, FHWA must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement [50 CFR §402.14(i)(3)].

AMOUNT 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 harm through habitat loss, and death and injury during tree clearing operations within secondary development areas at three interchanges.

Based on our analysis of the environmental baseline and effects of the proposed action, the Service anticipates that three maternity colonies of Indiana bats, and 14 male or non-reproductively active female Indiana bats occupy the action area and may be impacted as a result of the proposed project. Collectively, the effects of the action, as described in the accompanying Biological Opinion, are expected to result in behavioral or physiological effects that impair essential behavioral patterns. Death, decreased fitness, and reduced reproductive success of a few individuals are reasonably certain to occur. Although it is extremely difficult to determine precisely, we believe that no more than 10 Indiana bats will be incidentally taken over the term of this project.

The Service anticipates that incidental take of Indiana bats will be difficult to detect for the following reasons: the species is highly motile; 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, we believe the level of take of this species can be monitored by tracking the level of habitat destruction and modification. Specifically, if the current anticipated level of habitat loss is exceeded, we fully expect the level of incidental take to increase as well. Thus, the following indicators will serve to alert us to when more than 10 individuals may be taken: (1) any additional tree clearing occurs outside the right-of-way corridor as described in the accompanying BO, (2) any additional impacts to wetlands within the road right-of-way occur, beyond those described in the accompanying BO, or (3) any additional stream impacts occur within the road right-of-way beyond those described in the accompanying BO.

EFFECT OF THE TAKE

In the accompanying Biological Opinion, the Service determined that, based on the proposed project and the conservation measures described on pages 7-10, 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:

1. The implementation status of all the proposed conservation measures, mitigation efforts, and terms and conditions need to 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, operation, and maintenance of the U.S. 24 highway project in Ohio.

3. Restore Indiana bat habitat in temporary construction areas to the maximum extent practicable.

4. To the maximum extent practicable, incorporate measures to benefit the Indiana bat into mitigation plans for stream and wetland impacts.

5. Ensure that construction equipment is in proper working order to minimize operation noise and reduce the risk of equipment spills and leaks.

6. Ensure that if suitable Indiana bat roost trees may be impacted by waste, borrow, staging, and/or maintenance areas, these trees are explicitly identified and consultation re-initiated accordingly.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, FHWA 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. FHWA will prepare an annual report detailing all conservation measures, mitigation efforts, and terms and conditions that have been initiated, are ongoing, or completed during the previous calendar year and the current status of those yet to be completed. The report will be submitted to the Service's ROFO by 31 January each year (the first report will be due January 31, 2007) and reporting will continue until the construction phase of the project is completed.

   B. Any dead bats located within the construction limits and right-of-way, 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 U.S. 24 highway project engineers, construction personnel (includes logging personnel), equipment operators, and road maintenance staff will attend a mandatory environmental awareness training to learn about the Indiana bat and its habitat requirements. This training will provide personnel with an increased awareness about the species and should increase the likelihood of compliance with the non-discretionary measures and terms of this Incidental Take Statement. The program should be developed in cooperation with the Service. All participants are to be provided with a protocol for reporting the presence of any live, injured, or dead bats observed or found within or near the construction limits or right-of-way during construction, operation, and maintenance of the new U.S. 24. This training should occur prior to the initiation of onsite project activities.

3. Develop a reforestation plan using native tree species for disturbed areas adjacent to stream crossings and within the stream and wetland mitigation areas. Specifically, as noted under the section entitled, "Construction minimization measures," these tree species should be incorporated into post-construction revegetation plans to control erosion and maintain water

quality, as well as along relocated stream segments. Tree species used for reforestation should be a combination of the species from the following list. These species frequently exhibit suitable Indiana bat roost tree characteristics:

Black Ash (*Fraxinus nigra*)
Green Ash (*Fraxinus pennsylvanica*)
White Ash (*Fraxinus americana*)
Eastern Cottonwood (*Populus deltoides*)
American Elm (*Ulmus americana*)
Slippery Elm (*Ulmus rubra*)
Bitternut Hickory (*Carya cordiformis*)
Shagbark Hickory (*Carya ovata*)
Shellbark Hickory (*Carya laciniosa*)
Black Locust (*Robinia pseudoacacia*)
Red Maple (*Acer rubrum*)
Silver Maple (*Acer saccharinum*)
Sugar Maple (*Acer saccharum*)
Black Oak (*Quercus velutina*)
Post Oak (*Quercus stellata*)
Red Oak (*Quercus rubra*)
Shingle Oak (*Quercus imbricaria*)
White Oak (*Quercus alba*)
Sassafras (*Sassafras albidum*)

4. During the development of mitigation plans required under Sections 401 and 404 of the Clean Water Act, seek mitigation opportunities which both fulfill the requirements of this Act and benefit the Indiana bat through habitat protection, restoration and/or enhancement. The Service strongly encourages stream and wetland mitigation areas to be planted with native tree species that provide suitable habitat for the Indiana bat, as described in Term and Condition number 3 above.

5. Conduct regular inspections of construction equipment to ensure that equipment is in good working order to minimize disturbance to bats from operational noise and to reduce the risk of surface water contamination from equipment leaks and spills which could affect the bats prey base and drinking sources.

6. If a limited number of trees must be removed between April 15 and September 15, the contractor will be required to obtain the service of a qualified bat scientist to investigate trees for the presence of Indiana bats. Pending results of the investigation, the following actions will occur:

(a) A qualified bat scientist will evaluate the potential of roosting habitat for each selected tree. If the tree offers no potential for roosting habitat, it may be cut between April 15 and September 15.

(b) If a selected tree does offer the potential for roosting habitat, an emergence survey will be conducted. If no bats are detected, the tree may be cut the day following completion of the emergence survey.

(c) If bats are detected during the emergence survey, the tree will not be cut until the period between September 15 and April 15.

In conclusion, the Service believes that the U.S. 24 highway project will result in the permanent loss of 73.1 acres of suitable Indiana bat maternity, roosting and foraging habitat from road construction, and that additional suitable roosting and foraging habitat will be lost due to secondary development at three interchanges. The Service believes that no more than 10 Indiana bats will be incidentally taken as a result of the proposed action, and that harm through habitat loss will occur. 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—as indicated by additional, unanticipated habitat loss (Extent of Take section above)--such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. FHWA 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.

REINITIATION NOTICE

This concludes formal consultation with FHWA on the construction, operation, and maintenance of the U.S. 24 highway project in Allen County, Indiana and Paulding and Defiance counties, 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.

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. Provide funding to staff a permanent full-time Indiana bat Transportation Liaison within the Service's Reynoldsburg, Ohio Ecological Services Field Office (ROFO).

2. In coordination with ROFO, purchase or otherwise protect Indiana bat hibernacula in Ohio.

3. Expand on scientific research and educational outreach efforts on Indiana bats in coordination with ROFO.

4. Pursue the purchase of easements to restore and protect high quality Indiana bat roosting, foraging, and commuting habitat, including riparian corridors.

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.

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