Appendix G

INDIANA BAT BIOLOGICAL ASSESSMENT

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NORTH VERNON U.S. 50 BYPASS (EAST)

JENNINGS COUNTY, INDIANA

DES NO 1173374

Prepared for:
INDOT/ Parsons Transportation Group Inc.

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INDIANA BAT BIOLOGICAL ASSESSMENT
NORTH VERNON U.S. 50 BYPASS (EAST)
JENNINGS COUNTY, INDIANA
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1.0 INTRODUCTION

Eco-Tech Consultants, Inc. was contracted by Parsons Transportation Group (Parsons) to produce a Biological Assessment (BA) for the U.S. 50 Bypass (East) in Jennings County, Indiana. The purpose of this BA is to identify and discuss potential impacts to federally-listed species as a result of the U.S. 50 Bypass project.

In accordance with the Endangered Species Act (ESA) of 1973, federal agencies (and associated state agencies that receive federal funding) are required "to insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of any habitat of such species determined to be critical unless an exemption has been granted."

2.0 PROJECT DESCRIPTION

2.1. Background and Purpose

The U.S. 50 North Vernon Bypass project involves construction of a highway bypass around the city of North Vernon in Jennings County. Construction on the western half of the project, which consists of a new two-lane road from U.S. 50 northeast to SR 3 north of North Vernon, began in March 2012. The approximate length of this roadway is 4.5 miles.

Within the current document effects are discussed that would be associated with a proposed extension of the new roadway currently under construction between C.R. 400W and S.R. 3. This extension would run from S.R. 3 on the north side of North Vernon east and south to rejoin existing U.S. 50 east of North Vernon, thus completing a northern bypass of North Vernon.

When completed, the project will reduce congestion in and around North Vernon, improve safety, improve accessibility, and meet local and state planning objectives.

The purpose of this project is to resolve four documented transportation problems in the U.S. 50/North Vernon area. Specifically, the project will:

- Reduce congestion along U.S. 50 and S.R. 3/S.R. 7 through and around North Vernon;
- Provide a safer transportation facility for both truck and passenger vehicles through and around North Vernon;
- Provide an efficient transportation link between the existing and growing industrial area on the north side of North Vernon to U.S. 50; and
- Support state and local transportation planning.

Information about the project is available at: http://www.in.gov/indot/projects/2429.htm

Numerous alternatives have been considered during the history of this project. Most recently, seven alternatives (6D, 4SB1, 4SB2, 4MB1, 4MB2, 4NB1, and 4NB2) were considered during multi-agency meetings, and alternative 6D was selected as the preferred alternative.

2.2. Proposed Action

Alternative 6D begins at S.R. 3, progressing east until it turns southward after crossing N C.R. 75 W. The alignment then proceeds east after crossing W C.R. 250 N to meet U.S. 50 at the project's southeastern terminus. The length of this alignment is approximately 3.3 miles, and the proposed Right of Way (ROW) ranges in width from 300 to 500 feet (Exhibits 1 & 2).

2.3. Project Area

The proposed project is located in Jennings County, Indiana, east of the City of North Vernon. The project falls within the North Vernon and Butlerville, Indiana USGS 7.5-Minute Topographic Quadrangles. Land use within the immediate surrounding area consists primarily of agriculture, forested land, and residential land. Prominent ecological features in the vicinity of the project include a relatively large forest block associated with Selmier State Forest and the Vernon Fork of the Muscatatuck River. The Vernon Fork has an approximate drainage area of 110 mi^2, much of which is forested.

The project is situated entirely within the Eastern Corn Belt Plains (55) Level III Ecoregion as mapped by the US Environmental Protection Agency (USEPA 1997). This section of the Eastern Corn Belt Plains (55) is characterized by rolling plains with poorly drained soils and high stream biodiversity. Average annual precipitation is 35-40 inches. This area has been heavily cleared for agriculture, especially corn and soybeans.

3.0 Identification of Listed Species

3.1. Critical Habitat

No critical habitat for any federally-listed species is present within the project area. The only critical habitat currently designated in Indiana for species considered in this BA is for Indiana bat hibernacula in Crawford and Greene Counties (USFWS 2012a).

3.2. Consultation to Date

Federally-Listed Species

During early coordination with state and federal agencies two federally-listed species were identified as occurring within the vicinity of the project: the Indiana bat (*Myotis sodalis*, federally endangered) and the gray bat (*Myotis grisescens*, federally endangered). An additional species found in the area, the bald eagle (*Haliaeetus leucocephalus*), was de-listed in 2007; however, this species remains protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act (as do all native migratory birds).

The federally endangered gray bat (*Myotis grisescens*) has been recorded from Crosley Fish and Wildlife Area approximately 3 miles from the project area. Prior to surveys conducted in 2012, the nearest documented case of Indiana bat presence was approximately five miles northeast of the project area along the Vernon Fork of the Muscatatuck River. Additionally, other documented cases of Indiana bat presence were found in Big Oaks National Wildlife Refuge, approximately 5 miles east of the project area (Ronald Hellmich, Indiana Division of Nature

Preserves, pers. comm.; Appendix A). Indiana bats are also known from Muscatatuck National Wildlife Refuge. The three groups of Indiana bat records demonstrate presence of the Indiana bat within this area of the state, but the colonies are too far from the project to be affected by it (personal communication, Mike Litwin, USFWS).

Further consultation with an additional specialist within the Indiana Department of Natural Resources (IDNR), yielded information involving an acoustic study performed on Selmier State Forest from May 11 to 15, 2012 (Scott Haulton, IDNR Wildlife Specialist, pers. comm.). During this study no pulses were identified as Indiana bats (See Section 4.2 and correspondence from IDNR representative Scott Haulton in Appendix A).

On August 6, 2012 a juvenile female Indiana bat was captured on the western side of the project area. Radio-tracking was unsuccessful; therefore, no information regarding foraging habitat or roost tree location is available for this bat. The results of this survey are detailed in a previous report from Eco-Tech Consultants, Inc. (dated September 2012) and summarized in Section 4 of this report. No gray bats were captured in the project area during surveys conducted in 2009 or 2012.

Due to the presence of a federally-listed species, informal consultation for Indiana bats has been on-going during development and assessment of proposed alternatives for this project. This Biological Assessment is provided in order to determine whether formal consultation is necessary (see Coordination Letters in Appendix A).

Additional Species

Information regarding additional rare species within the project area is provided here because such species may become federally-listed in the future. To date, none of these species are candidates or proposed for federal listing; therefore, they will not be discussed outside this section of the Biological Assessment. Recommendations were provided by the IDNR for state listed species possible from the area based on information from the Indiana Natural Heritage Data Center. Several plant and animal species are known from the area, but only two, the eastern box turtle (*Terrapene carolina carolina*; state special concern (SSC)) and eastern hemlock (*Tsuga canadensis*; watch list (WL)), are known from the site. Listed plant species known from near the impact area include Sullivantia (*Sullivantia sullivantii*; state threatened (ST)), shining ladies'-tresses (*Spiranthes lucida*; state rare (SR)), barren strawberry (*Waldsteinia fragarioides*; SR), wolf bluegrass (*Poa wolfii*; SR), and eastern hemlock (*Tsuga canadensis*; (WL). Listed animal species include the eastern box turtle, Kirtland's Snake (*Clonophis kirtlandii*; state endangered (SE)), least weasel (*Mustela nivalis*; SSC), and Bald Eagle (SSC). In addition to state-listed species provided by IDNR, the evening bat (*Nycticeius humeralis*, SE), is also known to inhabit the project area (see results of 2009 bat survey; Appendix B).

The IDNR recommended avoiding and minimizing all impacts, to the extent possible, to state-listed species. Impacts to listed plant species and the least weasel were not anticipated by IDNR. To avoid impacts to eastern box turtles, Kirtland's snakes, and other herpetofauna, the IDNR recommended conducting construction operations between April and October to avoid

impacts to hibernating individuals. Moreover, they recommended removing all debris and vegetation, to the extent possible, from the work area to discourage individuals from using the work site for cover. Additionally, silt fencing should be placed around the work site to prevent individuals from entering the site. Finally, a thorough search for individuals should be conducted by an accredited herpetologist within the work site each day and any captured individuals should be relocated away from the work site. The eastern hemlock and Bald Eagle could potentially be impacted near riparian areas. To reduce impacts the IDNR recommended avoiding areas with eastern hemlock stands and minimizing the amount of riparian tree clearing.

4.0 Species Status and Life History

Species Status

The Indiana bat is a temperate, insectivorous, migratory bat that hibernates in caves and abandoned mines during winter and spends the summer season in forested areas. It was listed as an endangered species on March 11, 1967 by the USFWS. However, the Indiana bat did not receive protection until enactment of the Endangered Species Act (ESA) in 1973 (Public Law 93-205), as amended. Critical habitat for the species was designated on September 24, 1976; it consisted of 11 caves and two mines in six states. Several years following its listing, biologists developed an Indiana bat recovery plan which outlines habitat requirements, critical habitat, potential causes for declines, and recovery objectives (Federal Register 1976b). The recovery plan was reviewed and published by the USFWS in 1983 (Brady et al. 1983). An agency draft of a revised plan was published in 1999, but it was never finalized (USFWS 1999). The Indiana bat recovery team is currently utilizing new information and making revisions to the recovery plan (USFWS 2007).

This steady overall decline can be attributed to several causes, including human modifications to hibernacula and surrounding areas, disturbance and vandalism of hibernacula, natural catastrophes, and threats to summer habitat and migration pathways, including loss and degradation of forested habitat (USFWS 2007). Even with the discovery of many new, large hibernacula, the range wide population estimate dropped approximately 57 percent from 1965 to 2001. However, estimates of range wide Indiana bat population totals from surveys conducted post-2001 have actually increased. In 2005, a 16.9% population increase was found, yielding an approximate total of 425,430 Indiana bats (USFWS 2007). According to the USFWS (2012) the Indiana bat range wide population estimate was 468,184. The USFWS views the apparent upward population trend as viable because the same surveyors have been consistently conducting the winter surveys at all large hibernacula over the past 20 years. In addition, large increases in local populations at 34 known high-priority hibernacula in recent years have been observed. The USFWS (2007) anticipates that planned improvements in hibernacula survey methodology will soon provide an even greater confidence level in the overall population trend.

White-nose syndrome (WNS), a fungal disease first found in cave-hibernating bats during the winter of 2006-2007, presents a severe threat to Indiana bats. Having been found originally in New England, this malady has already caused catastrophic die-offs of bats in the eastern U.S.

Indiana bats are known to be susceptible to WNS, which is associated with the fungus *Geomyces destructans*. WNS has killed over one million bats in the eastern U.S., and was recently discovered in both Kentucky and Indiana (USFWS 2011c).

Distribution

The Indiana bat's range includes most of the eastern United States. It is known to occur from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida (Barbour and Davis 1969, Gardner and Cook 2002). The species' range is generally consistent with the presence of limestone caves that serve as hibernacula in the winter (Menzel et al. 2000). According to the USFWS (2007) winter survey results from 2005 indicated that there were a total of 23 Priority 1 hibernacula in seven states; including Illinois (one site), Indiana (seven sites), Kentucky (five sites), Missouri (six sites), New York (two sites), Tennessee (one site), and West Virginia (one site). Over 90 percent of the estimated range wide Indiana bat population hibernates in only five states, Indiana (45.2%), Missouri (14.2%), Kentucky (13.6%), Illinois (9.7%), and New York (9.1%).

Indiana bats are known to migrate up to 360 miles from their hibernacula to find suitable summer habitat to raise offspring (Kurta and Murray 2002, Winhold and Kurta 2006). However, some migrate much shorter distances as evidenced by banded females recovered from maternity colonies at Mammoth Cave National Park. Additionally, recent radio-telemetry studies in New York found that of 70 individuals emerging from three hibernacula most migrated to summer habitat only 40 miles away (USFWS 2007). Until recently, it was thought that the entire species, with the exception of some males, migrated north and west from their hibernacula to forested areas in Missouri, Indiana, Kentucky, Iowa, Ohio, and Michigan during the summer. This migration pattern was illustrated by Barbour and Davis (1969), with summer band recoveries near the Wayne National Forest in southern Ohio of both male and female bats banded at Carter Caves State Resort Park, in Carter County, Kentucky. Moreover, reproductive Indiana bats have now been documented in the following states: Arkansas, Illinois, Indiana, Iowa, Kentucky, Michigan, Maryland, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Vermont, Virginia, and West Virginia (USFWS 2007).

Although Indiana bat maternity colonies occur throughout much of the mideastern United States (e.g., West Virginia, Virginia, Pennsylvania, New York), they appear to be relatively less abundant in these peripheral portions of their range (USFWS 2007). The regional differences in summer distribution and relative abundance are likely influenced by geographic distribution of important hibernacula and also by regional climate and elevation variation (USFWS 2007, Brack et al. 2002). Therefore, the understanding of how and to what extent these factors influence the distribution and abundance of maternity colonies is still evolving (USFWS 2007).

Winter Habitat

Indiana bats use sloughing bark and cracks in dead, partially dead, and live trees as day roosts during autumn (Kiser and Elliott 1996, MacGregor et al.1999). Autumn roost trees range from 4.7 to 26.4 inches in diameter at breast height (dbh) and occur in forested, semi-forested, and open habitats (Kiser and Elliott 1996). Depending on local weather conditions, Indiana bats

normally enter the hibernaculum in October and remain there through April (Hall 1962, LaVal et al. 1977, LaVal and LaVal 1980).

Prior to entering the hibernacula in autumn, swarming occurs at the entrances of either the hibernacula (Cope and Humphrey 1977) or other caves located near the hibernacula (LaVal et al. 1977). Swarming usually lasts for several weeks (August - September) and mating occurs toward the end of this period. Mated females usually enter directly into hibernation, whereas males may remain active through the end of November. Reproductive females store sperm through the winter, delaying fertilization until early May. During April and May the majority of the Indiana bat population emerges leaving their cave areas to find suitable summer habitat. However, some male and non-reproductive female Indiana bats will remain near the hibernacula during the summer. Females usually start grouping into larger nursery colonies by mid-May and give birth to a single young between late June and early July (Easterla and Watkins 1969, Humphrey et al. 1977).

Indiana bats hibernate primarily in caves, but they have also have been documented using abandoned mines. As of November 2006, the USFWS (2007) has winter records of 281 distinct hibernacula in 19 states that have been occupied continually since 1995. According to Barbour and Davis (1969), 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 to lower temperature areas of the cave as outside temperatures decrease. In mid-winter Indiana bats tend to roost in portions of the cave where temperatures are cool (37° to 43°F). Relative humidity in Indiana bat hibernacula tends to be high, usually above 74 percent, but not exceeding saturation (Hall 1962, Humphrey 1978, Kurta and Teramino 1994, LaVal et al. 1976).

Summer Habitat

Selection of roost trees by Indiana bat colonies is based on structural characteristics. Tree diameter, solar exposure, and height in canopy are among the most important factors involved in roost selection (Romme et al. 1995, Kurta and Murray 2002). Male and female Indiana bats inhabit different habitats and choose roost trees with differing characteristics during the summer months (Kurta 2005). Reproductive females tend to choose roosts in mature forests with large trees, scattered gaps in the canopy, and an open understory (Gardner et al. 1991a, Callahan et al. 1997). The number of available roost trees in an area influences the suitability of habitat for female Indiana bats (Kurta 2005, Farmer et al. 2002). Gardner et al. (1991a) found that of 39 roost trees evaluated, 31% were not suitable the following summer, and that 33% of the remaining trees were unavailable for use after two summers. Thus, roost trees are an ephemeral resource.

Maternity colonies have been found under sloughing bark of dead, partially dead and live trees (Carter 2003, Gardner et al. 1991a, Kurta et al. 1993, Kurta et al. 2002, Romme et al. 1995). These colonies have been found in lowland forests (Cope et al. 1974, Humphrey et al. 1977), and more recently in upland forests (Callahan et al. 1997, Clark et al. 1987, Gardner et al. 1991a, Kiser et al. 2002). Such colonies are usually located in large-diameter, standing dead trees, with direct exposure to sunlight (Callahan et al. 1997). Maternity roosts can contain over

350 individual bats during July and August (Kiser et al. 1998). During Callahan's study (1997), he arranged roost trees into two groups depending on the intensity of use and size of the colony that used each tree. Callahan (1993) classified any tree that was used more than once by greater than 30 bats each time as a primary roost tree, and any tree with less than 30 bats or used only once as an alternate roost tree. The primary roost trees had an average dbh of 22.4 inches, while open snags used as alternate roosts had an average dbh of 20.9 inches (Callahan et al. 1997).

Indiana bats require more than one roost tree to fulfill their needs during the summer (Callahan et al. 1997). Barclay and Kurta (2004) found one maternity colony that used 18 roost trees during a single summer. In addition, Indiana bats are known to roost in several different species of trees, selecting roost trees by the structural composition of each tree. Farmer et al. (1997) contends that structure is probably more important than tree species in selection of roost trees.

Twelve tree species are listed in the Habitat Suitability Index Model (Romme et al. 1995) as primary species (class 1 trees). The trees listed by Romme et al. (1995) 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*), northern red oak (*Quercus rubra*), post oak (*Q. stellata*), white oak (*Q. alba*), slippery elm (*Ulmus rubra*), and American elm (*U. americana*). In addition to these species, Romme et al. (1995) listed sugar maple (*A. saccharum*), shingle oak (*Q. imbricaria*), and sassafras (*Sassafras albidum*) as class 2 trees. The class 2 trees are those species believed to be less important, but still have the necessary characteristics to be used as roosts. Trees normally used as primary roosts are dead and have a dbh greater than 12 inches (Romme et al. 1995).

At least 33 tree species have been found to be roosts for reproductive female Indiana bats, and 87 percent of them are ashes (13%), elms (13%), hickories (22%), maples (15%), poplars (9%), and oaks (15%; USFWS 2007). It was previously believed that oak and hickory were more commonly used in the southern portion of the range (Callahan et al. 1997, Gardner et al. 1991a), and elm, ash, maple, and cottonwood were occupied more often in northern areas (Kurta et al. 1996, 2002; Whitaker and Brack 2002). However, more recent research reveals that Indiana bats occupy ash and elm most often in southern Illinois (Carter 2003) and hickories most often in Vermont (Palm 2003). Therefore, it appears that tree species use is more closely related to local availability and suitable structure than to broad regional preferences (USFWS 2007). Nonetheless, some common trees, such as American beech (*Fagus grandifolia*), basswood (*Tilia americana*), black cherry (*Prunus serotina*), box elder (*A. negundo*), and willow (*Salix* spp.), are rarely or never used, suggesting that they are typically not acceptable even when suitable structure is present, especially as a primary roost (USFWS 2007).

Most (97%) roost trees of female Indiana bats at maternity sites are deciduous species, except for a few coniferous trees discovered in the Great Smoky Mountains (Harvey 2002, Britzke et al.

2003) and in New England (Palm 2003). This more likely reflects availability rather than a preference for deciduous trees (USFWS 2007).

Food Habits

Historically, the Indiana bat was thought to prey primarily on moths (Lepidoptera), beetles (Coleoptera), true flies (Diptera), and caddisflies (Trichoptera) (Belwood 1979, Brack 1983, Brack and LaVal 1985). During a study by Belwood (1979), the primary insects consumed by females and juveniles in southern Indiana were Lepidoptera (57%), Diptera (18%), and Coleoptera (9%). Belwood's information was very similar to a three-year study conducted by Brack (1983) throughout Indiana. Brack (1983) found that Indiana bats consumed Lepidoptera (48%), Coleoptera (24%), and Diptera (8.5%). He also found Trichoptera (9.8%) to be an important food source. Studies by Lee (1993) and Kurta and Whitaker (1998) found that the same four insect orders were consumed by Indiana bats in central/northern Indiana and in Michigan. However, these studies showed that Indiana bats preyed much more heavily on caddisflies in central/northern Indiana and in Michigan. The female Indiana bats in central and northern Indiana consumed Lepidoptera (40%), Trichoptera (29%), Coleoptera (13%), and Diptera (9%) (Lee 1993). The most recent Indiana bat food habits study was conducted in Michigan at the northern limits of the species' range. These bats consumed primarily Trichoptera (55.1%) and Diptera (25.5%), which have aquatic larvae (Kurta and Whitaker 1998). These authors hypothesized that Indiana bats in northern portions of their range feed more on aquatic insects than southern populations because they forage primarily over streams and wetlands.

Indiana bats forage primarily in forested habitats (Cope et al. 1974, Humphrey et al. 1977, LaVal et al. 1977, Belwood 1979), but they will also forage in edges of forests and croplands, fallow fields, and areas of impounded water (Gardner et al. 1991b). Indiana bats may utilize as many as four different foraging areas during nightly foraging (Murray 1998), using the same travel corridor each night to move from the roost tree to the foraging areas. It has been documented that Indiana bats may travel up to 3.0 mi from their summer roosts to summer foraging areas and will visit these same areas each night. Reproductively active females traveled a mean distance of 1.5 mi from their roost trees to foraging areas in Illinois (Gardner et al. 1991b). During a study by Pruitt et al. (1995) at the Jefferson Proving Ground (JPG), Jefferson County, Indiana, reproductive female bats were found to travel a mean distance of 1.7 mi from their original capture sites to their roost trees. Also at JPG, a male traveled 0.4 mi from the capture site to its roost; this distance is less, but similar to the distance of 0.7 mi found by Gardner et al. (1991b) for males in Illinois.

White-Nose Syndrome (WNS)

White-nose syndrome (WNS) is an emerging infectious fungal disease that has resulted in high levels of mortality in multiple cave dwelling bat species. The emergence of this pathogen has destabilized healthy bat populations causing 100% mortality in some regional populations. Its alarming virulence and mortality, rapid spread, and epidemiological complexity has largely shaped the way contemporary bat research and management is conducted. Bat management

and conservation in the WNS era has arisen as one of the top conservation issues of the 21st century.

White-nose syndrome (WNS) has been characterized as a condition affecting hibernating bats and was named for the white fungal growth located on hairless areas of the body such as the muzzle, ears, and/or wing/tail membranes (Blehert et al. 2009, Lorch et al. 2011, Meteyer et al., 2011). Behavioral responses to WNS include movement to entrances of hibernacula, day flight during mid-winter, cluster formation on the ground, and other uncharacteristic winter/hibernating behavior (Blehert et al. 2009, Foley et al. 2011). Bats affected with WNS are thought to leave their hibernacula early in search of food and, subsequently, starve or freeze to death.

WNS was first documented by a photograph taken at Howes Cave, 52 kilometers west of Albany, New York in February 2006 (Blehert et al. 2009). A caver photographed hibernating bats with an unusual white substance on their muzzles and observed several dead bats (USFWS 2009a). The following winter, New York Department of Environmental Conservation biologists documented WNS after observing bats exhibiting abnormal behavior, a white, powdery substance on the muzzle, and a few hundred dead bats in several caves in the Albany, NY area (USFWS 2009a). Since then, sick, dying and dead bats have been found in unprecedented numbers in and around caves and mines throughout the eastern United States.

The USFWS now estimates bat mortality to be at least 5.7 million (USFWS 2012b). In some hibernaculum, 90 to 100 percent of infected bats are dying (USFWS 2009). Since the 2010-2011 winters, WNS has spread to 19 states and four Canadian provinces including: Connecticut, Indiana, Kentucky, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia, New Brunswick (CAN), Nova Scotia (CAN), Ontario (CAN), and Quebec (CAN; USFWS 2011a). WNS threatens to spread further into the Midwest, Southeast, and West which are home to many federally endangered bat species as well as some the largest known bat populations in the country (USFWS 2009a).

Researchers associate a newly identified psychrophilic fungus (*Geomyces destructans*) as the etiologic agent of white-nose syndrome (Foley et al. 2011, Lorch et al. 2011, Blehert 2012, Reeder et al. 2012, Warnecke et al. 2012). This fungus thrives in the cold (3-15°C) and humid (>90%) conditions characteristic of the caves and mines used by bats (USFWS 2009b, Foley et al. 2011). Bats with obvious WNS symptoms have shown noticeable agitation and excessive grooming. Biologists believe that these infected bats may be waking up more often throughout hibernation to groom themselves leading to an increased use of fat reserves needed for winter hibernation. However, once clean the bat will re-enter torpor allowing the fungus to re-establish. Cryan et al. (2010) suggested the fungus might directly interfere with important physiological functions leading to disruptions in homeostasis, thermoregulation, and respiration while also increasing the risk of dehydration, among other things. Specifically, this fungus has been observed to cause a higher metabolic rate in hibernating bats which can lead to more frequent arousals (Janicki, 2010, Reeder et al. 2012). This can also result in the reduction of

adipose storage in bats hibernating in caves, usually followed by mortality (Frick et al., 2010). Nine bat species currently known to be affected by white-nose syndrome include the little brown bat (*Myotis lucifugus*), Indiana bat, eastern small-footed bat (*M. leibii*), northern long-eared bat (*M. septentrionalis*), gray bat (*M. grisescens*), tri-colored bat (*Perimyotis subflavus*), big brown bat (*Eptesicus fuscus*), cave bat (*M. velifer)* and the southeastern bat (*M. austroriparius)* (Foley et al. 2011). Both the federally listed Virginia big-eared bat (*Corynorhinus townsendii virginianus*) and Ozark big-eared bat (*Corynorhinus townsendii ingens*) are found in the affected area, but neither has been confirmed with white-nose syndrome of *G. destructans* infection.

The means of transmission of WNS has shown to be possible through direct contact among bats (Lorch et al. 2011). Evidence collected to date indicates that human activity in caves and mines may be assisting in the spread of WNS since some caves used by people have WNS affected bats, while other, nearby caves not used by people do not seem to be affected. It is likely that the fungus can be transported inadvertently from site-to-site on gear and boots of cave visitors (USFWS 2009a, Lindner et al. 2010). Adherence to the federal WNS disinfection protocol is required by all cavers, biologists, and tourists to reduce the human spread of this fungus (USFWS, 2012b).

Human health implications are not known and there is no information indicating that people or other animals have been affected after exposure to the white fungus (Blehert 2012).

5.0 Survey Methods and Results

The following are excerpts from the respective previous studies. References to associated figures have been removed; however, copies of the previous reports in their entirety can be found in Appendices B, C, and D.

5.1. 2009 Eco-Tech Bat Survey

See also Appendix B.

Survey and Monitoring Methods

The survey was conducted according to the guidelines of Appendix 5 of the "Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision" (USFWS 2007). These guidelines call for one net site to be mist netted for two calendar nights per one kilometer (km) of forested habitat to be cleared. A thorough office review of the proposed project area was conducted by Eco-tech biologists in order to identify forest impacts. Office review of aerial photography and topographic maps found that approximately 4.1 km of forested habitat would be affected by the project as it was aligned at that time, yielding four proposed mist net sites. Because the proposed project would cross a major river, an additional net site was added in order to ensure that sufficient sample effort was employed.

Potential sites were chosen based on factors such as the potential for presence of travel corridors and water, in addition to a relatively closed canopy cover. Topographic maps and

current aerial photographs were used to determine the extent of tree clearing, as well as the presence or absence of these important factors. If any of the potential mist net sites were found to not be suitable upon site visit, then another was chosen. Mist net sites (five total) were located as close as possible to the actual alignment; however, some sites were located a short distance (<0.4 miles) from the alignment in order to sample important Indiana bat habitat features such as streams, ponds and forested corridors.

Results

A total of five sites were surveyed using mist nets on July 16-23, 2009. A total of 29 individuals of six chiropteran species were captured during this mist-net survey. No Indiana bats were captured. Figure 1 depicts the abundance of the six species at each sample site. The following four species were captured with equal frequency (6 individuals of each species): eastern pipistrelle (*Perimyotis subflavus*), little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*) and eastern red bat (*Lasiurus borealis*). The next most common species was the northern long-eared bat (*Myotis septentrionalis*) (n=4), and a single evening bat (*Nycticeius humeralis*, Indiana State Endangered Species) was captured. Slightly more than half of captures (52%) were non-reproductive males. The remaining captures were of females of several species. Several of these females were, or recently had been, reproductively active.

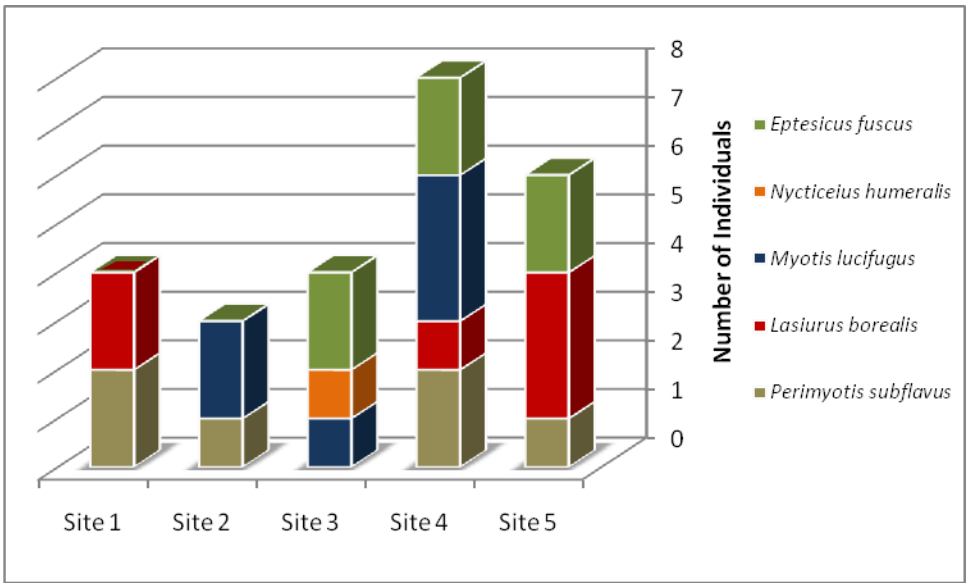

Figure 1. Bat species captured during a mist net survey for the federally endangered Indiana bat (*Myotis sodalis*) for the proposed North Vernon Bypass, Jennings County, Indiana (7/16/09 thru 7/23/09).

5.2. 2012 IDNR Selmier SF Acoustic Study

Scott Haulton (IDNR Wildlife Specialist) deployed four acoustic detectors (Anabat SD2s) for five nights from May 11 – 15, 2012 at random locations throughout Selmier State Forest. Each detector recorded a period from at least 30 minutes before sunset to at least 30 minutes after sunrise. The Echoclass software (Britzke 2012) was used to identify calls. No pulses were

identified to Indiana bat. Detailed correspondence with Scott Haulton can be found in Appendix A.

5.3. 2012 Eco-Tech Bat Survey

See also Appendix C.

Survey and Monitoring Methods

This survey was conducted in accordance with the guidelines of Appendix 5 of the "Indiana Bat Draft Recovery Plan: First Revision" (USFWS 2007). In order to identify forest impacts, Eco-Tech biologists conducted a desktop review of the proposed bypass alternative combinations using current aerial photography, topographic maps, and the proposed project area map provided by the client. A 0.5 km buffer was placed around all alignments to serve as the potential survey extent. Altogether there was a total of 14 km of linear suitable habitat along the proposed alignments. However, there is significant overlap among the alignment buffers. After a map review of available habitat, potential mist net sites, and the proposed alignments during coordination with USFWS field office biologist Mike Litwin, it was decided that 11 mist net sites would suitably sample all available habitat (concurrence, 8/1/12).

Upon capturing a female Indiana bat, a 0.5 gram LB-2 Holohil transmitter with whip antenna was attached in order to determine maternity roost location. The transmitter was affixed dorsally between the shoulders using a skin-bonding agent (Skin Bond). All roads within 100 mi^2 around the capture location were driven by a pair of biologists during daylight hours while using a Wildlife Materials TRX-1000S radio-telemetry receiver with a 3-element Yagi antenna in order to find the individual's roost. Under normal circumstances, emergence counts would have been performed for a period of five consecutive nights on all located roosts; however, no emergence counts were conducted during this survey as a result of the inability to track the individual to its roost location.

Results

A total of 11 sites were surveyed using mist nets from August 1-13, 2012 along the proposed bypass in Jennings County, Indiana. A total of 86 bats from six species were captured at 11 sites (44 net nights) within the proposed bypass alignments. One federally endangered Indiana bat was captured. The big brown bat was the most commonly encountered species, composing 46.5% of the total capture. The eastern red bat (*Lasiurus borealis*) was the next most frequently captured bat, making up 31.4% of total captures. Other species captured included northern long-eared bats (9.3%), tri-colored bat (7.0%), little brown bats (4.7%), and an Indiana bat (1.2%). Sites 4 and 9 were found to be the most successful sites with 16 and 19 captures, respectively. An Indiana bat was captured at Site 1. Only Site 10 failed to record captures (Table 1).

One juvenile female Indiana bat (Bat 00299) was captured and fitted with a transmitter. This individual left the survey area on August 6, but could not be located throughout the duration of the survey. All roads within a 100 mi^2 area around the capture site were driven daily during

daylight hours for the duration of the survey for a total effort of 35 hours. Despite this effort no signal was detected. No emergence counts were conducted due to the inability to track the individual to its roost location.

Table 1. Bat species captured during a mist net survey for the proposed North Vernon Bypass (U.S. 50), Jennings County, Indiana (8/1/12 thru 8/13/12).

Site	Date	Site leader	Lat	Lon	*Eptesicus fuscus*	*Lasiurus borealis*	*Myotis lucifugus*	*Myotis septentrionalis*	*Myotis sodalis*	*Perimyotis subflavus*	Total
Site 1	8/6/12	S. Slankard	39.03190	-85.63053	1	1	0	1	1	0	**4**
	8/7/12	S. Slankard	39.03190	-85.63053	0	2	0	1	0	0	**3**
Site 2	8/8/12	S. Slankard	39.02246	-85.62102	3	0	0	0	0	0	**3**
	8/9/12	S. Slankard	39.02246	-85.62102	0	0	0	0	0	0	**0**
	8/10/12	S. Slankard	39.02246	-85.62102	1	0	0	0	0	0	**1**
Site 3	8/6/12	L. Droppelman	39.02955	-85.60368	1	0	0	1	0	0	**2**
	8/7/12	L. Droppelman	39.02955	-85.60368	2	1	0	1	0	0	**4**
Site 4	8/6/12	T. Brown	39.02197	-85.60528	3	4	0	1	0	2	**10**
	8/7/12	T. Brown	39.02197	-85.60528	2	3	0	0	0	1	**6**
Site 5	8/6/12	J. Salyers	39.01101	-85.36628	0	2	0	0	0	0	**2**
	8/7/12	J. Salyers	39.01101	-85.36628	5	4	0	0	0	1	**10**
Site 6	8/12/12	T. Brown	39.01326	-85.58460	1	0	1	0	0	0	**2**
	8/13/12	T. Brown	39.01293	-85.58492	1	0	0	0	0	0	**1**
Site 7	8/8/12	T. Brown	39.02136	-85.59115	0	1	0	1	0	0	**2**
	8/9/12	T. Brown	39.02339	-85.59040	1	0	0	0	0	0	**1**
	8/10/12	T. Brown	39.02339	-85.59040	0	0	0	0	0	0	**0**
Site 8	8/3/12	L. Droppelman	39.03571	-85.59126	1	4	1	0	0	1	**7**
	8/4/12	L. Droppelman	39.03571	-85.59126	3	1	1	0	0	0	**5**
Site 9	8/1/12	L. Droppelman	39.03563	-85.60100	9	3	1	1	0	0	**14**
	8/2/12	L. Droppelman	39.03563	-85.60100	4	0	0	0	0	1	**5**
Site 10	8/8/12	J. Salyers	39.03385	-85.57371	0	0	0	0	0	0	**0**
	8/9/12	J. Salyers	39.03385	-85.57371	0	0	0	0	0	0	**0**
Site 11	8/12/12	L. Droppelman	39.02359	-85.55164	0	1	0	1	0	0	**2**
	8/13/12	L. Droppelman	39.02359	-85.55164	2	0	0	0	0	0	**2**
				Total	**40**	**27**	**4**	**8**	**1**	**6**	**86**

5.4. 2012 Eco-Tech Indiana Bat Habitat Assessment

See also Appendix D.

Habitat Assessment Methods

The first step in calculating potential direct, indirect, and cumulative impacts was to assess the quality of habitat which may be impacted by the proposed alternatives. A variety of methods have been used to characterize Indiana bat summer roosting habitat. The methodology employed in this report closely follows the USFWS 2012 Indiana bat Survey Protocol Appendix A: Summer Habitat Assessments (USFWS 2012c).

Habitat was evaluated in forested areas of the clearing limits with 35 predetermined locations. At each sample point, a 15 meter radius evaluation plot was established. Data collected within each circular plot consisted of a qualitative evaluation of the following parameters:

1. Average % canopy, midstory, and understory cover
2. Dominant tree species in canopy, midstory and understory
3. Average vegetation density at canopy, midstory and understory
4. Percentage of trees with exfoliating bark
5. Size composition of live trees (small: 4-8”; medium: 9-15”; large >15”)
6. Water resources
7. Number of potential roost trees, based on: condition-(live, live/damaged, snag), % exfoliating bark, solar exposure, tree size, species

GPS coordinates and four representative photos (in the four cardinal directions) from each sample point were obtained. Each plot was assigned a suitability rating of "*Low, Medium,* or *High*", based on the parameters above. Forested stands falling within the project area survey limits were assigned a qualitative rating of Low, Medium, or High based on information collected during the habitat assessment and interpretation of aerial photography.

Habitat Assessment Results

The Indiana bat habitat assessment area, which surrounds the alignment alternatives and includes relevant forest stands, encompassed approximately 1,817 acres. Of this area, 562 acres (31%) are forested. The landscape within 2.5 km of the survey limits encompasses approximately 18,732 ac, 7,400 ac of which (40%) are forested. Tulip poplar and shagbark hickory were the most commonly encountered tree species (present at 26% of all points sampled). Red maple (23%), sassafras (20%), and white oak (20%) were the next most frequently encountered trees (Figure 2).

Based on the data collected, 11 locations were classified as high suitability, 14 as moderate, and 10 as low. High quality areas had characteristics favorable for foraging, roosting, and/or commuting by Indiana bats, such as the presence of 1 or more PRTs, low density midstory and/or understory, flight corridors to adjacent foraging areas, good canopy closure, and/or close proximity to water.

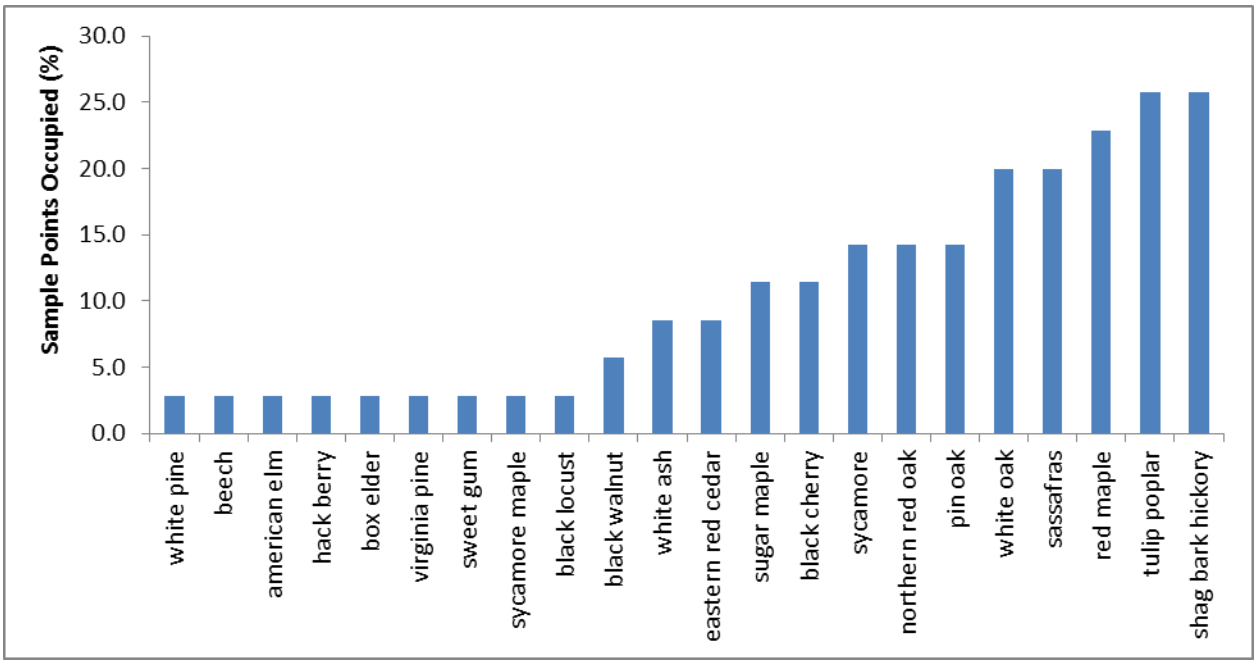

Figure 2. Frequency of tree species (percent of sample points occupied) in forest stands assessed for the North Vernon Bypass (U.S. 50) project, Jennings County, Indiana.

Best professional judgment was ultimately used to categorize habitat at each survey point; however, several quantifiable parameters support these characterizations. For instance, average midstory density in areas of high suitability was 33% whereas moderate and low suitability were 52% and 75%, respectively. In addition, the average number of potential roost trees (PRTs) and percent of trees with exfoliating bark were highest at high quality sites and lowest at low quality sites. Conversely, average distance to water was relatively similar among sites, and it did not directly correspond to habitat suitability rankings (Table 2).

Table 2. Average values of quantifiable parameters for habitats ranked as high, moderate, or low suitability for Indiana bats during the habitat assessment conducted for the North Vernon Bypass (U.S. 50) project, Jennings County, Indiana.

	Percent Cover					
Suitability	**Canopy**	**Midstory**	**Understory**	**Average Number of PRTs**	**Percent of Trees with Exfoliating Bark**	**Average Distance to Water**
High	81%	33%	53%	1.36	20.9%	499 m
Moderate	83%	52%	65%	1.14	8.6%	418 m
Low	83%	75%	74%	0.00	0.5%	467 m

The project survey limits included a substantial percentage (69%) of non-habitat, with smaller areas of medium (14%), high (10%), and low (7%) quality Indiana bat habitat (Figure 3).

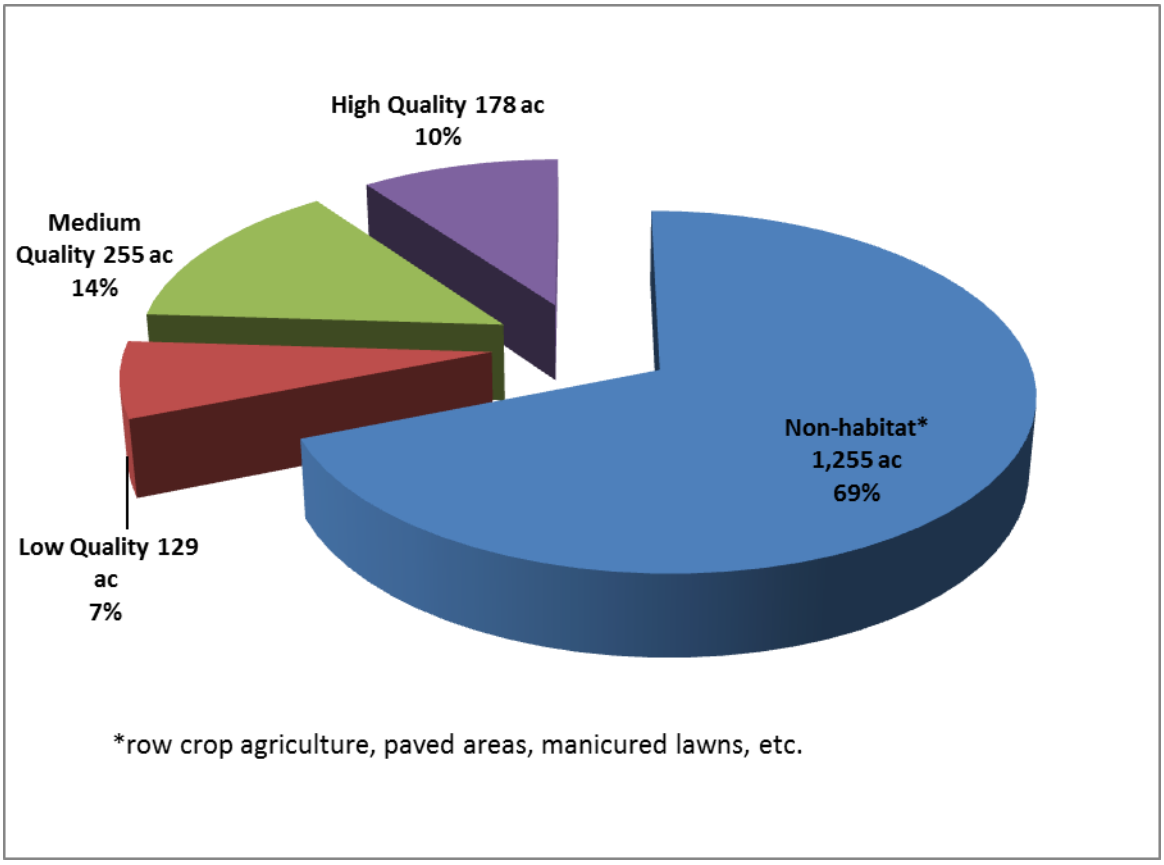

Figure 3. Habitat quality composition within the project survey limits for the North Vernon Bypass (U.S. 50) project, Jennings County, Indiana

Habitat Impact Analysis Methods

All forested stands within the project survey limits were digitized in ArcGIS (ver 10.0) using recent aerial photography. Forested polygons within the survey limits were given values of "Low, Medium, or High" based on information gathered in the habitat assessment. Georeferenced clearing limits were then used to calculate the amount of forested habitat that would be impacted by the preferred alternative (i.e., the forested habitat shapefile was clipped using the clearing limits shapefiles). This approach was used to determine the loss of potential Indiana bat habitat categorized by habitat quality (Exhibit 3).

Additional impacts to Indiana bat habitat include habitat fragmentation (splitting of large blocks into smaller blocks) and loss of connectivity between forested patches. While field surveys of habitat quality were limited to a habitat assessment area directly adjacent to the alternatives, analysis of habitat impacts must also take into account landscape-level effects. For assessment of landscape effects, the boundary of each forested stand within 2.5 km of the project area was digitized in ArcGIS (ver 10.0) using recent aerial photography.

In order to assess the indirect impact of the project on Indiana bat habitat within the local landscape, five common, intuitive habitat fragmentation metrics were calculated using spatial characteristics measured in ArcGIS (ver 10.0). Fragmentation metrics were then calculated in

Microsoft Excel using spatial characteristics of each patch derived from ArcGIS measurements. Baseline conditions were calculated concerning stands of existing forest. Then, habitat within the preferred alignment was clipped from the habitat shapefile to simulate the effects of habitat removal, and fragmentation metrics were recalculated (Exhibit 4). The following metrics were included:

1. *Number of patches* = total number of separate forest patches within 2.5 km
2. *Mean patch area* = sum of patch area/number of patches
3. *Mean perimeter to area ratio* = (∑(perimeter of each patch in ft/area of each patch in ft^2))/total number of patches
4. *Patch density* (number of patches per 100 ha) = (number of patches/total area surveyed in m^2)*10,000*100
5. *Total edge* = ∑(perimeter of all patches)

Additional qualitative analysis of habitat and connectivity was also conducted based on interpretation of aerial photography (Exhibit 4). Information regarding additional access points was obtained from the design team. In addition, comparisons of the probable cumulative effect of development associated with the alternatives were derived from land use comparisons based on interpretation of aerial photography.

Detailed results and comparisons of all alternatives are reported in Appendix D. However, due to subsequent design refinements, the habitat impact calculations reported for the preferred alternative in this BA have been updated and do not match Appendix D exactly.

Habitat Impact Analysis Results

Habitat impacts are discussed in the following effects section (Section 5).

6.0 EFFECTS OF THE PROPOSED ACTION

6.1. Direct Effects

Summer Habitat

The direct effect of the project includes immediate effects on Indiana bats and their habitat, including interrelated and interdependent actions. Trees of suitable roost tree diameter with cavities, broken branches, and sloughing bark are present within the clearing limits. Removal during summer could risk the take of multiple individuals and their pups.

Winter tree clearing, when Indiana bats are in hibernacula, essentially eliminates the possibility of direct take. Additionally, roost trees often consist of dead snags, which are an ephemeral resource. Therefore, it is likely that Indiana bats are adapted to the loss of maternity trees and the subsequent search for a new tree. However, elimination of entire forest stands and multiple potential roost trees may not be equivalent to the loss of single trees, and may result in loss of vital energy reserves during the search for suitable roost trees.

The proposed project will result in the direct loss of approximately 42.1 acres of potential Indiana bat habitat. The majority of this (26.7 ac, 63%) is relatively low quality habitat typified by a low density of potential roost trees, high mid-story density, and low percentage of trees with exfoliating bark (see Section 4.4 for detailed description of habitat quality). In general, this is younger forest. Less than half the habitat to be impacted is of high quality (10.6 ac, 25%), and a small amount is of medium quality (4.8 ac, 11%) (Table 3, Exhibit 3).

Table 3. Indiana bat summer habitat impacts associated with the proposed North Vernon Bypass (U.S. 50) project, Jennings County, Indiana.

Habitat Quality	Acreage Effected
High	10.6
Medium	4.8
Low	26.7
Total	**42.1**

In addition to the direct removal of suitable Indiana bat habitat, the project may affect habitat at a landscape scale, thereby increasing the overall habitat impacts to more than 42.1 acres of forest clearing. Fragmentation of forested stands will reduce the amount of habitat available for Indiana bat roosting and foraging. In addition, the creation of wide expanses of pavement and manicured right-of-way may act as a barrier to movement.

Habitat fragmentation generally leads to an increase in the amount of forest edge habitat, and reduces the amount of forest interior habitat available. While certain wildlife species are favored by early-successional habitats produced along forest edge, research indicates that Indiana bats are favored by preservation of large blocks of forest (Menzel et al. 2005).

While no single number provides a complete measure of habitat fragmentation (Strand et al. 2007), the metrics listed in Table 4 provide a means to quantify some of the landscape changes that will be brought about by the preferred alternative. Relationships between bat habitat use and at least two of the metrics listed in Table 4 (patch density and patch area) have been found in the past (Medlin et al. 2010). However, making comparisons to studies completed at different scales and using different metrics is problematic.

Table 4. Metrics describing fragmentation of Indiana bat summer habitat associated with the proposed North Vernon Bypass (U.S. 50) project, Jennings County, Indiana.

Forested Patch Characteristics	Baseline (Current Condition)	6D	Expected Direction With Increased Fragmentation
Number of Patches	83	90	Increase
Mean Patch Area (ac)	89.17	81.78	Decrease
Mean Perimeter/Area Ratio	0.01	0.02	Increase
Patch Density	1.09	1.19	Increase
Total Edge (ft)	1,118,423	1,114,669	Increase

The preferred alternative (6D) will fragment available habitat. All measures of habitat fragmentation, except total edge indicate that the project will fragment available habitat to some degree. The relationship of bat activity to indices of habitat fragmentation is not well-understood or intuitive in every case. For instance, Medlin et al. (2010) actually found that bat activity displayed a positive relationship with patch density. However, it is unlikely that fragmentation associated with the current project will have a positive effect on bat activity. Therefore, it is likely that the effects of habitat fragmentation associated with the current project are best framed in terms of habitat connectivity derived from analysis of aerial photography (Exhibit 4).

Habitat connectivity is likely to be affected by the project footprint. In addition to reducing habitat connectivity by fragmenting forest blocks, the proposed road may decrease connectivity across open habitats. For instance, connectivity between the forested stand where an Indiana bat was captured and high quality habitat approximately 0.25 mile to the north will likely be reduced. These areas are currently separated by agricultural land and a two-lane county road; however, it is likely that the proposed road will present a more substantial movement barrier than existing agricultural land. It is true that both agricultural lands and road corridors may be perceived as potential barriers by bats; however, agricultural lands provide potential insect prey. In addition, noise associated with roads has been shown to deter bats (Bennett and Zurcher 2013, Schaub et al. 2008). Also, *Myotis* species have been observed to commute across open land at relatively low height (<2 m) (Russell et al. 2009), which would place bats at a height where they are more likely to be deterred by passing cars.

Winter Habitat

Critical habitat for Indiana bats consists of large hibernacula, which are of primary concern for Indiana bat conservation, especially due to the presence of white-nose syndrome in Indiana. The closest critical habitat is in Crawford County, which places the action area more than 50 miles from critical habitat. Therefore, no effects to critical habitat are anticipated.

Construction during the hibernating season that results in destruction of karst systems has the potential to directly affect Indiana bats. However, the USFWS maintains a list of known Indiana bat hibernacula, none of which are in Jennings County. Therefore, no effect to Indiana bat winter habitat is anticipated (personal communication, Mike Litwin, USFWS via Dan Prevost, Parsons).

General Disturbance

Construction projects within karst areas have the potential to indirectly affect Indiana bats through alteration of airflow within cave systems, flooding due to increased runoff, and introduction of contaminants. If blasting is conducted, there is potential for air flow alterations due to changes in the bedrock structure. Because of increases in paved area, the project has the potential to increase the speed with which water drains into sinkholes, and may increase flooding of the receiving karst systems. In addition, soil disturbance may increase the silt load of runoff within the project area if sediment and erosion Best Management Practices (BMPs) are not in place.

Noise disturbance created during construction is another potential direct effect to Indiana bats. If adjacent maternity roosts or hibernacula are affected by noise and/or vibrations, the area of direct effects may extend outside of the 42.1 ac where direct disturbance will occur. However, a number of published examples of bats tolerating vehicular noise exist in the literature. For instance, Brack et al. (2004) found an Indiana bat colony within 50 feet of a four-lane interstate highway (I-64) in Indiana. Similarly, multiple roosts for Indiana bats have been noted within 680 feet of Interstate 81 in New York (Niver 2008).

6.2. Indirect Effects

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. Winter clearing of 42.1 acres of forested habitat might be considered an indirect effect because direct detriment to the species occurs at a later time, when bats return to maternity habitat. However, these effects have been discussed in Section 5.2 because clearing will directly affect Indiana bat habitat.

In addition to direct effects of construction on Indiana bats and their habitat, the road may also indirectly lead to Indiana bat mortality later through collisions of bats with cars. Russell et al. (2009) documented mortality of 27 little brown bats, one Indiana bat, and one unidentifiable *Myotis* sp. found during multiple searches of a section of road in Pennsylvania (approximately 4.5 km of road). In addition, they found that bats generally used forest canopy to approach and cross roads. Where available canopy was low (≤6 m), bats crossed roads at lower heights, at which height they were susceptible to collision with vehicles. Additionally, Russel et al. (2009) found that the majority of commuting bats flying over open fields flew at a height less than 2 m above the ground. Therefore, elimination of canopy cover may also result in bats traveling at lower heights where they are more susceptible to vehicular mortality.

Another potential indirect effect of the project is disturbance to the aquatic ecosystem. Indiana bats forage extensively on insects, and many insects have aquatic larvae. Indiana bats could potentially be affected if aquatic habitat quality is reduced by construction siltation and/or subsequent infiltration of roadway contaminants (e.g., salt, lubricants, fuels, herbicides, and pesticides). Mitigation of impacts to the aquatic ecosystem is discussed in Section 6.1.

6.3. Cumulative Effects

The cumulative effects of this project include the effects of future state and private activities that are reasonably certain to occur within the action area. Because the project area is within close proximity to North Vernon, a variety of currently-planned non-federal actions may affect Indiana bats or bat habitat in the area. However, cumulative effects of secondary development adjacent to the US 50 bypass will be limited because access to the ROW will be restricted to three existing points (western terminus at SR 3, at CR 75, and eastern terminus at US 50).

The future land use map depicted in the Jennings County Comprehensive Plan (JCCP 2013) on page 57 shows areas intended for long-term growth and current zoning. Approximately one-third of the preferred alignment extends through an area currently zoned for industrial use, and the proposed bypass will eventually connect to an area east of North Vernon which is designated for long-term growth. As stated in the JCCP (2013) on page 83, "efforts will be made to identify future industrial growth areas tied with the likely bypass routes."

Secondary development will likely further impact Indiana bat habitat in the area. Additional forest clearing, noise, and pavement will deter bats from using these areas in the future. However, the JCCP (2013) identifies areas of forest preservation-open space along the Muscatatuck River. This is advantageous because this river presents a likely travel and foraging corridor within the project area; however, without conservation easements or other protective instruments, habitat preservation is not guaranteed.

The effects of secondary residential development are difficult to predict because this type of development is heavily dependent on outside factors such as the economy and population growth. However, restriction of ROW access to three existing points will limit secondary development along the bypass corridor, and the fact that the preferred alternative alignment remains relatively close to North Vernon may shield undeveloped forest areas further to the east from secondary residential development (Exhibit 4).

7.0 CONSERVATION MEASURES

7.1. Completed Project Design and NEPA Measures

Numerous alternatives have been assessed during planning phases for this project. However, for initial analysis of the effect of this project on federally-listed bat species seven alternatives were selected for comparison, two of which were selected for detailed analysis (see Appendix D). During an initial comparison of route alternatives, the preferred alternative was determined to be the least deleterious to Indiana bat habitat in terms of total forested impact, impacts to high quality Indiana bat habitat, indices of habitat fragmentation, habitat connectivity, number of new access points, and potential for future development of currently isolated areas.

7.2. INDOT Proposed Commitments

Final erosion control measures have not been developed for this project; however, prior to construction, a Construction Plan will be developed and Rule 5 permit will be obtained in accordance with 372 IAC 15-5-6.5. In accordance with the Memorandum of Understanding (MOU) between USFWS and INDOT, a karst survey will be completed and the preferred alternative will be designed to avoid averse physical and water quality/quantity impacts on significant karst resources.

In terms of stream and wetland mitigation the following commitments are proposed:

- **Wetlands:** 44 acres of wetland mitigation (estimate), 24 acres of which will be forested wetland

- **Stream:** 420 LF of perennial stream mitigation, 2,800 LF of intermittent/ephemeral stream mitigation

INDOT has committed to seeking opportunities to preserve potential Indiana bat habitat throughout the project corridor by (1) minimizing tree clearing within the ROW where possible, (2) setting aside for preservation excess ROW parcels that provide potential habitat, and (3) evaluating other excess parcels for suitability for creation of Indiana bat habitat. INDOT will review potential sites with USFWS as the ROW acquisition process progresses. In addition, clearing of trees suitable for Indiana bat roosting greater than 3 inches in diameter breast high will be limited to the period when Indiana bats are absent from maternity habitat (April 1 through September 30 as suggested by IDNR [Appendix A]).

8.0 DETERMINATION OF EFFECT

Indiana bat presence within the project area was determined from the capture of a single juvenile female on August 6, 2012. The home range of this individual could not be established due to the fact that it could not be relocated after capture. Due to the relatively late date of capture, it is possible that this represents a transient individual from a nearby colony rather than a juvenile from an unknown maternity colony within the project area. No other records of Indiana bat presence have been established during mist net surveys conducted in 2009 and 2012 or through acoustic surveys conducted by Indiana DNR. Therefore, it is unlikely that a substantial maternity colony exists within the project area.

Prior to surveys conducted in 2012, the nearest documented case of Indiana bat presence was approximately five miles northeast of the project area along the Vernon Fork of the Muscatatuck River. Additional documented cases of Indiana bat presence are known from Big Oaks National Wildlife Refuge and Muscatatuck National Wildlife Refuge (See Section 2.2). Therefore, Indiana bat presence is well-established in surrounding areas. However, the three known Indiana bat maternity colonies in surrounding areas are a minimum of five miles from the project area, and will not be affected by the preferred alternative for the US 50 (East) North Vernon Bypass.

The proposed project will result in the direct loss of approximately 42.1 acres of potential Indiana bat habitat. Fragmentation of forested blocks and the creation of a wide, paved alignment may further impede movement of Indiana bats through the project area, thereby increasing the area of Indiana bat habitat affected by the project.

Screening of preliminary alternatives eliminated alignments that were much more deleterious to Indiana bat habitat in terms of potential habitat clearing, habitat fragmentation, and potential for cumulative impacts. Wetland and stream mitigation will provide over 24 acres of potential maternity habitat for Indiana bats that will be protected in perpetuity. In addition, INDOT will seek opportunities to minimize tree clearing and preserve forested tracts where possible.

In light of the apparent lack of a substantial maternity colony within the project limits and the conservation measures proposed for protection and enhancement of potential Indiana bat habitat we conclude that the project may affect, but is not likely to adversely affect the Indiana bat (Table 5).

Table 5. Determination of potential effects to federally listed species as a result of the North Vernon Bypass (U.S. 50) project, Jennings County, Indiana.

Common Name	**Scientific Name**	**Effect Determination**
Indiana bat	*Myotis sodalis*	May Affect, Not Likely to Adversely Affect

9.0 LITERATURE CITED

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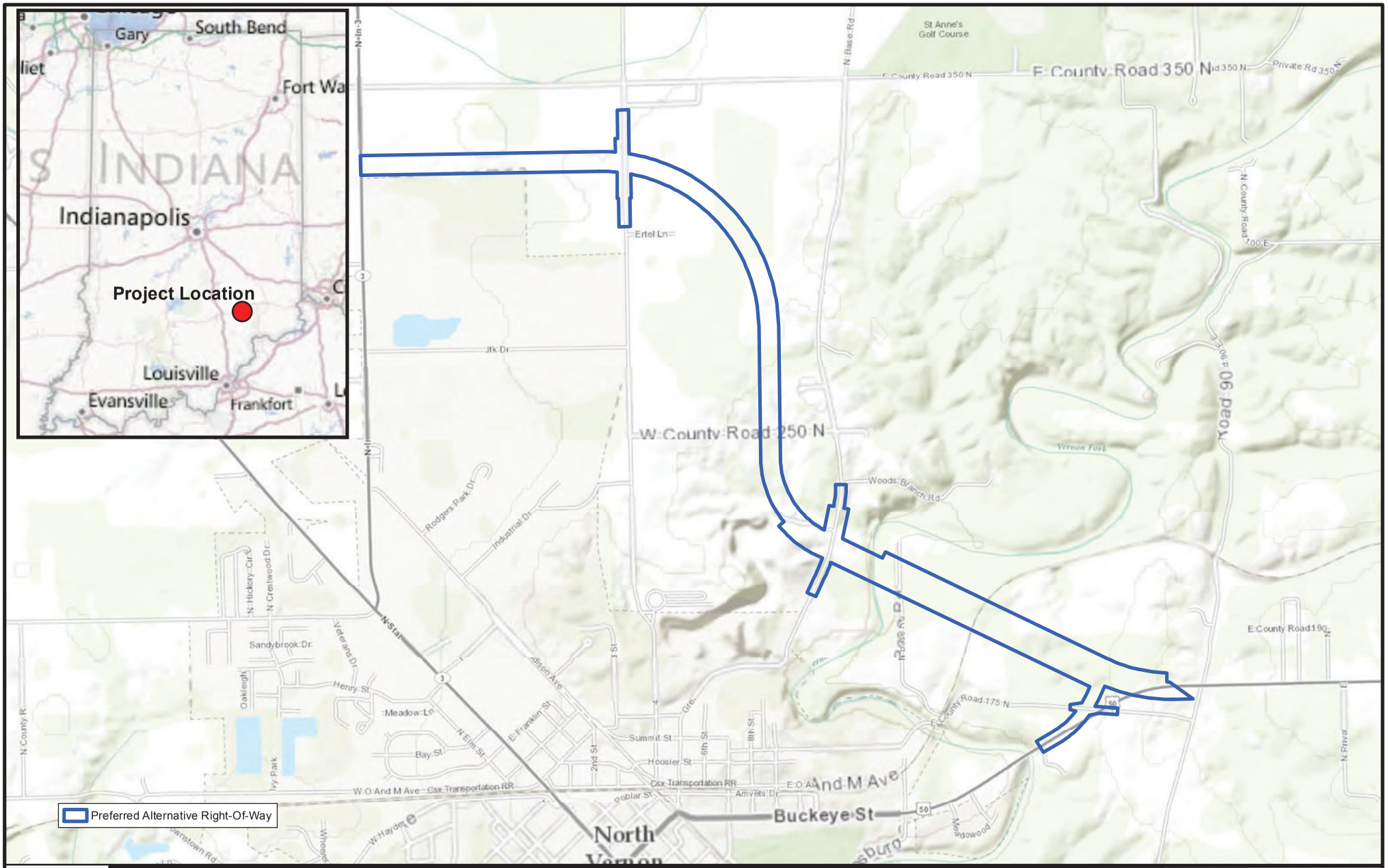
ATTACHED EXHIBITS

Exhibit 1	Project Location (topographic)
Exhibit 2	Project Location (aerial)
Exhibit 3	Forested Habitat Clearing
Exhibit 4	Forested Habitat Fragmentation



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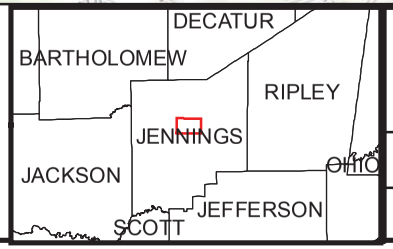

U.S. 50 North Vernon Bypass (East)
Jennings County, IN

1:24,000

0 155 310 620 930 1,240 Meters

Imagery Source: USGS Topographic

Exhibit 1

Project Location (topographic)

Eco-Tech CONSULTANTS

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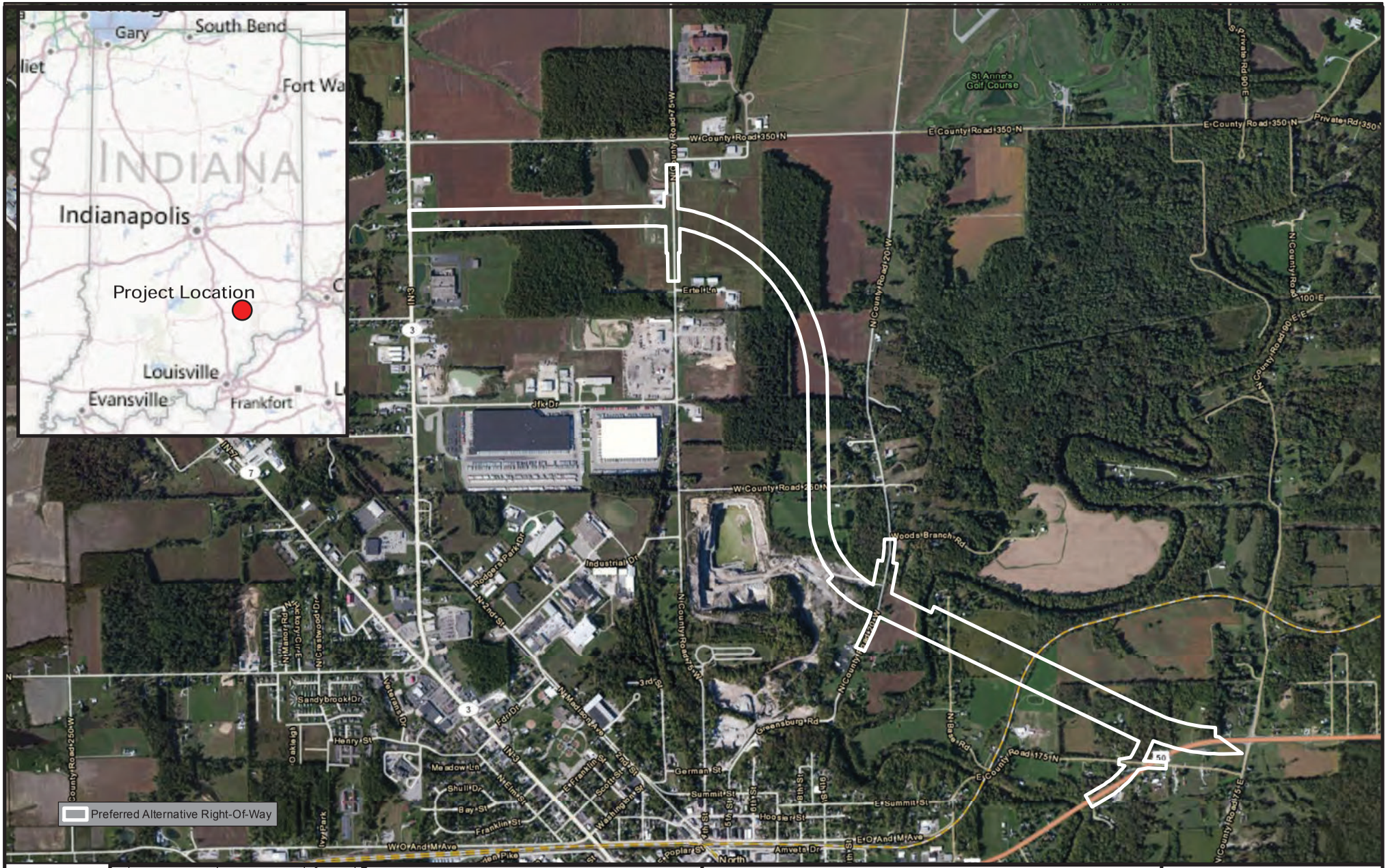
Prepared For: INDOT/Parsons Corp.	
ETC File: LV2012028	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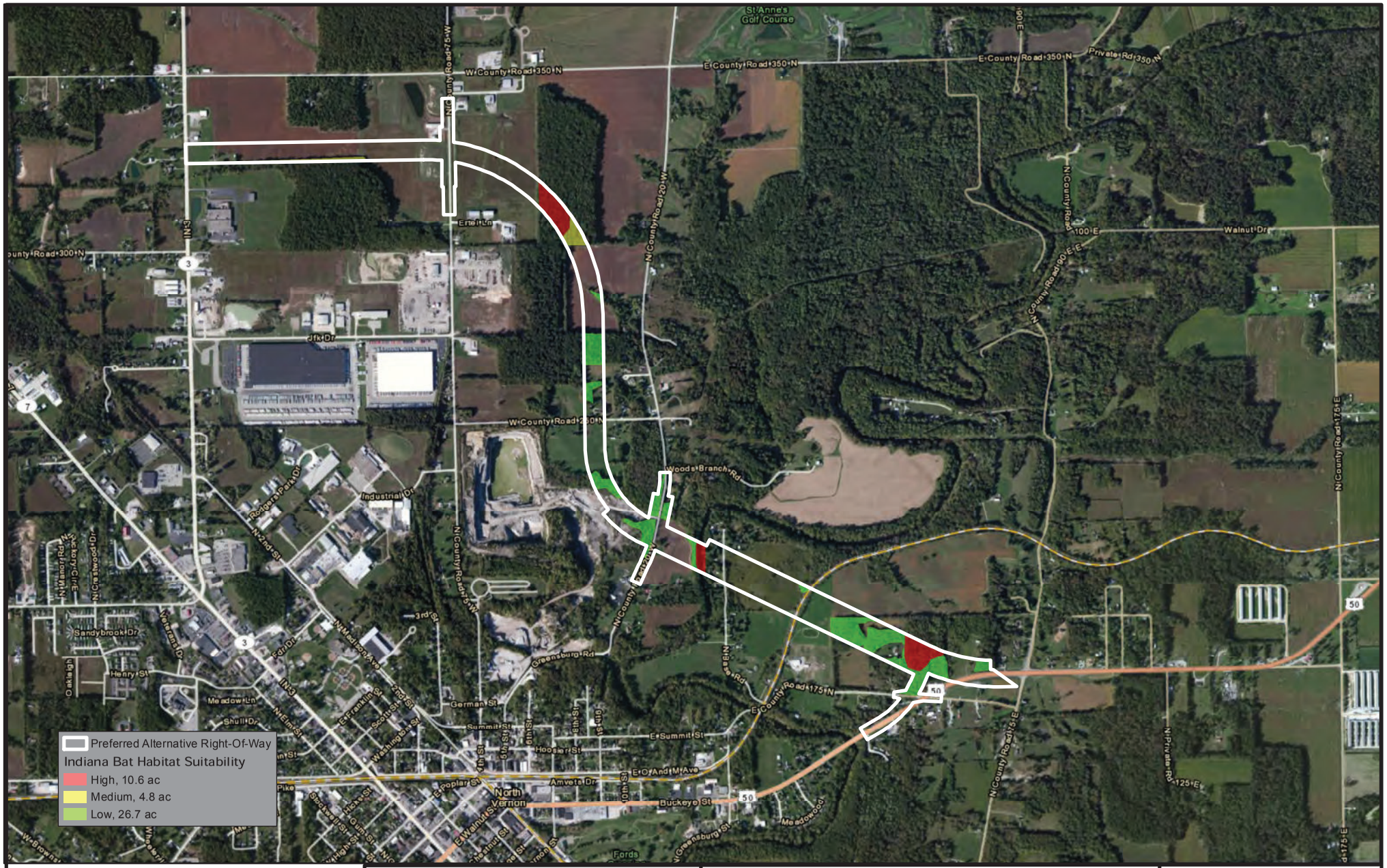
South Bend
Fort Wa
INDIANA
Indianapolis
Project Location
Louisville
Evansville
Frankfort
St Anne's Golf Course
W County Road 350 N
E County Road 350 N
Private Rd 350 N
W County Road 250 N
Woods Branch Rd
Industrial Dr
Jfk Dr
Erte Ln
Rodgers Park Dr
Sandybrook Dr
Henry St
Meadow Ln
Shull Dr
Bay St
Franklin St
Greensburg Rd
German St
Summit St
E Summit St
Hoosier St
Amvets Dr
W Of And M Ave
E Of And M Ave
E County Road 175 N
Preferred Alternative Right-Of-Way
N
DECATUR
BARTHOLOMEW
RIPLEY
JENNINGS
JACKSON
JEFFERSON
SCOTT
OHIO
U.S. 50 North Vernon Bypass (East)
Jennings County, IN
1:24,000
0 155 310 620 930 1,240 Meters
Imagery Source: ESRI Basemap Imagery
Exhibit 2
Project Location
Eco-Tech CONSULTANTS
Drawn by: TTB
Print Date:3/18/13
Prepared For: INDOT/Parsons Corp.
ETC File: LV2012028



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U.S. 50 North Vernon Bypass (East)
Jennings County, IN

1:24,000

0 155 310 620 930 1,240 Meters

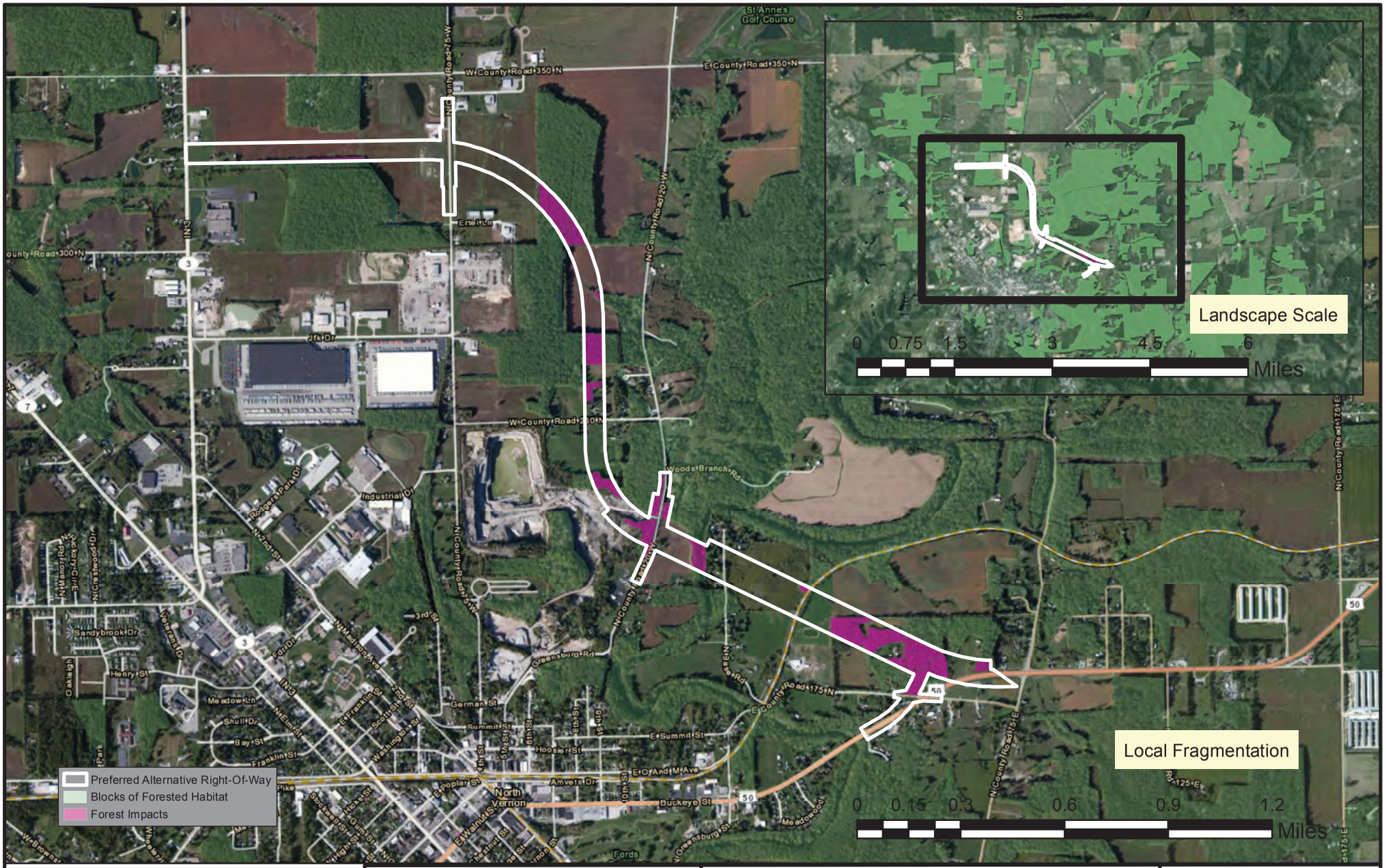
Imagery Source: ESRI Basemap Imagery

Exhibit 3

Forested Habitat Clearing

Eco-Tech CONSULTANTS

Drawn by: TTB	Print Date:3/18/13
Prepared For: INDOT/Parsons Corp.	
ETC File: LV2012028	



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U.S. 50 North Vernon Bypass (East)
Jennings County, IN

1:24,000

0 155 310 620 930 1,240 Meters

Imagery Source: ESRI Imagery

Exhibit 4
Forested Habitat Fragmentation

Eco-Tech CONSULTANTS

Drawn by: TTB	Print Date:3/18/13
Prepared For: INDOT/Parsons Corp.	
ETC File: LV2012028	

APPENDIX A

AGENCY CORRESPONDENCE

United States Department of the Interior
Fish and Wildlife Service

Bloomington Field Office (ES)
620 South Walker Street
Bloomington, IN 47403-2121
Phone: (812) 334-4261 Fax: (812) 334-4273

September 10, 2012

Mr. Dan Prevost
Parsons
101 West Ohio Street, Suite 2121
Indianapolis, Indiana 46240

Project:	North Vernon Bypass East
Road(s):	US 50
Waterway:	Vernon Fork of Muscatatuck River and tributaries
Work Type:	Highway realignment/new route construction
County(ies):	Jennings

Dear Mr. Prevost:

This responds to your letter dated August 14, 2012 requesting U.S. Fish and Wildlife Service (FWS) comments on the aforementioned project. These comments are consistent with the intent of the National Environmental Policy Act of 1969, the Endangered Species Act of 1973, and the U. S. Fish and Wildlife Service's Mitigation Policy.

Your letter states that the proposed east bypass starts at the eastern terminus of the west leg of the bypass (SR 3) and terminates along the existing US 50 route east of North Vernon. Several preliminary alternatives have been proposed, with multiple eastern termini, and additional alternatives are likely to be developed. Detailed environmental studies will not be conducted until preliminary alternative screening has been completed. We are providing the following general comments on fish and wildlife issues of concern, and will provide more detailed comments as project development progresses.

1. Stream Impacts

All route alternatives will require multiple stream impacts, including a new crossing of the Vernon fork of the Muscatatuck River. The project should be located and designed to minimize stream/riparian impacts, avoid areas of high quality aquatic habitats such as rock riffles and mussel beds, and avoid the need to realign or relocate stream channels. The FWS would oppose realignments of perennial streams and good-quality intermittent streams. The environmental document should provide fish community and stream habitat information from existing data or, as appropriate, from site-specific stream surveys. Stream impacts for each alternative should be

estimated in terms of the number of crossings, quality of the stream at each crossing and extent of impacts at each crossing.

2. Terrestrial Wildlife Habitat

All route alternatives should be designed to minimize forest loss and fragmentation. Bird surveys should be conducted in large forested areas during nesting season.

3. Wetlands

Wetlands are present in the floodplains of the Muscatatuck River and its tributaries, and on Cobbsfork soils in interfluvial areas. The National Wetland Inventory map do not shows wetland impacts for most route alternatives, however the perched interfluvial wetlands are often not mapped correctly. A preliminary wetland survey should be conducted for all routes, using all available mapping and orthophotography resources. A comprehensive wetland delineation should be conducted for alternatives carried forward as soon as access becomes available. Wetland impacts should be avoided to the extent possible, and unavoidable impacts should be mitigated in accordance with the MOU between INDOT, the FWS and the Indiana DNR.

4. Migratory Birds

Executive Order #13186, issued on January 10, 2001, directs each federal agency taking actions having or likely to have a negative effect on migratory bird populations to work with the FWS to develop an agreement to conserve migratory birds. In addition to avoiding or minimizing impacts to migratory bird populations, agencies are expected to take reasonable steps to restore and enhance habitat and incorporate migratory bird conservation into agency planning processes whenever possible. The Environmental Document will need to address this issue.

Although no longer federally listed under the Endangered Species Act, bald eagles and their foraging and winter roosting habitat remain protected under the Bald and Golden Eagle Protection Act (BGEPA) and Migratory Bird Treaty Act (MBTA). Take and/or disturbance of bald and golden eagles is prohibited without a permit. The FWS recommends taking all practical measures to minimize detrimental effects on eagles. Guidelines to avoid disturbance of eagle nests are available at http://www.fws.gov/midwest/eagle/guidelines/index.html. Recent amendments to the BGEPA allow the limited issuance of permits to authorize take of eagles when it is associated with otherwise lawful activities, cannot practicably be avoided, and is compatible with the goal of stable or increasing eagle breeding populations.

There are currently no bald eagle nests within the study area, however the Muscatatuck River corridor provides suitable nesting habitat, and bald eagles are rapidly expanding their nesting range in Indiana.

5. Water Quality

The environmental document should include a discussion of best management practices to be used to avoid erosion and runoff of soil and other pollutants during construction, and to mitigate

the effects of polluted road runoff from traffic on new routes.

6. Karst

Most of the study area is underlain by karst geologic formations. A karst survey should be conducted in accordance with our karst MOU with INDOT. All route alternatives should be designed to avoid adverse physical and water quality/quantity impacts on significant karst resources (e.g. caves, springs, sinkholes).

7. Secondary Impacts

New route alternatives often generate the potential for extensive habitat impacts from secondary development. Secondary impacts should be minimized by not locating new routes near good quality habitats and sensitive areas, and by implementing access control near such areas.

Endangered Species

The proposed project is within the range of the federally endangered Indiana bat (*Myotis sodalis*).

Indiana bats hibernate in caves, then disperse to reproduce and forage in relatively undisturbed forested areas associated with water resources during spring and summer. Research has shown that they will inhabit fragmented landscapes with adequate forest for roosting and foraging. Young are raised in nursery colony roosts in trees, typically near drainageways in undeveloped areas.

There are numerous recent summer records of Indiana bats from the Muscatatuck River watershed in Jennings, Ripley and Jefferson Counties, therefore there are substantial concerns about potential impacts on Indiana bats. INDOT commissioned a mist-net bat survey of the project study area in August of this year. The survey captured a reproductive Indiana bat and attempted to track it to a roost tree using radio telemetry. The transmitter signal could not be detected despite extensive telemetry efforts, thus we do not know the location of any roost trees for that bat.

Because Indiana bats are now known to be present in the study area, the project may adversely affect a federally endangered species. Informal consultation for the US 50 project is ongoing, pursuant to Section 7 of the Endangered Species Act. Because the route alternatives to be carried forward from preliminary screening have not yet been selected, and because the exact route alignments are not known, no determinations can be made at this time. INDOT will eventually need to provide a biological assessment (BA) in order to determine whether formal consultation is necessary. The BA should address alignments carried forward to allow the FWS to determine the alignment(s) that will avoid or minimize adverse effects on the Indiana bat.

This endangered species information is provided for technical assistance only, and does not fulfill the requirements of Section 7 of the Endangered Species Act. Please coordinate with the Indiana Department of Natural Resources for comprehensive information on species listed as endangered or special concern by the State of Indiana.

We appreciate the opportunity to comment at this early stage of project planning. As project plans progress please continue to coordinate with our office concerning measures to minimize impacts on fish and wildlife resources. If you have any questions about our recommendations, please call Mike Litwin at (812) 334-4261 (Ext. 205).

Sincerely yours,

Michael A. Litwin

for Scott E. Pruitt
Field Supervisor

cc: Federal Highway Administration, Indianapolis, IN
Christie Stanifer, Indiana Division of Fish and Wildlife, Indianapolis, IN

THIS IS NOT A PERMIT

State of Indiana
DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife

Early Coordination/Environmental Assessment

DNR #: ER-16517 **Request Received:** August 16, 2012

Requestor: Parsons Transportation Group Inc
Richard Connolly
101 West Ohio Street Suite 2121
Indianapolis, IN 46204

Project: US 50 North Vernon bypass - East; Des. # 1173374

County/Site info: Jennings

The Indiana Department of Natural Resources has reviewed the above referenced project per your request. Our agency offers the following comments for your information and in accordance with the National Environmental Policy Act of 1969.

If our agency has regulatory jurisdiction over the project, the recommendations contained in this letter may become requirements of any permit issued. If we do not have permitting authority, all recommendations are voluntary.

Regulatory Assessment: This proposal will require the formal approval for construction in a floodway under the Flood Control Act, IC 14-28-1. Please submit a copy of this letter with the permit application.

Natural Heritage Database: The Natural Heritage Program's data have been checked.
The species and state significant communities below have been recorded within ½ mile of three areas of the project. The Division of Nature Preserves does not anticipate any impacts to the listed plant species or communities as a result of the project.

I) South boundary of project:

A. PLANTS:
1. Sullivantia (Sullivantia sullivantii) - state threatened
3. Shining Ladies'-tresses (Spiranthes lucida) - state rare
2. Barren Strawberry (Waldsteinia fragarioides) - state rare

B. COMMUNITIES:
1. Dry-mesic Upland Forest
2. Limestone Cliff

C. ANIMAL (documented in 2010):
Eastern Box Turtle (Terrapene carolina carolina) - state special concern

II) Alternate Route 3: Limestone Cliff community.

III) Alternate Route 4 (crosses US 50):

ANIMALS:
1. Kirtland's Snake (Clonophis kirtlandii) - state endangered
2. Least Weasel (Mustela nivalis) - state special concern

Fish & Wildlife Comments: Avoid and minimize impacts to fish, wildlife, and botanical resources to the greatest extent possible, and compensate for impacts. The following are recommendations that address potential impacts identified in the proposed project area:

A) Listed Species:
We do not foresee any impacts to the least weasel resulting from the project.

To minimize impacts to the eastern box turtle and kirtland's snake, where any excavation/digging will occur, we recommend that construction only take place from April through October. This will help minimize the threats to hibernating kirtland's snakes and eastern box turtles that would be unable to get away. We also recommend that all logs, trash, or any other type of debris (including riprap) be removed from the construction zone at least one week prior to the start of work to keep these species from hiding underneath the debris. If any vegetation will be removed during work, this should also be done one week prior to construction. After the trash and vegetation are removed, a trenched-in silt fence should be placed around the construction area. Once the silt fence is installed, a walk-through should be conducted to look for any eastern box turtles. Also, any equipment, materials, or debris left overnight in the area should be checked for the presence of kirtland's snakes prior to the start of work the next day.

Any reptiles or amphibians encountered in the project area should be removed, unharmed, and placed outside the construction area. Any turtles encountered should be moved to the nearest forested area. An accredited herpetologist should be hired to translocate state or federally listed herps from current locations within the construction area to an area of suitable habitat. Also, we recommend contacting and coordinating with Sarabeth Klueh, Division of Fish and Wildlife herpetologist, at (812) 334-1137 or sklueh@dnr.in.gov for guidance regarding development of herpetile removal plans. Removal of any state endangered species will require a permit issued by the Division of Fish and Wildlife. Please contact Linnea Petercheff at (317) 233-6527 or lpetercheff@dnr.in.gov regarding this permit, if needed.

B) Alternatives:
For any alternative, we recommend a route which results in the least impacts to fish, wildlife, and botanical resources. Environmentally preferable transportation options should focus on low impact alternatives that minimize road widening and that minimizes the need for new-terrain road construction. New terrain road alignments should be laid out with avoidance and minimization of environmental impacts as a top priority because the environmental impacts from road construction are typically permanent and irreversible. We strongly recommend further study seeking to produce alternatives with lower environmental impacts.

Alternative 1 is not recommended due to the large-scale impacts to forested areas adjacent to Selmier State Forest and potential impacts to rare and unique eastern hemlock relict populations. Moving the north-south segment of Alternative 1 west of Woods Branch and then joining with Alternative 2 at the river crossing (if no eastern hemlock relict populations are found at the location) could make Alternative 1 more environmentally acceptable.

Alternative 2 crosses several large forested areas on the southwest and southeast side of the EDC Proposed Industrial Park after which it proceeds south through several more forested tracts of substantial size. This alternative crosses the river at a point where some substantial wetlands are located on the west banks and, although the river does not have north-facing bluffs at this location, it is unknown (due to a lack of surveys) whether or not relict eastern hemlock populations could be impacted.

Alternative 2 is not recommended as it will impact large amounts of forested habitat and potentially eastern hemlock relict populations. However, modifying Alternative 2 by following Alternative 1 from SR 3 to CR 75, then proceeding south along this path to near CR 250 before resuming the proposed Alternative 2 alignment could substantially reduce this alternative's impacts, and result in a viable alternative.

Alternatives 3 and 4 follow an existing road on the north side of Selmier State Forest and cross the Vernon Fork Muscatatuck Forest east of the state forest. This alignment then will impact deep forested valleys southeast of the river. The forested areas along the southeast side of the river generally follow the top of the tributary valleys resulting in large areas of entirely forested stream valleys. The expanse of forested habitat as measured from the river banks is about 1000' wide at the narrowest point near the potential road crossing.

The Alternative 3 segment east of the river proceeds south after the river crossing through five (5) separate steep-sloped forested valleys and would result in unreasonable impacts to fish, wildlife, and botanical resources.

Alternative 4 will impact large areas of forested habitat in steep forested river valleys. Significant modifications could make this alternative environmentally acceptable, such as an elevated roadway over the forested valley linking elevation 700' on the northwest side of the river to elevation 725' on the southeast side of the river. This will avoid causing significant environmental harm from placing an at-grade road through a 1000' wide forested valley environment.

Alternative 5 splits off from Alternative 1 west of the Muscatatuck River crossing, proceeds due east to cross the river close to the upstream end of the north-facing bluffs (where eastern hemlock relict populations may still be present), then crosses several more large forested areas before rejoining US 50. This alternative is not recommended due to the impacts to large forested areas west of the state forest and possible impacts to eastern hemlock relict populations.

C) Habitat Mitigation:
Impacts to non-wetland forest under one (1) acre should be mitigated at a 1:1 ratio, while impacts to non-wetland forest over one (1) acre should be mitigated at a minimum 2:1 ratio. Impacts to wetlands should be mitigated at the appropriate ratio as well, in accordance with the DNR's new Floodway Habitat Mitigation guidelines (see http://www.in.gov/legislative/iac/20120801-IR-312120434NRA.xml.pdf).

D) Stream Crossings:
Any new, replacement, or rehabbed structure should not create conditions that are less favorable for wildlife passage under the structure compared to current conditions. Design plans for new bridges should include a level area of natural ground under the structure with a minimum 8' tall by 24' wide opening (that does not include the size of the opening over the channel). This opening under the bridge with unsubmerged, dry land is essential for wildlife passage. If riprap is planned under the bridge, only dry land unarmored with riprap should be considered in the opening dimensions.

Considerations can be made if alternative armoring materials are used. Because part of the area above the ohwm on the banks is typically used by wildlife, we recommend that a smooth-surfaced material such as articulated concrete mats be placed on the side-slopes instead of part or all of the proposed riprap (or riprap at the toe and turf reinforcement mats above the riprap toe protection). Such materials will not impair wildlife movement along the banks under the bridge.

E) Bank Stabilization:
Minimize the use of riprap and use alternative erosion protection materials whenever possible. Where riprap must be used, we recommend placing only enough riprap to provide stream bank toe protection, such as from the toe of the bank up to the ordinary high water mark (ohwm). From the ohwm to the top of the bank, we recommend using erosion control blankets or turf reinforcement mats instead of riprap as these are compatible with vegetation growth and provide equal or better erosion control protection than riprap. The use of erosion control blankets, turf reinforcement mats, and other similar materials seeded with a native plant seed mix will allow a natural, vegetated stream bank to develop.

We recommend bioengineered bank stabilization materials and methods. Information about bioengineering techniques can be found at http://www.in.gov/legislative/iac/20120404-IR-312120154NRA.xml.pdf. Also, the following is a USDA/NRCS document that outlines many different bioengineering techniques for streambank stabilization: http://directives.sc.egov.usda.gov/17553.wba (Choose Handbooks; Title 210 Engineering; National Engineering Handbook; Part 650 Engineering Field Handbook. Choose Chapter 16 from next window).

The additional measures listed below should be implemented to avoid, minimize, or compensate for impacts to fish, wildlife, and botanical resources:
1. Revegetate all bare and disturbed areas in the floodway with a mixture of native grasses, sedges, wildflowers, and also native hardwood trees and shrubs as soon as possible upon completion. Do not use any varieties of Tall Fescue or other non-native plants (e.g. crown-vetch).
2. Minimize and contain within the project limits inchannel disturbance and the clearing of trees and brush.
3. Do not work in the waterway from April 1 through June 30 without the prior written approval of the Division of Fish and Wildlife.
4. Do not cut any trees suitable for Indiana bat roosting (greater than 3 inches dbh, living or dead, with loose hanging bark) from April 1 through September 30.
5. Do not excavate in the low flow area except for the placement of piers, foundations, and riprap, or removal of the old structure.
6. Do not construct any temporary runarounds or causeways.
7. Use minimum average 6 inch graded riprap stone extended below the normal water level to provide habitat for aquatic organisms in the voids.
8. Plant native hardwood trees along the top of the bank and right-of-way to replace the vegetation destroyed during construction.
9. Post "Do Not Mow or Spray" signs along the right-of-way.
10. Appropriately designed measures for controlling erosion and sediment must be implemented to prevent sediment from entering the stream or leaving the construction site; maintain these measures until construction is complete and all disturbed areas are stabilized.
11. Seed and protect all disturbed streambanks and slopes that are 3:1 or steeper with erosion control blankets (follow manufacturer's recommendation for installation); seed and apply mulch on all other disturbed areas.
12. Plant five native trees, at least 2 inches in diameter-at-breast height, for each tree

Contact Staff: Christie L. Stanifer, Environ. Coordinator, Fish & Wildlife

Our agency appreciates this opportunity to be of service. Please contact the above staff member at (317) 232-4080 if we can be of further assistance.

for _____ **Date:** September 14, 2012
Christie L. Stanifer
Environ. Coordinator
Division of Fish and Wildlife

Indiana Department of Natural Resources

Mitchell E. Daniels, Jr., Governor
Robert E. Carter, Jr., Director

Division of Nature Preserves
402 W. Washington St., Rm W267
Indianapolis, IN 46204-2739

September 11, 2012

Richard J. Connolly
Parsons
101 W. Ohio, Suite 2121
Indianapolis, IN 46204

Dear Richard Connolly:

I am responding to your request for information on the endangered, threatened, or rare (ETR) species, high quality natural communities, and natural areas documented from the US 50 bypass study area, North Vernon, Indiana. The Indiana Natural Heritage Data Center has been checked and following you will find information on the ETR species documented within the project study area.

For more information on the animal species mentioned, please contact Christie Stanifer, Environmental Coordinator, Division of Fish and Wildlife, 402 W. Washington Room W273, Indianapolis, Indiana 46204, (317)232-8163.

The information I am providing does not preclude the requirement for further consultation with the U.S. Fish and Wildlife Service as required under Section 7 of the Endangered Species Act of 1973. If you have concerns about potential Endangered Species Act issues you should contact the Service at their Bloomington, Indiana office.

U.S. Fish and Wildlife Service
620 South Walker St.
Bloomington, Indiana 47403-2121
812-334-4261

At some point, you may need to contact the Department of Natural Resources' Environmental Review Coordinator so that other divisions within the department have the opportunity to review your proposal.

An Equal Opportunity Employer

For more information, please contact:

Department of Natural Resources
attn: Christie Stanifer
Environmental Coordinator
Division of Fish and Wildlife
402 W. Washington Street, Room W273
Indianapolis, IN 46204
(317)232-8163

Please note that the Indiana Natural Heritage Data Center relies on the observations of many individuals for our data. In most cases, the information is not the result of comprehensive field surveys conducted at particular sites. Therefore, our statement that there are no documented significant natural features at a site should not be interpreted to mean that the site does not support special plants or animals.

Due to the dynamic nature and sensitivity of the data, this information should not be used for any project other than that for which it was originally intended. It may be necessary for you to request updated material from us in order to base your planning decisions on the most current information.

Thank you for contacting the Indiana Natural Heritage Data Center. You may reach me at (317)232-8059 if you have any questions or need additional information.

Sincerely,

Ronald P. Hellmich

Ronald P. Hellmich
Indiana Natural Heritage Data Center

Enclosure: Data sheet

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Endangered, Threatened and Rare Species and Significant Natural Areas Documented Within the US 50 Bypass Study Area, North Vernon, Indiana

Type	Species Name	Common Name	Fed	State	Town Range	Date	Comments
Mammal	Mustela nivalis	Least Weasel		SSC	007N009E 30	2002-04-14	
Reptile	Clonophis kirtlandii	Kirtland's Snake		SE	007N009E 30 SEQ	1997-05	
SELMIER STATE FOREST							
High Quality Natural Community	Primary - cliff limestone	Limestone Cliff		SG	007N008E 23 SEQ SEQ	1985?	
VIOLET AND LOUIS J. CALLI SR. NATURE PRESERVE							
Vascular Plant	Poa wolfii	Wolf Bluegrass		SR	007N008E 35 SWQ	1986-05-15	
Vascular Plant	Spiranthes lucida	Shining Ladies'-tresses		SR	007N008E 35	1930-05	
Vascular Plant	Waldsteinia fragarioides	Barren Strawberry		SR	007N008E 35	1933-04	
High Quality Natural Community	Forest - upland dry-mesic	Dry-mesic Upland Forest		SG	007N008E 35 SWQ	1999	
Vascular Plant	Sullivantia sullivantii	Sullivantia		ST	007N008E 35 SEQ NWQ	2011-07-06	
Reptile	Terrapene carolina carolina	Eastern Box Turtle		SSC	007N008E 35	2010-07-13	
High Quality Natural Community	Primary - cliff limestone	Limestone Cliff		SG	007N008E 35 SWQ & SEQ NWQ	1986-05-15	

Fed: LE = listed federal endangered; LT = listed federal threatened; C = federal candidate species

State: SE = state endangered; ST = state threatened; SR = state rare; SSC = state species of special concern; SG = state significant; WL = Watch List; no rank = unlisted species but tracked due to rarity concerns.

Indiana Department of Natural Resources

Mitchell E. Daniels, Jr., Governor
Robert E. Carter, Jr., Director

Division of Nature Preserves
402 W. Washington St., Rm W267
Indianapolis, IN 46204-2739

November 14, 2012

Benjamin T. Hale
Eco-Tech Consultants
11321 Decimal Drive
Louisville, KY 40299

Dear Benjamin Hale:

I am responding to your request for information on the endangered, threatened, or rare (ETR) bat species documented from a project area, US 50 Bypass East, Jennings County, Indiana. The Indiana Natural Heritage Data Center has been checked and there are no ETR bat species documented within 0.5 mile of the project area.

You may want to consult with the U.S. Fish and Wildlife Service. The Service may have additional information on bat species in this area that is not included in the Indiana Natural Heritage Data Center database. Their Bloomington, Indiana office contact information is.

U.S. Fish and Wildlife Service
620 South Walker St.
Bloomington, Indiana 47403-2121
812)334-4261

At some point, you may need to contact the Department of Natural Resources' Environmental Review Coordinator so that other divisions within the department have the opportunity to review your proposal. For more information, please contact:

Department of Natural Resources
attn: Christie Stanifer
Environmental Coordinator
Division of Fish and Wildlife
402 W. Washington Street, Room W273
Indianapolis, IN 46204
(317)232-8163

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Please note that the Indiana Natural Heritage Data Center relies on the observations of many individuals for our data. In most cases, the information is not the result of comprehensive field surveys conducted at particular sites. Therefore, our statement that there are no documented significant natural features at a site should not be interpreted to mean that the site does not support special plants or animals.

Due to the dynamic nature and sensitivity of the data, this information should not be used for any project other than that for which it was originally intended. It may be necessary for you to request updated material from us in order to base your planning decisions on the most current information.

Thank you for contacting the Indiana Natural Heritage Data Center. You may reach me at (317)232-8059 you have any questions or need additional information.

Sincerely,

Ronald P. Hellmich

Ronald P. Hellmich
Indiana Natural Heritage Data Center

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From: Hellmich, Ron [mailto:rhellmich@dnr.IN.gov]
Sent: Wednesday, November 14, 2012 11:17 AM
To: Ben Hale
Subject: RE: data request

Ben,

Within a 2.5 mile search area still does not pick up *Myotis sodalis*. There is a *Myotis grisescens* record from 1971 at Crosley Fish and Wildlife Area about 3 miles south of the area. The nearest Myotis sodalis is about 5 to 5.5 miles to the northeast along the Vernon Fork of Muscatatuck River. These were found in late 90's surveys for a proposed reservoir in that area. Also there are several records from the Big Oaks National Wildlife Refuge about 5 miles east of the project area. I've attached a GIS shapefile of these records.

Thanks,

Ronald Hellmich
Indiana Natural Heritage Data Center
IDNR Nature Preserves
317-232-8059

From: Hellmich, Ron [mailto:rhellmich@dnr.IN.gov]
Sent: Wednesday, November 14, 2012 9:28 AM
To: Ben Hale
Subject: RE: data request

Ben,

Attached is the response letter for your request. Our database doesn't have any bat information for the project area, though a number of other ETR species are present within 0.5 mile of the area. The US Fish and Wildlife Service may have additional data not included in our database.

Thanks,

Ronald Hellmich
Indiana Natural Heritage Data Center
IDNR Nature Preserves
317-232-8059

Correspondence pertaining to proximal Indiana bat studies

To: Travis Brown
Cc: McGriff, Rob
Subject: RE: Selmeier State Forest Acoustic Study

Travis,

Four (4) acoustic detectors (Anabat SD2) were deployed on May 11, 2012 at random locations on the state forest property. Detectors were located >200 meters from one another and >100 meters from property boundaries. Each detector began recording ≥30 minutes prior to sunset and concluded ≥30 minutes after sunrise over a period of 5 nights (May 11-15). Bats were identified to species if ≥5 individual pulses in one file could be identified to that species. We used "EchoClass" software distributed by the USFWS for the analysis (http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html). Since no pulses (calls) were identified to Indiana bat (Myotis sodalis), it was our conclusion this species was not present at Selmier State Forest **during the survey period**. It is important to note that our survey was done just prior to the date USFWS recognizes as the earliest date appropriate (May 15) for Indiana bat presence/absence surveys. No other acoustic surveys have been done at Selmier.

Let me know if you need more info.
Scott

****
Scott Haulton,
Certified Wildlife Biologist
Forestry Wildlife Specialist
Indiana DNR, Division of Forestry
402 W. Washington St., Rm. W296
Indianapolis, IN 46204
317-234-5725 (voice)
317-233-3863 (fax)
http://www.in.gov/dnr/forestry/
Hardwood Ecosystem Experiment: http://www.heeforeststudy.org/
****
"Without data, all you are is just another person with an opinion."

Indiana Department of Environmental Management

We make Indiana a cleaner, healthier place to live.

Mitchell E. Daniels, Jr.
Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue
Indianapolis , Indiana 46206

(317) 232-8603
800) 451-6027
www.IN.gov/idem

INDOT

100 N Senate Ave
Indianapolis , IN 46204

Parsons
Richard Connolly
101 West Ohio Street Suite 2121
Indianapolis , IN 46204

Tuesday, September 25, 2012

To Engineers and Consultants Proposing Roadway Construction Projects:

RE: US 50 Bypass Project Designation # 1173374 The Indiana Department of Transportation (INDOT) intends to proceed with the above project in Jennings County, Indiana. This letter is part of the early coordination phase of the environmental review process. We are requesting comments from your area of expertise regarding any possible environmental effects associated with this project. Please use the above designation number and description in your reply. We will incorporate your comments into a study of the projectâ€™s environmental impacts. The western limit of this project is at SR 3 approximately 1,200 feet south of CR 350 N, the eastern terminus of the first phase of the bypass, which is currently under construction. The eastern terminus of this project will depend on the alternative selected during the project development process. Alternatives currently under consideration terminate as far west as the vicinity of the intersection of US 50 and CR 75 E and as far east as the vicinity of US 50 and CR 280 E

This letter from the Indiana Department of Environmental Management (IDEM) serves as a standardized response to enquiries inviting IDEM comments on roadway construction, reconstruction, or other improvement projects within existing roadway corridors when the proposed scope of the project is beneath the threshold requiring a formal National Environmental Policy Act-mandated Environmental Assessment or Environmental Impact Statement. As the letter attempts to address all roadway-related environmental topics of potential concern, it is possible that not every topic addressed in the letter will be applicable to your particular roadway project.

For additional information on specific roadway-related topics of interest, please visit the appropriate Web pages cited below, many of which provide contact information for persons within the various program areas who can answer questions not fully addressed in this letter. Also please be mindful that some environmental requirements may be subject to change and so each person intending to include a copy of this letter in their project documentation packet is advised to download the most recently revised version of the letter; found at: http://www.in.gov/idem/5283.htm.

To ensure that all environmentally-related issues are adequately addressed, IDEM recommends that you read this letter

in its entirety, and consider each of the following issues as you move forward with the planning of your proposed roadway construction, reconstruction, or improvement project:

WATER AND BIOTIC QUALITY

1. Section 404 of the Clean Water Act requires that you obtain a permit from the U.S. Army Corps of Engineers (USACE) before discharging dredged or fill materials into any wetlands or other waters, such as rivers, lakes, streams, and ditches. Other activities regulated include the relocation, channelization, widening, or other such alteration of a stream, and the mechanical clearing (use of heavy construction equipment) of wetlands. Thus, as a project owner or sponsor, it is your responsibility to ensure that no wetlands are disturbed without the proper permit. Although you may initially refer to the U.S. Fish and Wildlife Service National Wetland Inventory maps as a means of identifying potential areas of concern, please be mindful that those maps do not depict jurisdictional wetlands regulated by the USACE or the Department of Environmental Management. A valid jurisdictional wetlands determination can only be made by the USACE, using the 1987 Wetland Delineation Manual.

   USACE recommends that you have a consultant check to determine whether your project will abut, or lie within, a wetland area. To view a list of consultants that have requested to be included on a list posted by the USACE on their Web site, see USACE Permits and Public Notices (http://www.lrl.usace.army.mil/orf /default.asp) and then click on "Information" from the menu on the right-hand side of that page. Their "Consultant List" is the fourth entry down on the "Information" page. Please note that the USACE posts all consultants that request to appear on the list, and that inclusion of any particular consultant on the list does not represent an endorsement of that consultant by the USACE, or by IDEM.

   Much of northern Indiana (Newton, Lake, Porter, LaPorte, St. Joseph, Elkhart, LaGrange, Steuben, and Dekalb counties; large portions of Jasper, Starke, Marshall, Noble, Allen, and Adams counties; and lesser portions of Benton, White, Pulaski, Kosciusko, and Wells counties) is served by the USACE District Office in Detroit (313-226-6812). The central and southern portions of the state (large portions of Benton, White, Pulaski, Kosciosko, and Wells counties; smaller portions of Jasper, Starke, Marshall , Noble, Allen, and Adams counties; and all other Indiana counties located in north-central, central, and southern Indiana) are served by the USACE Louisville District Office (502-315-6733).

   Additional information on contacting these U.S. Army Corps of Engineers (USACE) District Offices, government agencies with jurisdiction over wetlands, and other water quality issues, can be found at http://www.in.gov/idem/4396.htm. IDEM recommends that impacts to wetlands and other water resources be avoided to the fullest extent.

2. In the event a Section 404 wetlands permit is required from the USACE, you also must obtain a Section 401 Water Quality Certification from the IDEM Office of Water Quality Wetlands Program. To learn more about the Wetlands Program, visit: http://www.in.gov/idem/4384.htm.

3. If the USACE determines that a wetland or other water body is isolated and not subject to Clean Water Act regulation, it is still regulated by the state of Indiana . A State Isolated Wetland permit from IDEM's Office of Water Quality (OWQ) is required for any activity that results in the discharge of dredged or fill materials into isolated wetlands. To learn more about isolated wetlands, contact the OWQ Wetlands Program at 317-233-8488.

4. If your project will involve over a 0.5 acre of wetland impact, stream relocation, or other large-scale alterations to water bodies such as the creation of a dam or a water diversion, you should seek additional input from the OWQ Wetlands Program staff. Consult the Web at: http://www.in.gov/idem/4384.htm for the appropriate staff contact to further discuss your project.

5. Work within the one-hundred year floodway of a given water body is regulated by the Department of Natural Resources, Division of Water. The Division issues permits for activities regulated under the follow statutes:
   - IC 14-26-2 Lakes Preservation Act 312 IAC 11

- IC 14-26-5 Lowering of Ten Acre Lakes Act No related code
- IC 14-28-1 Flood Control Act 310 IAC 6-1
- IC 14-29-1 Navigable Waterways Act 312 IAC 6
- IC 14-29-3 Sand and Gravel Permits Act 312 IAC 6
- IC 14-29-4 Construction of Channels Act No related code

For information on these Indiana (statutory) Code and Indiana Administrative Code citations, see the DNR Web site at: http://www.in.gov/dnr/water/9451.htm . Contact the DNR Division of Water at 317-232-4160 for further information.

The physical disturbance of the stream and riparian vegetation, especially large trees overhanging any affected water bodies should be limited to only that which is absolutely necessary to complete the project. The shade provided by the large overhanging trees helps maintain proper stream temperatures and dissolved oxygen for aquatic life.

6. For projects involving construction activity (which includes clearing, grading, excavation and other land disturbing activities) that result in the disturbance of one (1), or more, acres of total land area, contact the Office of Water Quality – Watershed Planning Branch (317/233-1864) regarding the need for of a Rule 5 Storm Water Runoff Permit. Visit the following Web page
   - http://www.in.gov/idem/4902.htm

   To obtain, and operate under, a Rule 5 permit you will first need to develop a Construction Plan (http://www.in.gov/idem/4917.htm#constreq), and as described in 327 IAC 15-5-6.5 (http://www.in.gov/legislative/iac/T03270/A00150 [PDF], pages 16 through 19). Before you may apply for a Rule 5 Permit, or begin construction, you must submit your Construction Plan to your county Soil and Water Conservation District (SWCD) (http://www.in.gov/isda/soil/contacts/map.html).

   Upon receipt of the construction plan, personnel of the SWCD or the Indiana Department of Environmental Management will review the plan to determine if it meets the requirements of 327 IAC 15-5. Plans that are deemed deficient will require re-submittal. If the plan is sufficient you will be notified and instructed to submit the verification to IDEM as part of the Rule 5 Notice of Intent (NOI) submittal. Once construction begins, staff of the SWCD or Indiana Department of Environmental Management will perform inspections of activities at the site for compliance with the regulation.

   Please be mindful that approximately 149 Municipal Separate Storm Sewer System (MS4) areas are now being established by various local governmental entities throughout the state as part of the implementation of Phase II federal storm water requirements. All of these MS4 areas will eventually take responsibility for Construction Plan review, inspection, and enforcement. As these MS4 areas obtain program approval from IDEM, they will be added to a list of MS4 areas posted on the IDEM Website at: http://www.in.gov/idem/4900.htm.

   If your project is located in an IDEM-approved MS4 area, please contact the local MS4 program about meeting their storm water requirements. Once the MS4 approves the plan, the NOI can be submitted to IDEM.

   Regardless of the size of your project, or which agency you work with to meet storm water requirements, IDEM recommends that appropriate structures and techniques be utilized both during the construction phase, and after completion of the project, to minimize the impacts associated with storm water runoff. The use of appropriate planning and site development and appropriate storm water quality measures are recommended to prevent soil from leaving the construction site during active land disturbance and for post construction water quality concerns. Information and assistance regarding storm water related to construction activities are available from the Soil and Water Conservation District (SWCD) offices in each county or from IDEM.

7. For projects involving impacts to fish and botanical resources, contact the Department of Natural Resources - Division of Fish and Wildlife (317/232-4080) for addition project input.

8. For projects involving water main construction, water main extensions, and new public water supplies, contact

the Office of Water Quality - Drinking Water Branch (317-308-3299) regarding the need for permits.

9. For projects involving effluent discharges to waters of the State of Indiana , contact the Office of Water Quality - Permits Branch (317-233-0468) regarding the need for a National Pollutant Discharge Elimination System (NPDES) permit.

10. For projects involving the construction of wastewater facilities and sewer lines, contact the Office of Water Quality - Permits Branch (317-232-8675) regarding the need for permits.

AIR QUALITY

The above-noted project should be designed to minimize any impact on ambient air quality in, or near, the project area. The project must comply with all federal and state air pollution regulations. Consideration should be given to the following:

1. Regarding open burning, and disposing of organic debris generated by land clearing activities; some types of open burning are allowed (http://www.in.gov/idem/4148.htm) under specific conditions. You also can seek an open burning variance from IDEM.

   However, IDEM generally recommends that you take vegetative wastes to a registered yard waste composting facility or that the waste be chipped or shredded with composting on site (you must register with IDEM if more than 2,000 pounds is to be composted; contact 317/232-0066). The finished compost can then be used as a mulch or soil amendment. You also may bury any vegetative wastes (such as leaves, twigs, branches, limbs, tree trunks and stumps) onsite, although burying large quantities of such material can lead to subsidence problems, later on.

   Reasonable precautions must be taken to minimize fugitive dust emissions from construction and demolition activities. For example, wetting the area with water, constructing wind barriers, or treating dusty areas with chemical stabilizers (such as calcium chloride or several other commercial products). Dirt tracked onto paved roads from unpaved areas should be minimized.

   Additionally, if construction or demolition is conducted in a wooded area where blackbirds have roosted or abandoned buildings or building sections in which pigeons or bats have roosted for 3-5 years precautionary measures should be taken to avoid an outbreak of histoplasmosis. This disease is caused by the fungus Histoplasma capsulatum, which stems from bird or bat droppings that have accumulated in one area for 3-5 years. The spores from this fungus become airborne when the area is disturbed and can cause infections over an entire community downwind of the site. The area should be wetted down prior to cleanup or demolition of the project site. For more detailed information on histoplasmosis prevention and control, please contact the Acute Disease Control Division of the Indiana State Department of Health at (317) 233-7272.

2. The U.S. EPA and the Surgeon General recommend that people not have long-term exposure to radon at levels above 4 pCi/L. (For a county-by-county map of predicted radon levels in Indiana, visit: http://www.in.gov/idem/4145.htm.)

   The U.S. EPA further recommends that all homes (and apartments within three stories of ground level) be tested for radon. If in-home radon levels are determined to be 4 pCi/L, or higher, EPA recommends a follow-up test. If the second test confirms that radon levels are 4 pCi/L, or higher, EPA recommends the installation of radon-reduction measures. (For a list of qualified radon testers and radon mitigation (or reduction) specialists visit: http://www.in.gov/isdh/regsvcs/radhealth/pdfs/radon_testers_mitigators_list.pdf.) It also is recommended that radon reduction measures be built into all new homes, particularly in areas like Indiana that have moderate to high predicted radon levels.

   To learn more about radon, radon risks, and ways to reduce exposure visit: http://www.in.gov/isdh/regsvcs/radhealth/radon.htm, http://www.in.gov/idem/4145.htm, or

http://www.epa.gov/radon/index.html.

3. With respect to asbestos removal: all facilities slated for renovation or demolition (except residential buildings that have (4) four or fewer dwelling units and which will not be used for commercial purposes) must be inspected by an Indiana-licensed asbestos inspector prior to the commencement of any renovation or demolition activities. If regulated asbestos-containing material (RACM) that may become airborne is found, any subsequent demolition, renovation, or asbestos removal activities must be performed in accordance with the proper notification and emission control requirements.

   If no asbestos is found where a renovation activity will occur, or if the renovation involves removal of less than 260 linear feet of RACM off of pipes, less than 160 square feet of RACM off of other facility components, or less than 35 cubic feet of RACM off of all facility components, the owner or operator of the project does not need to notify IDEM before beginning the renovation activity.

   For questions on asbestos demolition and renovation activities, you can also call IDEM's Lead/Asbestos section at 1-888-574-8150.

   However, in all cases where a demolition activity will occur (even if no asbestos is found), the owner or operator must still notify IDEM 10 working days prior to the demolition, using the form found at http://www.in.gov/icpr/webfile/formsdiv/44593.pdf.

   Anyone submitting a renovation/demolition notification form will be billed a notification fee based upon the amount of friable asbestos containing material to be removed or demolished. Projects that involve the removal of more than 2,600 linear feet of friable asbestos containing materials on pipes, or 1,600 square feet or 400 cubic feet of friable asbestos containing material on other facility components, will be billed a fee of $150 per project; projects below these amounts will be billed a fee of $50 per project. All notification remitters will be billed on a quarterly basis.

   For more information about IDEM policy regarding asbestos removal and disposal, visit: http://www.in.gov/idem/4983.htm.

4. With respect to lead-based paint removal: IDEM encourages all efforts to minimize human exposure to lead-based paint chips and dust. IDEM is particularly concerned that young children exposed to lead can suffer from learning disabilities. Although lead-based paint abatement efforts are not mandatory, any abatement that is conducted within housing built before January 1, 1978 , or a child-occupied facility is required to comply with all lead-based paint work practice standards, licensing and notification requirements. For more information about lead-based paint removal visit: http://www.in.gov/isdh/19131.htm.

5. Ensure that asphalt paving plants are permitted and operate properly. The use of cutback asphalt, or asphalt emulsion containing more than seven percent (7%) oil distillate, is prohibited during the months April through October. See 326 IAC 8-5-2 , Asphalt Paving Rule (http://www.ai.org/legislative/iac/T03260/A00080.PDF).

6. If your project involves the construction of a new source of air emissions or the modification of an existing source of air emissions or air pollution control equipment, it will need to be reviewed by the IDEM Office of Air Quality (OAQ). A registration or permit may be required under 326 IAC 2 (View at: www.ai.org/legislative/iac/t03260/a00020.pdf.) New sources that use or emit hazardous air pollutants may be subject to Section 112 of the Clean Air Act and corresponding state air regulations governing hazardous air pollutants.

7. For more information on air permits visit: http://www.in.gov/idem/4223.htm, or to initiate the IDEM air permitting process, please contact the Office of Air Quality Permit Reviewer of the Day at (317) 233-0178 or OAMPROD atdem.state.in.us.

LAND QUALITY

In order to maintain compliance with all applicable laws regarding contamination and/or proper waste disposal, IDEM recommends that:

1. If the site is found to contain any areas used to dispose of solid or hazardous waste, you need to contact the Office of Land Quality (OLQ)at 317-308-3103.

2. All solid wastes generated by the project, or removed from the project site, need to be taken to a properly permitted solid waste processing or disposal facility. For more information, visit http://www.in.gov/idem/4998.htm.

3. If any contaminated soils are discovered during this project, they may be subject to disposal as hazardous waste. Please contact the OLQ at 317-308-3103 to obtain information on proper disposal procedures.

4. If PCBs are found at this site, please contact the Industrial Waste Section of OLQ at 317-308-3103 for information regarding management of any PCB wastes from this site.

5. If there are any asbestos disposal issues related to this site, please contact the Industrial Waste Section of OLQ at 317-308-3103 for information regarding the management of asbestos wastes (Asbestos removal is addressed above, under Air Quality).

6. If the project involves the installation or removal of an underground storage tank, or involves contamination from an underground storage tank, you must contact the IDEM Underground Storage Tank program at 317/308-3039. See: http://www.in.gov/idem/4999.htm.

FINAL REMARKS

Should you need to obtain any environmental permits in association with this proposed project, please be mindful that IC 13-15-8 requires that you notify all adjoining property owners and/or occupants within ten days your submittal of each permit application. However, if you are seeking multiple permits, you can still meet the notification requirement with a single notice if all required permit applications are submitted with the same ten day period.

Should the scope of the proposed project be expanded to the extent that a National Environmental Policy Act Environmental Assessment (EA) or Environmental Impact Statement (EIS) is required, IDEM will actively participate in any early interagency coordination review of the project.

Meanwhile, please note that this letter does not constitute a permit, license, endorsement or any other form of approval on the part of the Indiana Department of Environmental Management regarding any project for which a copy of this letter is used. Also note that is it the responsibility of the project engineer or consultant using this letter to ensure that the most current draft of this document, which is located at http://www.in.gov/idem/5284.htm, is used.

Sincerely,

Thomas W. Easterly
Commissioner

Signature(s) of the Applicant

I acknowledge that the following proposed roadway project will be financed in part, or in whole, by public monies.

Project Description

US 50 Bypass Project Designation # 1173374 The Indiana Department of Transportation (INDOT) intends to proceed with the above project in Jennings County, Indiana. This letter is part of the early coordination phase of the environmental review process. We are requesting comments from your area of expertise regarding any possible environmental effects associated with this project. Please use the above designation number and description in your reply. We will incorporate your comments into a study of the projectâ€™s environmental impacts. The western limit of this project is at SR 3 approximately 1,200 feet south of CR 350 N, the eastern terminus of the first phase of the bypass, which is currently under construction. The eastern terminus of this project will depend on the alternative selected during the project development process. Alternatives currently under consideration terminate as far west as the vicinity of the intersection of US 50 and CR 75 E and as far east as the vicinity of US 50 and CR 280 E

With my signature, I do hereby affirm that I have read the letter from the Indiana Department of Environment that appears directly above. In addition, I understand that in order to complete that project in which I am interested, with a minimum of impact to the environment, I must consider all the issues addressed in the aforementioned letter, and further, that I must obtain any required permits.

Date: 10-9-13

Signature of the INDOT
Project Engineer or Other Responsible Agent

Date: 10-9-13

Signature of the
For Hire Consultant

Richard Connolly

Representing the Company: Parsons

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
We Protect Hoosiers and Our Environment.

Mitchell E. Daniels Jr.
Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue
Indianapolis, Indiana 46204
(317) 232-8603
Toll Free (800) 451-6027
www.idem.IN.gov

August 24, 2012

66-33
Mr. Dan Prevost
Parsons
101 West Ohio Street, Suite 2121
Indianapolis, Indiana 46204

Dear Mr. Prevost:

RE: Wellhead Protection Area Proximity Determination
Designation Number 1173374, US 50 Bypass, North Vernon, Indiana, Jennings County

Upon review of the above referenced site, it has been determined that the site **is not located** within a Wellhead Protection Area. This information is accurate to the best of our knowledge. However, there are in some cases, a few factors that could impact the accuracy of this determination. For example, some Wellhead Protection Area Delineations have not been submitted or many have not been approved by this office. In these cases, we use a 3,000 foot fixed radius buffer to make the proximity determination. To find the status of a Public Water Supply System's Wellhead Protection Area Delineation, please visit our tracking database at http://www.in.gov/idem/4289.htm.

Note, the Drinking Water Branch has launched a new self service feature which allows one to determine a wellhead proximity without submitting the application form. Use the following instructions: 1) Go to http://idemmaps.idem.in.gov/apps/whpa/ ; 2) Using the icon/tools in the upper right hand corner of the application, zoom to your site location or address; and 3) Once you have located your site of interest click on the "I" icon, and then using your mouse click on your location. The site wellhead protection area proximity determination will be displayed below the icon tools in the upper right hand corner of tool. In the future, please consider using this self service feature if it is suitable for your needs.

If you have any additional questions, please feel free to contact me at the address above or at (317) 234-7476.

Sincerely,

James Sullivan, Chief
Ground Water Section
Drinking Water Branch
Office of Water Quality

JS:gml

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
We Protect Hoosiers and Our Environment.

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If you have any additional questions, please feel free to contact me at the address above or at (317) 234-7476.

Sincerely,

James Sullivan, Chief
Ground Water Section
Drinking Water Branch
Office of Water Quality

JS:gml

APPENDIX B

2009 INDIANA BAT SURVEY REPORT

MIST NET SURVEY FOR THE FEDERALLY ENDANGERED INDIANA BAT (*Myotis sodalis*) FOR THE PROPOSED US 50, NORTH VERNON BYPASS JENNINGS COUNTY, INDIANA

Prepared for:
Corradino, LLC
Indianapolis, IN

Prepared by:
Eco-Tech Consultants, Inc.
Jeffersonville, IN

August 2009

MIST NET SURVEY FOR THE FEDERALLY ENDANGERED INDIANA BAT (*Myotis sodalis*) FOR THE PROPOSED US 50, NORTH VERNON BYPASS, JENNINGS COUNTY, INDIANA.

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1.0 INTRODUCTION

Eco-Tech Consultants, Incorporated (ETC) was subcontracted by Corradino, LLC to conduct a mist net survey for the federally endangered Indiana bat (*Myotis sodalis*) for the proposed US 50, North Vernon Bypass, Jennings County, Indiana (Appendix A). Portions of the proposed project may require tree clearing within potential Indiana bat summer roosting habitat.

The proposed North Vernon Bypass is located north of North Vernon, Indiana (Appendix A, Figure 1). The alignment would cross agricultural, residential and forested lands.

The purpose of this survey was to determine presence/absence of the Indiana bat within potential summer roosting habitat located in proposed clearing areas associated with the new road alignment. This survey was performed in accordance with the Agency Draft Indiana Bat Revised Recovery Plan (USFWS 2007).

1.1 Project Area

The proposed project is located in the Pre-Wisconsinan Drift Plains ecoregion of Indiana (Level IV ecoregion; Woods et al. 2007). The soils of this area are deeply-leached and acidic. They consist of pre-Wisconsinan till and thin loess. The region is largely flat with some dissected areas and extensive areas of poorly drained soils. Beech forests and elm-ash swamps were once common here (Woods et al. 2007), and relatively extensive forested areas are still present. Rock outcrops are prominent in the area, especially along the banks of the Vernon Fork of the Muscatatuck River. Karst features are also present in the vicinity of the proposed alignment and at nearby sites such as the Crosley Fish and Wildlife Area.

1.2 Project Description

The proposed bypass would require clearing of approximately 35 acres of forested habitat, all of which is considered to be potential summer habitat for Indiana bat maternity colonies. The 6.75-mile proposed alignment for Alternative B would cross approximately 4.1 km of forested habitat, including one bridge crossing of the Vernon Fork of the Muscatatuck River.

2.0 INDIANA BAT NATURAL HISTORY

2.1 Species Status

The Indiana bat is a temperate, insectivorous, migratory bat that hibernates in caves and abandoned mines during winter and spends the summer season in forested areas. It was listed as an endangered species on March 11, 1967 by the USFWS. However, the Indiana bat did not receive protection until enactment of the Endangered Species Act (ESA) in 1973 (Public Law 93-205), as amended. Critical habitat for the species was designated on September 24, 1976; it consisted of 11 caves and two mines in six states. Several years following its listing, an Indiana bat recovery plan was developed by biologists (i.e., the recovery team), which outlines habitat requirements, critical habitat, potential causes for declines, and recovery objectives. The recovery plan was reviewed and published by the USFWS in 1983 (Brady et al. 1983). An agency draft of a revised plan was published in 1999, but it was never finalized. The Indiana bat recovery team is currently utilizing new information and making revisions to the recovery plan (USFWS 2007).

Indiana bat estimated population numbers have consistently declined from 1965 to 2001. This steady overall decline can be attributed to several causes including human modifications to hibernacula and surrounding areas, disturbance and vandalism of hibernacula, natural catastrophes, and threats to summer habitat and migration pathways, including loss and degradation of forested habitat (USFWS 2007). Even with the discovery of many new, large hibernacula, the range wide population estimate dropped approximately 57 percent from 1965 to 2001. However, estimates of range wide Indiana bat population totals from surveys conducted post-2001 have actually increased. In 2005, a 15% population increase was found, yielding an approximate total of 457,000 Indiana bats (USFWS 2007). The USFWS views the apparent upward population trend as viable because the same surveyors have been consistently conducting the winter surveys at all large hibernacula over the past 20 years. In addition, large increases in local populations at 34 known high-priority hibernacula in recent years have been observed. The USFWS (2007) anticipates that planned improvements in hibernacula survey methodology will soon provide an even greater confidence level in the overall population trend.

2.2 Distribution

The Indiana bat's range includes most of the eastern United States. It is known to occur from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida (Barbour and Davis 1969, Gardner and Cook 2002). The species' range is generally consistent with the presence of limestone caves that serve as hibernacula in the winter (Menzel et al. 2001). According to the USFWS (2007) winter survey results from 2005 indicated that there were a total of 23 Priority 1 hibernacula in seven states; including Illinois (one site), Indiana (seven sites), Kentucky (five sites), Missouri (six sites), New York (two sites), Tennessee (one site), and West Virginia (one site). Over 90 percent of the estimated range wide Indiana bat population hibernates in only five states, Indiana (45.2%), Missouri (14.2%), Kentucky (13.6%), Illinois (9.7%), and New York (9.1%).

Indiana bats are known to migrate up to 360 miles from their hibernacula to find suitable summer habitat to raise offspring (Kurta and Murray 2002, Winhold and Kurta 2006). Although, some migrate much shorter distances as evidenced by banded female Indiana bat recoveries from maternity colonies at Mammoth Cave National Park. Additionally, recent radio-telemetry studies in New York found that of 70 Indiana bats emerging from three hibernacula most migrated to summer habitat only 40 miles away (USFWS 2007). Until recently, it was thought that the entire species, with the exception of some males, migrated north and west from their hibernacula to forested areas in Missouri, Indiana, Kentucky, Iowa, Ohio, and Michigan during the summer (Barbour and Davis 1969). This migration pattern was illustrated by Barbour and Davis (1969), with summer band recoveries near the Wayne National Forest in southern Ohio of both male and female bats banded at Carter Caves State Resort Park, in Carter County, Kentucky. In addition, reproductive Indiana bats have now been documented in the following states: Arkansas, Illinois, Indiana, Iowa, Kentucky, Michigan, Maryland, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Vermont, Virginia, and West Virginia (USFWS 2007).

Although Indiana bat maternity colonies occur throughout much of the mideastern United States (e.g., West Virginia, Virginia, Pennsylvania, New York), they appear to be relatively less abundant in these peripheral portions of their range (USFWS 2007). The regional differences in summer distribution and relative abundance are likely influenced by geographic distribution of important hibernacula and also by regional climate and elevation variation (USFWS 2007, Brack et al. 2002). Therefore, the understanding of how and to what extent these factors influence the distribution and abundance of maternity colonies is still evolving (USFWS 2007).

2.3 Winter Habitat

Indiana bats use sloughing bark and cracks in dead, partially dead, and live trees as day roosts during autumn (Kiser and Elliott 1996, MacGregor et al.1999). Autumn roost trees range from 4.7 to 26.4 inches in diameter at breast height (dbh) and occur in forested, semi-forested, and open habitats (Kiser and Elliott 1996). Depending on local weather conditions, Indiana bats normally enter the hibernaculum in October and remain there through April (Hall 1962, LaVal et al. 1977, LaVal and LaVal 1980).

Prior to entering the hibernacula in autumn, swarming occurs at the entrances of either the hibernacula (Cope and Humphrey 1977) or other caves located near the hibernacula (LaVal et al. 1977). Swarming usually lasts for several weeks (August - September) and mating occurs toward the end of this period. Mated females usually enter directly into hibernation, whereas males may remain active through the end of November. Reproductive females store sperm through the winter, delaying fertilization until early May. During April and May the majority of the Indiana bat population emerges leaving their cave areas to find suitable summer habitat. However, some male and non-reproductive female Indiana bats will remain near the hibernacula during the summer. Females usually start grouping into larger nursery colonies by mid-May and give birth to a single young between late June and early July (Easterla and Watkins 1969, Humphrey et al. 1977).

Indiana bats hibernate primarily in caves, but they have also have been documented using abandoned mines. As of November 2006, the USFWS (2007) has winter records of 281 distinct hibernacula in 19 states that have been occupied continually since 1995. According to Barbour and Davis (1969), 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 to lower temperature areas of the cave as outside temperatures decrease. In mid-winter Indiana bats tend to roost in portions of the cave where temperatures are cool (37° to 43°F). Relative humidity in Indiana bat hibernacula tends to be high, usually above 74 percent, but not exceeding saturation (Hall 1962, Humphrey 1978, Kurta and Teramino 1994, LaVal et al. 1976).

2.4 Summer Habitat

Selection of roost trees by Indiana bat colonies are based on structural characteristics. Tree diameter, solar exposure, and height in canopy are among the most important (Romme et al. 1995, Kurta and Murray 2002). Male and female Indiana bats inhabit different habitats and choose roost trees with differing characteristics during the summer months (Kurta 2005). Reproductive females tend to choose roosts in mature forests with large trees, scattered gaps in the canopy, and an open understory (Gardner et al. 1991b, Callahan et al. 1997). The number of available roost trees in an area influences the suitability of habitat for female Indiana bats (Kurta 2005). Gardner et al. (1991b) found that of 39 roost trees evaluated, 31% were not suitable the following summer, and that 33% of the remaining trees were unavailable for use after two summers. Thus roost trees are an ephemeral resource.

Maternity colonies have been found under sloughing bark of dead, partially dead and live trees (Carter 2003, Gardner et al. 1991b, Kurta et al. 1993, Kurta et al. 2002, Romme et al. 1995). These colonies have been found in lowland forests (Cope et al. 1974, Humphrey et al. 1977), and more recently in upland forests (Callahan et al. 1997, Clark et al. 1987, Gardner et al. 1991b, Kiser et al. 2002). Such colonies are usually located in large-diameter, standing dead trees, with direct exposure to sunlight (Callahan et al. 1997). Maternity roosts can contain over 350 individual bats during July and August (Kiser et al. 1998). During Callahan's study (1997), he arranged roost trees into two groups depending on the intensity of use and size of the colony

that used each tree. Callahan (1993) classified any tree that was used more than once by greater than 30 bats each time as a primary roost tree, and any tree with less than 30 bats or used only once as an alternate roost tree. The primary roost trees had an average dbh of 22.4 inches, while open snags used as alternate roosts had an average dbh of 20.9 inches (Callahan et al. 1997).

Indiana bats require more than one roost tree to fulfill their needs during the summer (Callahan et al. 1997). Barclay and Kurta (2004) found one maternity colony that used 18 roost trees during a single summer. In addition, Indiana bats are known to roost in several different species of trees, selecting roost trees by the structural composition of each tree. Farmer et al. (1997) contends that structure is probably more important than tree species in selection of roost trees.

Twelve tree species are listed in the Habitat Suitability Index Model (Romme et al. 1995) as primary species (class 1 trees). The trees listed by Romme et al. (1995) 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*), northern red oak (*Quercus rubra*), post oak (*Q. stellata*), white oak (*Q. alba*), slippery elm (*Ulmus rubra*), and American elm (*U. americana*). In addition to these species, Romme et al. (1995) listed sugar maple (*A. saccharum*), shingle oak (*Q. imbricaria*), and sassafras (*Sassafras albidum*) as class 2 trees. The class 2 trees are those species believed to be less important, but still have the necessary characteristics to be used as roosts. Trees normally used as primary roosts are dead and have a dbh greater than 12 inches (Romme et al. 1995).

At least 33 tree species have been found to be roosts for reproductive female Indiana bats, and 87 percent of them are ashes (13%), elms (13%), hickories (22%), maples (15%), poplars (9%), and oaks (15%; USFWS 2007). It was previously believed that oak and hickory were used more commonly used in the southern portion of the range (Callahan et al. 1997, Gardner et al. 1991b), and elm, ash, maple, and cottonwood were occupied more often in northern areas (Kurta et al. 1996, 2002; Whitaker and Brack 2002). However, more recent research reveals that Indiana bats occupy ash and elm most often in southern Illinois (Carter 2003) and hickories most often in Vermont (Palm 2003). Therefore, it appears that tree species use is more closely related to local availability and suitable structure than to broad regional preferences (USFWS 2007). Nonetheless, some common trees, such as American beech (*Fagus grandifolia*), basswood (*Tilia americana*), wild black cherry (*Prunus serotina*), box elder (*A. negundo*), and willow (*Salix* spp.), are rarely to never used, suggesting that they are typically not acceptable even when suitable structure is present, especially as a primary roost (USFWS 2007).

Most (97%) roost trees of female Indiana bats at maternity sites are deciduous species, except for a few coniferous trees discovered in the Great Smoky Mountains (Harvey 2002, Britzke et al. 2003) and in New England (Palm 2003). This more likely reflects availability rather than a preference for deciduous trees (USFWS 2007).

2.5 Food Habits

Historically, the Indiana bat was thought to prey primarily on moths (Lepidoptera), beetles (Coleoptera), true flies (Diptera), and caddisflies (Trichoptera) (Belwood 1979, Brack 1983, Brack and LaVal 1985). During a study by Belwood (1979), the primary insects consumed by females and juveniles in southern Indiana were Lepidoptera (57%), Diptera (18%), and Coleoptera (9%). Belwood's information was very similar to a three-year study conducted by Brack (1983) throughout Indiana. Brack (1983) found that Indiana bats consumed Lepidoptera (48%), Coleoptera (24%), and Diptera (8.5%). He also found Trichoptera (9.8%) to be an

important food source. Studies by Lee (1993) and Kurta and Whitaker (1998) found that the same four insect orders were consumed by Indiana bats in central/northern Indiana and in Michigan. However, these studies showed that Indiana bats preyed much more heavily on caddisflies in central/northern Indiana and in Michigan. The female Indiana bats in central and northern Indiana consumed Lepidoptera (40%), Trichoptera (29%), Coleoptera (13%), and Diptera (9%) (Lee 1993). The most recent Indiana bat food habits study was conducted in Michigan at the northern limits of the species' range. These bats consumed primarily Trichoptera (55.1%) and Diptera (25.5%), which have aquatic larvae (Kurta and Whitaker 1998). These authors hypothesized that Indiana bats in northern portions of their range feed more on aquatic insects than southern populations because they forage primarily over streams and wetlands.

The only food habit information from Kentucky for Indiana bats is from Jackson County. Kiser and Elliott (1996) conducted a study to determine the food habits of male Indiana bats at a cave entrance. During the autumn of 1994 and 1995, male Indiana bats consumed primarily Lepidoptera (28.5% and 34.0%), Coleoptera (15.9% and 40.2%), Homoptera (15.3% and 4.5%), and Diptera (28.8 % and 18.8%). The increase in consumption of snout beetles (Coleoptera: Curculionidae) during the 1995 samples indicates that Indiana bats are opportunistic foragers (Kiser and Elliott 1996).

Indiana bats forage primarily in forested habitats (Cope et al. 1974, Humphrey et al. 1977, LaVal et al. 1977, Belwood 1979), but they will also forage in edges of forests and croplands, fallow fields, and areas of impounded water (Gardner et al. 1991a). Indiana bats may utilize as many as four different foraging areas during nightly foraging (Murray 1998), using the same travel corridor each night to move from the roost tree to the foraging areas. It has been documented that Indiana bats may travel up to three miles from their summer roosts to summer foraging areas and will visit these same areas each night. Reproductively active females traveled a maximum mean distance of 1.5 miles from their roost trees to foraging areas in Illinois (Gardner et al. 1991a). During a study by Pruitt et al. (1995) at the Jefferson Proving Ground (JPG), Jefferson County, Indiana, reproductive female bats were found to travel a mean distance of 1.7 miles from their original capture sites to their roost trees. Also at JPG, a male traveled 0.4 mile from the capture site to its roost; this distance is less, but similar to the distance of 0.7 mile found by Gardner et al. (1991a) for males in Illinois.

2.6 White-Nose Syndrome (WNS)

White-nose syndrome (WNS) has been characterized as a condition affecting hibernating bats and was named for the white fungal growth located on hairless areas of the body such as the muzzle, ears, and/or wing/tail membranes (Blehert et al. 2008). Behavioral responses to WNS include movement to entrances of hibernacula, day flight during mid-winter, cluster formation on the ground, and other uncharacteristic winter/hibernating behavior. Bats affected with WNS are thought to leave their hibernacula early in search of food and, subsequently, starve or freeze to death.

WNS was first documented by a photograph taken at Howes Cave, approximately 32 miles west of Albany, New York in February 2006 (Blehert et al. 2008). A caver photographed hibernating bats with an unusual white substance on their muzzles and observed several dead bats (USFWS 2009a). The following winter, New York Department of Environmental Conservation biologists documented WNS after observing bats exhibiting abnormal behavior, white, powdery substance on the muzzle, and a few hundred dead bats in several caves in the Albany, NY area (USFWS 2009). Since then sick, dying and dead bats have been found in unprecedented numbers in and around caves and mines from Vermont to Virginia.

WNS has killed hundreds of thousands of bats across the northeast and east during the past three years and continues unchecked (USFWS, 2009b). It has rapidly spread to over 65 sites and has been associated with the deaths of over 400,000 bats in the United States (USFWS 2009). In some hibernaculum, 90 to 100 percent of infected bats are dying (USFWS 2009). Since the 2006-2007 winters, WNS has spread to nine states including: Connecticut, Massachusetts, New Hampshire, New York, New Jersey, Pennsylvania, Vermont, West Virginia and most recently Virginia (USFWS 2009). WNS threatens to spread to the Midwest and Southeast, which are home to many federally endangered bat species as well as some the largest known bat populations in the country (USFWS 2009).

Researchers associate WNS with a newly identified fungus (*Geomyces* sp.) that thrives in the cold and humid conditions characteristic of the caves and mines used by bats (USFWS 2009c). It is not yet known if the fungus is the cause of the mortality occurring in these hibernating bats or if it is a symptom of something else. Affected bats do not always have the white fungus but do leave their hibernacula during the winter and typically die. The fungus isn't always visible to the naked eye -- and usually is not seen on bats found flying or dead outside of their hibernacula or at their summer roosts.

Biologists believe that affected bats may be waking up more often throughout hibernation to groom themselves thus burning fat reserves needed for winter hibernation. Bats with obvious WNS have shown excessive grooming and noticeable agitation. It is thought the fungus causes enough irritation that the bat arouses from torpor to clean itself. Once clean, the bat will re-enter torpor allowing the fungus to re-establish. The fungus may not be readily visible on the bats, especially after they leave their hibernacula and groom themselves. Bat species currently known to be affected by the fungus are little brown bat (*Myotis lucifugus*), Indiana bat, small-footed bat (*M. leibii*), northern long-eared bat (*M. septentrionalis*), eastern pipistrelle bat (*Perimyotis subflavus*) and big brown bat (*Eptesicus fuscus*).

Transmission of WNS is unclear at this time however; biologists believe that WNS is transmitted primarily from bat-to-bat. Evidence collected to date indicates that human activity in caves and mines may be assisting in the spread of WNS since some caves used by people have WNS affected bats, while other, nearby caves not used by people do not seem to be affected. It is likely that the fungus can be transported inadvertently from site-to-site on gear and boots of cave visitors (USFWS 2009a).

Human health implications are not known and there is no information indicating that people or other animals have been affected after exposure to the white fungus.

Biologists with state and federal agencies and organizations across the country are still trying to find the answer to this deadly mystery. Despite the continuing search to find the source of this condition the cause of the bat deaths remains unknown.

3.0 MATERIALS AND METHODS

3.1 Mist Net Site Selection

The survey was conducted according to the guidelines of Appendix 5 of the “Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision” (USFWS 2007). These guidelines call for one net site to be mist netted for two calendar nights per one kilometer (km) of forested habitat to be cleared. A thorough office review of the proposed project area was conducted by ETC biologists in order to identify forest impacts. Office review of current aerial photography and

topographic maps found that approximately 4.1 km of forested habitat will be affected by this project, yielding four proposed mist net sites. Because the proposed project will cross a major river, an additional net site was added in order to ensure that sufficient sample effort was employed.

Potential sites were chosen based on factors such as the potential for presence of travel corridors and water, in addition to a relatively closed canopy cover. Topographic maps and current aerial photographs were utilized to determine the extent of tree clearing, as well as the presence or absence of these important factors. If any of the potential mist net sites were found to not be suitable upon site visit, then another was chosen. Mist net sites (five total) were located as close as possible to the actual alignment of Alternative B; however, some sites were located a short distance (<0.4 miles) from the alignment in order to sample important Indiana bat habitat features such as streams, ponds and forested corridors. Mist net sites are depicted on the attached topographic and aerial maps (Appendix A, Figure 1 and 2).

3.2 Mist Net Survey

Each mist net site consisted of two net sets where one net set consisted of two mist nets hung between two poles. Poles were at least 20 feet high and had ropes affixed to them to raise and lower the nets. The mist nets used in this survey were constructed of 50 denier/2-ply nylon, with a mesh size of 1.5 inches, and a length of 20 to 60 feet, depending on width of corridor (Table 1). Net sets were located so that the entire open portion of the flyway was covered by the nets. Nets were tended from dusk (approximately 21:00 EDT) until 02:00 (EDT). Mist nets were checked for bats every 10 minutes.

Upon capture, bats were removed from mist nets, identified to species, measured, and released unharmed at the capture site. Data recorded for each bat captured included species, age, gender, reproductive condition, right forearm length (RFA), and body weight. Bats were identified to species based upon distinctive morphological characteristics (e.g., body size, hair color, ear length, tragus length and shape, presence/absence of a keeled calcar). Adult female bats were classified as reproductive if they were pregnant (determined by palpation of abdomen) or lactating (i.e., teats conspicuous and enlarged, lack of hair around teats). Male bats with testicles descended into the scrotum were considered reproductive. Juveniles were distinguished from adults by examining ossification (bone growth) in phalangeal joints. All bats were released unharmed at the point of capture.

Weather conditions were documented each night to confirm that netting was conducted in accordance with Indiana Bat Recovery Team Guidance (USFWS 2007). The air temperature, wind speed, cloud cover, precipitation, and visibility of the moon were recorded at the beginning and end of each night of the survey. A digital or mercury thermometer was used to record temperature. Wind speed, percent cloud cover, and moon phase were estimated (Appendix C). All sites were photographed and their location recorded using a handheld GPS unit.

All netting was conducted in accordance to bat handling/disinfection protocols for summer bat field studies, as dictated by state and federal agencies to help prevent the spread of WNS.

4.0 RESULTS

A total of five sites were surveyed using mist nets on July 16-23, 2009. Detailed descriptions and sketches of each net site are included in Appendix B and Table 1. Bat Capture Datasheets are included in Appendix C. Photographs of net sites and representative bats captured during this survey are included in Appendix D. Additional wildlife observed and general comments

about each net site are included on net site descriptions and bat capture data forms in Appendices B and C. Brief synopses of mist net site characteristics and capture results are listed below.

4.1 Mist Net Sites and Cave Reconnaissance

Five mist net sites were located in suitable Indiana bat habitat as close to the proposed alignment as possible. Sample sites were located on the eastern and western sides of the alignment due to the fact that little wooded habitat was available in the middle of the project area. The Vernon Fork of the Muscatatuck River is impounded downstream of the alignment crossing; therefore, the river channel in the project area is very wide with little canopy cover. Due to the fact that most of this section of the Vernon Fork is not conducive to mist netting, only one site (site 2) could be located on the river.

A variety of bat corridor types were sampled for this project. Overall, four net sets were placed over road/trail corridors, three were placed over ponds, two were placed over rivers or streams and one was placed over a sandbar. The dominant canopy tree species varied by site, but sugar maple (*Acer saccharum*), Shagbark hickory (*Carya ovata*), American sycamore (*Platanus occidentalis*) and black walnut (*Juglans nigra*) were each dominant trees at more than one site. Canopy trees averaged 11-20 inches in dbh, and canopy coverage varied from 25 to 100 percent. Dominant understory species included sassafras (*Sassafras albidum*), red elm (*Ulmus rubra*) sugar maple, boxelder (*Acer negundo*) and many other species. Average understory dbh varied from two to six inches. Water was present at four of the five net sites (Appendix B).

Sites 1, 4 and 5 were netted for three nights because of a rainout event that occurred on the night of July 21, 2009. At approximately 23:30 rain began and became increasingly steady for more than 30 minutes. Bats were captured; however, weather conditions did not meet USFWS Indiana bat survey guidelines. Therefore, mist nets were taken down, and netting was resumed during the following two nights.

During mist net site scouting, a landowner indicated the presence of a small cave downstream of site 2. On July 19, 2009 ETC ecologists assessed the cave for bat activity. Approximately eight inches of water was present in the bottom of the cave. The entrance was two to three feet in diameter and lacked air flow and bat guano. Preliminary scouting of this cave indicates that it is not being used by any bat species (see Appendix D).

Table 1. Configuration and location summary for mist net sites during the survey for the federally endangered Indiana bat (*Myotis sodalis*) for the proposed North Vernon Bypass, Jennings County, Indiana.

SITE	SURVEY DATES	# OF NETS	NET CONFIGURATION (h x w)	BATS CAPTURED	Notes
1	July 21-23, 2009	2	A) 20' x 30' B) 30' x 20'	4	Rainout July 21
2	July 19-20, 2009	2	A) 20' x 60' B) 30' x 42'	4	
3	July 16-17, 2009	2	A) 20' x 20' B) 20' x 18'	5	
4	July 21-23, 2009	2	A) 20' x 20' B) 20' x 20'	9	Rainout July 21
5	July 21-23, 2009	2	A) 20' x 20' B) 20' x 20'	7	Rainout July 21

4.2 Capture Results

A total of 29 individuals of six chiropteran species were captured during this mist-net survey. No Indiana bats were captured. Figure 1 depicts the abundance of the six species at each sample

site. The following four species were captured with equal frequency (6 individuals of each species): eastern pipistrelle (*Perimyotis subflavus*), little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*) and eastern red bat (*Lasiurus borealis*). The next most common species was the northern long-eared bat (*Myotis septentrionalis*) (n=4), and a single evening bat (*Nycticeius humeralis*) was captured. Slightly more than half of captures (52%) were non-reproductive males. The remaining captures were of females of several species. Several of these females were, or recently had been, reproductively active (Table 2).

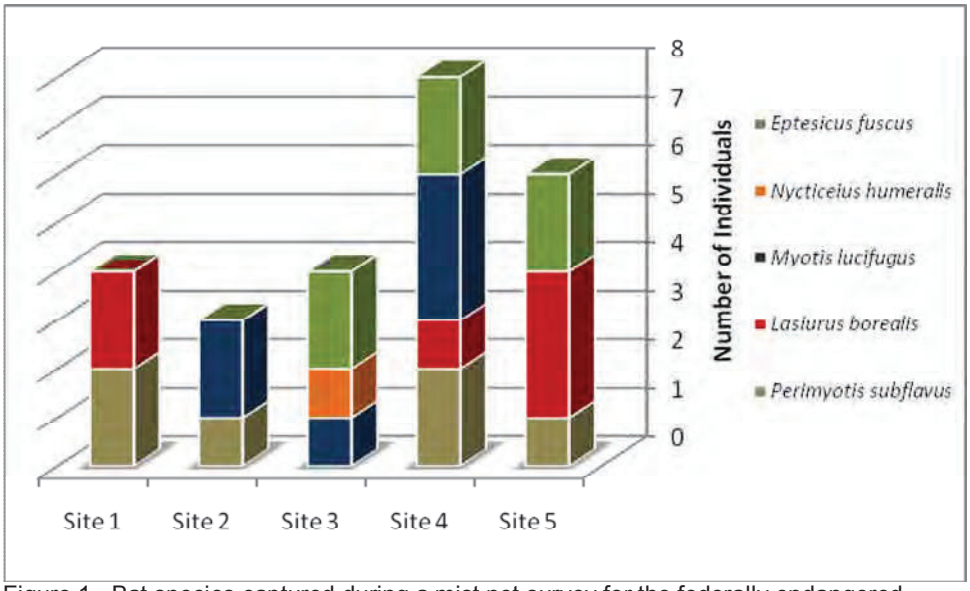

Figure 1. Bat species captured during a mist net survey for the federally endangered Indiana bat (*Myotis sodalis*) for the proposed North Vernon Bypass, Jennings County, Indiana (7/16/09 thru 7/23/09).

5.0 SUMMARY AND DISCUSSION

This mist net survey was conducted with the appropriate level of effort (20 net nights over 2 nights at 5 sites) and under the appropriate conditions to investigate presence/absence of Indiana bats during the maternity season in the vicinity of the proposed North Vernon Bypass in Jennings County, Indiana. A total of 29 bats from six species were captured during this survey. No federally-listed bat species were captured. One bat species listed as endangered by the state of Indiana, the evening bat, was captured at site 3.

Habitat for Indiana bats is present in woodlots throughout the project area. Dead snags and tree species with sloughing bark, such as white oak (*Quercus alba*), were noted. However, the results of this survey indicate that Indiana bats are not likely to be present, or are present in low numbers, within forested portions of the project area.

Table 2. Date, site, time of capture, net, species, sex, age, reproductive condition, forearm length, weight, and band number for all bats captured during the mist net survey for the federally endangered Indiana bat (*Myotis sodalis*) for the proposed North Vernon Bypass, Jennings County, Indiana (7/16/09 thru 7/23/09).

SITE	DATE	NET	TIME	SPECIES	SEX	AGE	REPRODUCTIVE CONDITION	RIGHT FOREARM LGTH (mm)	WEIGHT (g)	WING SCAR SCORE	BAND #
		A	21:18	*Perimyotis subflavus*	M	J	Non-reproductive	33.5	5.0	0	-
	7/21/2009	B	21:30	*Lasiurus borealis*	M	J	Non-reproductive	40.8	9.0	0	-
	7/22/2009	B	22:30	*Lasiurus borealis*	M	J	Non-reproductive	38.9	10.0	0	-
1	7/23/2009	B	23:56	*Perimyotis subflavus*	F	A	Post-lactating	35.2	7.2	0	-
		A	22:20	*Perimyotis subflavus*	F	A	Lactating	33.0	7.4	0	-
		A	22:20	*Myotis lucifugus*	M	A	Non-reproductive	35.0	7.0	1	-
	7/19/2009	A	22:40	*Myotis lucifugus*	F	A	Post-lactating	38.0	9.0	0	-
2	7/20/2009	B	23:20	*Myotis septentrionalis*	M	A	Non-reproductive	35.0	6.5	1	-
		A	23:30	*Nycticeius humeralis*	M	J	Non-reproductive	37.0	10.0	1	-
	7/16/2009	B	2:00	*Eptesicus fuscus*	M	A	Non-reproductive	49.0	19.8	0	-
		B	22:15	*Myotis septentrionalis*	F	J	Non-reproductive	38.0	5.5	0	-
		A	23:40	*Eptesicus fuscus*	F	A	Post-lactating	48.0	19.0	0	-
3	7/17/2009	B	2:00	*Myotis lucifugus*	M	A	Non-reproductive	38.0	7.5	0	-
		A	21:00	*Lasiurus borealis*	F	J	Non-reproductive	42.0	10.0	0	-
	7/21/2009	A	0:00	*Eptesicus fuscus*	M	A	Non-reproductive	49.0	18.5	0	-
		B	23:40	*Perimyotis subflavus*	F	A	Post-lactating	35.0	7.0	0	-
	7/22/2009	B	0:30	*Myotis lucifugus*	F	A	Non-reproductive	38.0	9.0	0	-
		A	22:20	*Myotis lucifugus*	F	A	Post-lactating	40.0	8.5	0	-
		A	22:20	*Perimyotis subflavus*	M	J	Non-reproductive	34.0	5.0	0	-
		A	22:20	*Myotis septentrionalis*	F	A	Non-reproductive	36.0	7.5	0	-
		A	0:40	*Myotis lucifugus*	F	A	Post-lactating	39.0	7.0	0	-
4	7/23/2009	A	1:30	*Eptesicus fuscus*	M	A	Non-reproductive	50.0	17.0	0	-

SITE	DATE	NET	TIME	SPECIES	SEX	AGE	REPRODUCTIVE CONDITION	RIGHT FOREARM LGTH (mm)	WEIGHT (g)	WING SCAR SCORE	BAND #
		A	21:20	*Eptesicus fuscus*	M	A	Non-reproductive	47.0	15.2	1	-
		A	21:20	*Myotis septentrionalis*	M	J	Non-reproductive	34.0	5.4	0	-
		A	21:40	*Lasiurus borealis*	M	--Escaped From Net--					
		A	21:40	*Perimyotis subflavus*	F	A	Lactating	35.0	7.4	1	-
		A	22:30	*Lasiurus borealis*	F	J	Non-reproductive	40.0	8.6	0	-
	7/21/2009	A	22:40	*Eptesicus fuscus*	M	A	Non-reproductive	45.0	17.0	1	-
	7/22/2009	--No Bats Captured--									
5	7/23/2009	A	22:20	*Lasiurus borealis*	F	A	Post-lactating	42.0	14.1	1	-

Total Number of Individuals	29
Species Richness	6
Mean Catch per Site	5.8
Mean Catch per Night	2.2
% Female	48

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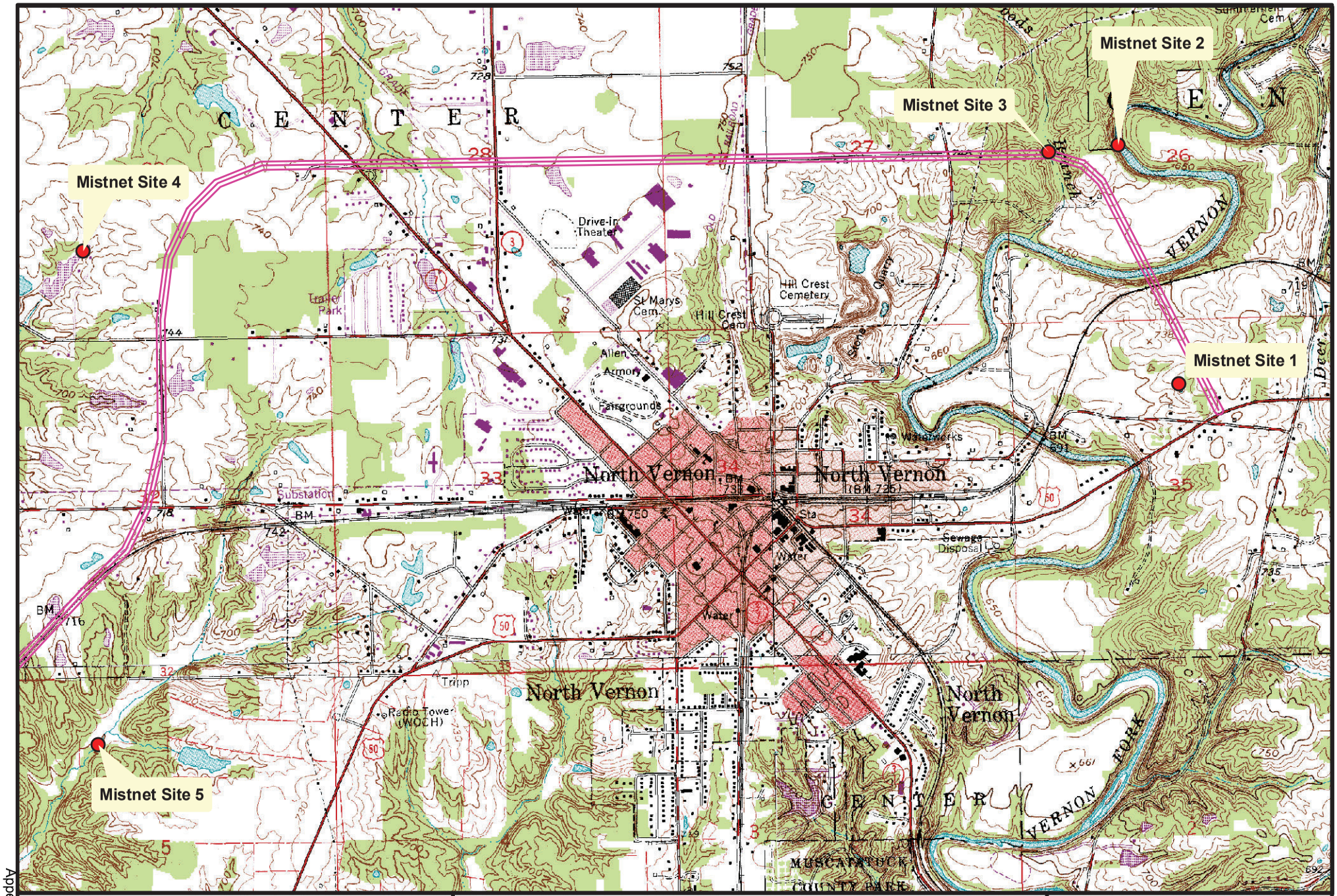
APPENDIX A MAPS



Corradino, LLC
Proposed U.S. 50, North Vernon Bypass
Jennings County, Indiana

0 700 1,400 2,800 4,200 5,600 Feet

Imagery Source:
USGS Topographic Map

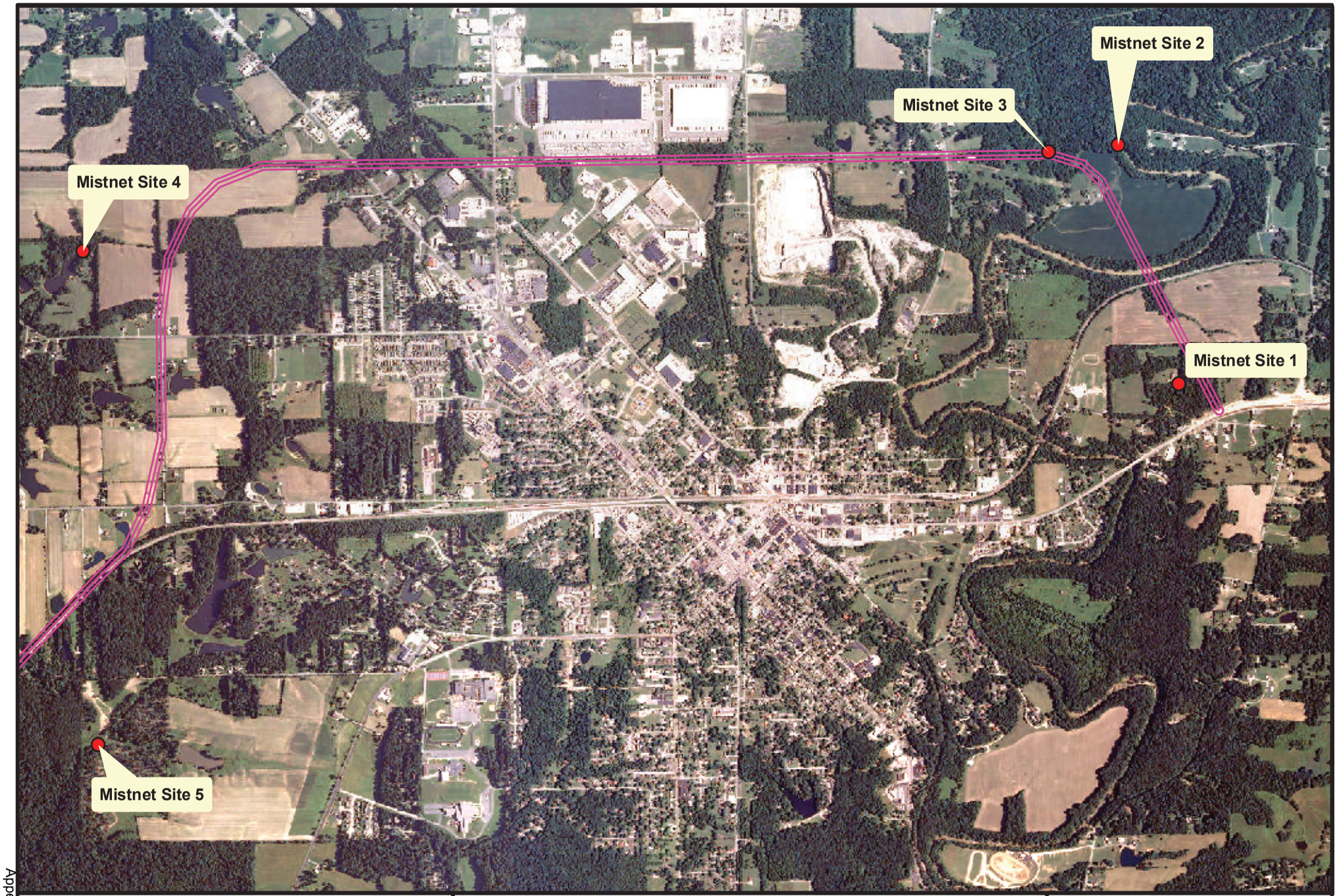
FIGURE 1
Project Location Map

Legend

- Mistnet Sites
- Alternative B

ETC ECOLOGICAL

Drawn by: TTB	Print Date: 08/17/09
Prepared for: Corradino, LLC	
ETC File: JV2009003	



Corradino, LLC
Proposed U.S. 50, North Vernon Bypass
Jennings County, Indiana

0 700 1,400 2,800 4,200 5,600 Feet

Imagery Source:
USGS Topographic Map

FIGURE 2
2008 Aerial Photograph

Legend

- Mistnet Sites
- Alternative B

ETC ECOLOGICAL

Drawn by: TTB	Print Date: 08/17/09
Prepared for: Corradino, LLC	
ETC File: JV2009003	

APPENDIX B SITE DESCRIPTIONS

Eco-Tech Consultants

NET SITE DESCRIPTION

Site: 1 **Project:** Proposed US 50 North Vernon Bypass **Dates:** July 21-23, 2009

ID by: Robert Omey, S. Roberts **Quad:** Butlerville **County:** Jennings **State:** IN

Net A	**Width (ft):**	30	**Height (ft):**	20	**Lat/Lon:**	39.01159°N, -85.6072116°W
Net B	**Width (ft):**	30	**Height (ft):**	30	**Lat/Lon:**	39.01143°N, -85.6023939°W

Vegetation

Dominant Canopy Species:
1) Sugar Maple
2) White Oak
3) Shellbark Hickory

Percent Canopy Closure:
Net A: 65
Net B: 75

Average Canopy DBH (in): 11-14 inches

Dominant Understory Species:
1) Sassafras
2) Shellbark hickory (sapling)
3) Green maple (sapling)

Understory Density:

Very Dense	X
Moderate	
Clear	

Average Understory DBH (in): ~2

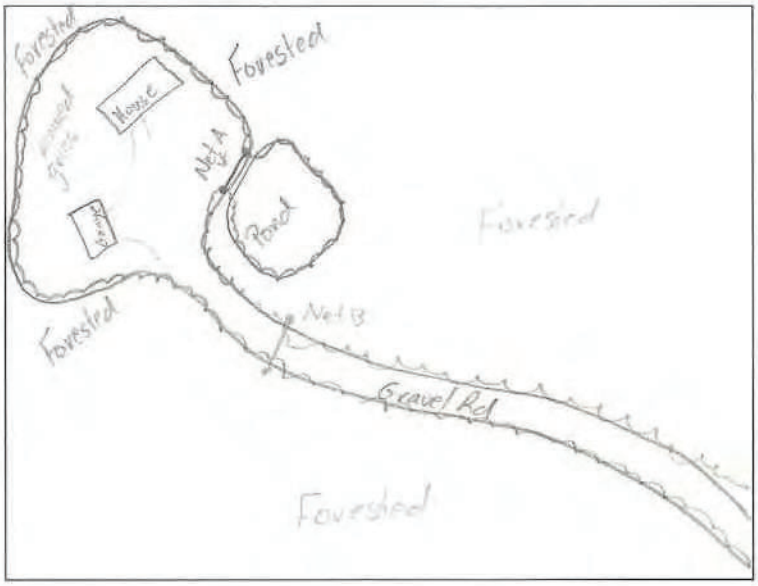
Stream

Bank Height (ft): N/A
Channel Width (ft): N/A
Water Width (ft): N/A
Average Water Depth (ft): N/A
Dominant Substrate: N/A
Turbidity (clear/cloudy): N/A

Comments/Descriptions

- Net A placed over gap in tree line between pond and mowed grass
- Net B placed over gravel drive leading to property owner's house.
- Conversation w/ landowner about sinkhole on property + nesting pair of Bluebirds (see photo)
- Green heron observed @ pond
- Green frogs and bullfrogs observed at pond.

Site Drawing



Net Site Descriptions-ld

Eco-Tech Consultants

NET SITE DESCRIPTION

Site: 2 Project: NORTH VERNON BYPASS Dates: 7/19 – 7/20/09

ID by: L. DROPPELMAN Quad: Butlerville County: JENNINGS State: INDIANA

Net A	Width (ft):	60	Height (ft):	20	Lat/Lon:	N39.022020	W-85.605327°
Net B	Width (ft):	42	Height (ft):	30	Lat/Lon:	N39.622161	W-85.605162°

Vegetation

Dominant Canopy Species:
1) PLATANUS OCCIDENTALIS
2) ACER SACHARUM
3) ULMUS RUBRA

Percent Canopy Closure:
Net A 60
Net B 40

Average Canopy DBH (in): 14

Dominant Understory Species:
1) ULMUS RUBRA
2) ACER NEGUNDO
3) ACER SACHARUM

Understory Density:
Very Dense [ ]
Moderate [ ]
Clear [X]

Average Understory DBH (in): 4

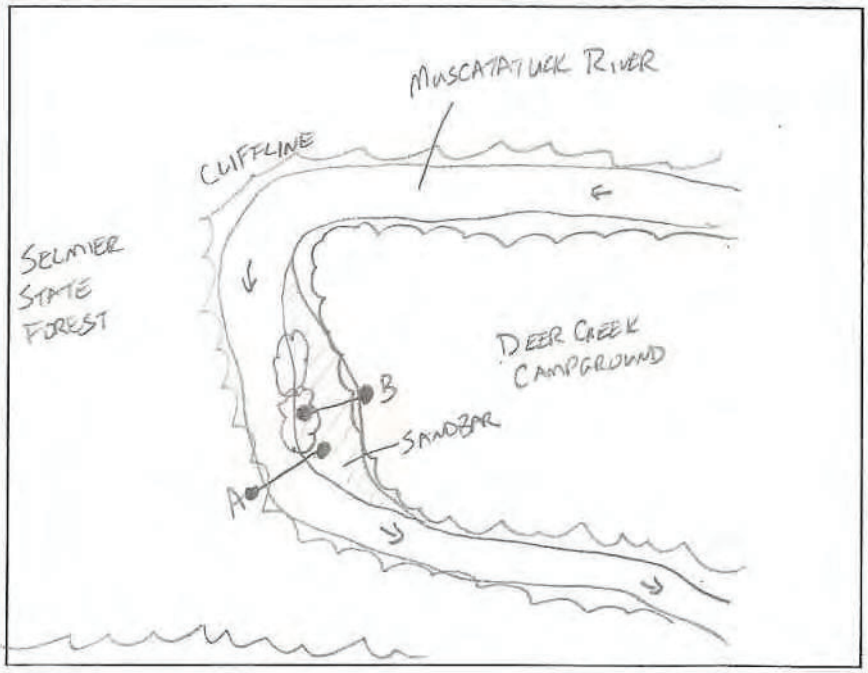
Stream

Bank Height (ft):	4	Average Water Depth (ft):	3.0
Channel Width (ft):	100	Dominant Substrate:	BEDROCK
Water Width (ft):	60	Turbidity (clear/cloudy):	CLOUDY

Comments/Descriptions

SITE IS LOCATED ON A BROAD SANDBAR ON THE INSIDE OF A MEANDER. ACCESS IS THROUGH A CAMPGROUND WITH PERMANENT RVS. SANDBAR HAS INTERMITTENT SYCAMORES. RIVER IS AT LOWFLOW. IT ABUTS A STEEP HILLSIDE/ CLIFFLINE THAT HAS MATURE FOREST. RIVER IS BEDROCK WITH SAND/COBBLE MIX. THIS IS THE ONLY NETTABLE SITE ON THE MUSCATATUCK WITHIN ½ MILE OF THE PROPOSED CORRIDOR.

Site Drawing



NET SITE DESCRIPTION

Site: 3 **Project:** US50 NORTH VERNON BYPASS **Dates:** 7/16/09 - 7/17/09

ID by: L. DROPPELMAN **Quad:** Butlerville **County:** JENNINGS **State:** INDIANA

Net A **Width (ft):** 20 **Height (ft):** 20 **Lat/Lon:** N 39.02175° / W -85.60922°

Net B **Width (ft):** 18 **Height (ft):** 20 **Lat/Lon:** N 39.02136° / W -85.60899°

Vegetation

Dominant Canopy Species:

1) JUGLANS NIGRA
2) PLATANUS OCCIDENTALIS
3)

Percent Canopy Closure:

Net A 80
Net B 95

Average Canopy DBH (in): 12"

Dominant Understory Species:

1) Lindera benzoin
2) Acer negundo
3) ULMUS RUBRA

Understory Density:

Very Dense	
Moderate	X
Clear	

Average Understory DBH (in): 2"

Stream

Bank Height (ft): N/A

Channel Width (ft):

Water Width (ft):

Average Water Depth (ft):

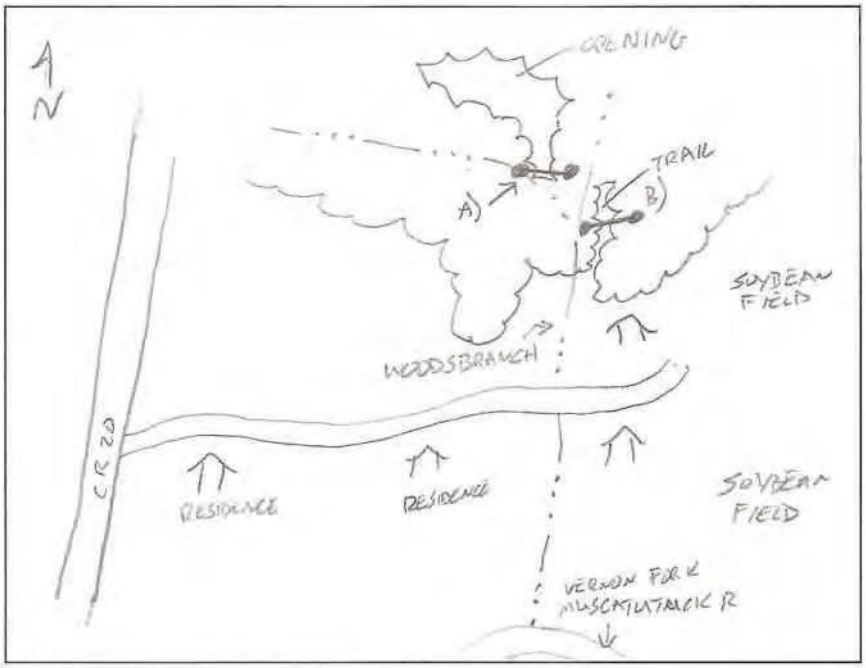
Dominant Substrate:

Turbidity (clear/cloudy):

Comments/Descriptions

NETTING A FORESTED STREAM TRAIL/STREAM CORRIDOR. THE SITE IS ON AN ACTIVE FARM AND ABUTS A STATE FOREST. WILDLIFE OPENINGS AND CLEARED TRAILS ARE ABUNDANT. SITE IS < 1/2 MILE FROM MUSCATATUCK RIVER.

Site Drawing



Eco-Tech Consultants

NET SITE DESCRIPTION

Site: 4 **Project:** North Vernon, IN Bats **Dates:** 7-21-23-09

ID by: Scott Slankard **Quad:** North Vernon **County:** Jennings **State:** IN

						Wpt.
Net A	**Width (ft):** 20	**Height (ft):** 20	**Lat/Lon:** 39.01809 / -85.66306	108
Net B	**Width (ft):** 20	**Height (ft):** 20	**Lat/Lon:** 39.01827 / -85.66276	107

Garmin 60cx (blue)

Vegetation

Dominant Canopy Species:
1) C. ovata
2) A. saccharum
3) F. pennsylvanica

Percent Canopy Closure:
Net A 100%
Net B 25%

Average Canopy DBH (in): 20"

Dominant Understory Species:
1) A. saccharum
2) C. carolinianna
3) T. distichum

Understory Density:
Very Dense [ ]
Moderate [X]
Clear [ ]

Average Understory DBH (in): 6"

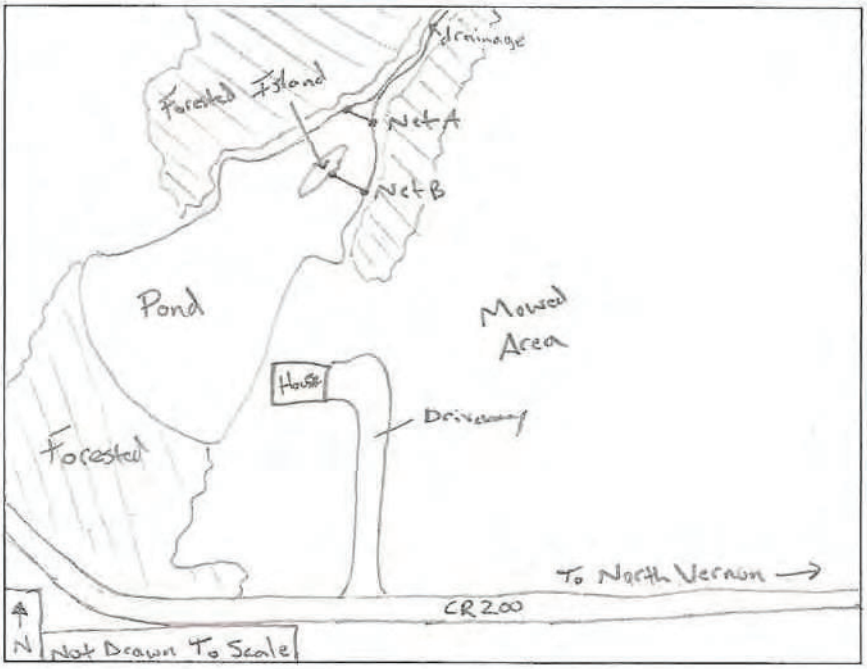
Stream

Bank Height (ft): ~~~~
Channel Width (ft): ~~~~
Water Width (ft): ~~~~

Average Water Depth (ft): ~~~~
Dominant Substrate: ~~~~
Turbidity (clear/cloudy): ~~~~

Comments/Descriptions

Site Drawing



Eco-Tech Consultants

NET SITE DESCRIPTION

Site: 5 Project: US50 NORTH VERNON BYPASS Dates: 7/21/09 - 7/23/09

ID by: L. DROPPELMAN Quad: HAYDEN County: JENNINGS State: INDIANA

Net A	Width (ft): 20	Height (ft): 20	Lat/Lon:	38.99662	/ -85.66264
Net B	Width (ft): 20	Height (ft): 20	Lat/Lon:	38.99648	/ -85.66306

Vegetation

Dominant Canopy Species:
1) CARYA LACINIOSA
2) PLATANUS OCCIDENTALIS
3) JUGLANS NIGRA

Percent Canopy Closure:
Net A 100%
Net B 100%

Average Canopy DBH (in): 12

Dominant Understory Species:
1) CARYA OVATA
2) CERCIS CANADENSIS
3) PLATANUS OCCIDENTALIS

Understory Density:

Very Dense	
Moderate	X
Clear	

Average Understory DBH (in): 4

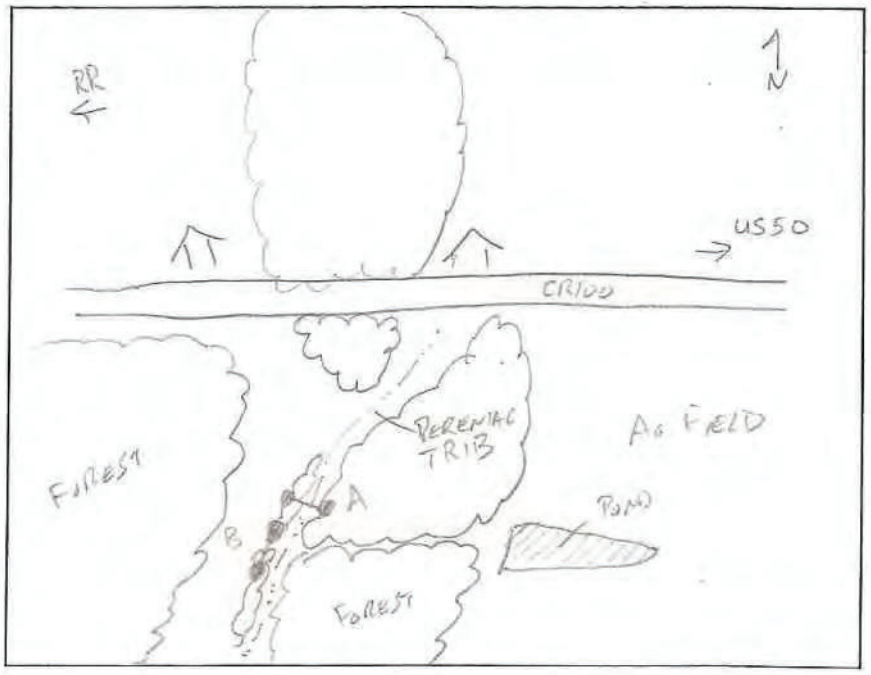
Stream

Bank Height (ft): 3
Channel Width (ft): 18
Water Width (ft): 15
Average Water Depth (ft): 1.0
Dominant Substrate: COBBLE
Turbidity (clear/cloudy): CLOUDY

Comments/Descriptions

SITE IS LOCATED ALONG AND ADJACENT TO A PERENIAL TRIBUTARY, SOUTH OF CR 100, WEST OF US50. LARGE BLOCK OF FOREST JUST SOUTH OF SITE. RECENT LOGGING IS EVIDENT. POOLS IN STREAM LOOK IDEAL FOR FORAGING/DRINKING.

Site Drawing



APPENDIX C BAT CAPTURE DATA SHEETS

BAT CAPTURE DATA FORM

Site: 1 **Investigator(s):** Robert Oney, Shane Roberts **Date:** July 21, 2009

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	21:00	71.0	79%	100 clouds	0	0	new moon
Mistnet End	03:00	67.3	89%	100 clouds	0	0	

Comments and Other Wildlife Noted: Green frog, Bullfrog. Rain started @ 11:32 pm (light)

Rain out

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
Perimyotis subflavus	A	21:18	3m	J	m	NR	5.0	33.5	0	—
Lasiurus borealis	B	21:30	5m	J	m	NR	9.0	40.8	0	—

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 1 **Investigator(s):** Robert Oney Shane Roberts **Date:** July 22, 2009

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	21:00	67.6°F	95%	100%	0	0	new moon
Mistnet End	02:00	64.9°F	95%	100%	0	light	

Comments and Other Wildlife Noted: Steady rain throughout the day, heavy at times, stopped around 20:00.

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
Lasiurus borealis	B	22:30	4	J	M	N R	10	38.9	0	—

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 1 Investigator(s): Robert C. Oney, Shane Roberts Date: July 23, 2009

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	21:00	71.2°F	73%	Clear	0	0	New Moon
Mistnet End	02.00	61.8°F	92%	Clear	0	0	

Comments and Other Wildlife Noted:

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
Perimyotis subflavus	B	23:56	5m	A	F	PL	7.2	35.2	0	—

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 2 **Investigator(s):** L. DROPPELMAN, T. BROWN **Date:** 7/19/09

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	21:00	71.2	58	CLEAR	NONE	SLIGHT	3/4
Mistnet End	02:00	57.8	76	CLEAR	NONE	NONE	

Comments and Other Wildlife Noted:

RACOON, W.T. DEER, N. LEOPARD FROG, BULLFROG

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
PERIMYOTIS SUBFLAVUS	A	22:20	4.0	A	F	L	7.4	33	0	
MYOTIS LUCIFUGUS	A	22:20	4.0	A	M	N	7.0	35	1	
M. LUCIFUGUS	A	22:40	2.5	A	F	PL	9.0	38	0	

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 2 Investigator(s): L. DROPPELMAN, T. BROWN Date: 7/20/09

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	21:00	69.5	59	CLEAR	NONE	SLIGHT	3/4
Mistnet End	02:00	61.0	81	CLEAR	SLIGHT	SLIGHT	

Comments and Other Wildlife Noted: MANY BEETLES FLYING
FEW BATS OBSERVED FLYING

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
MYOTIS SEPTENTRIONALIS	B	23:20	3.0	A	M	NON	6.5	35	1	—

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 3 Investigator(s): L. DROPPELMAN / T. BROWN Date: 7/16/09

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	21:00	69.0	59	OVERCAST	NONE	NONE	3/4
Mistnet End	02:00	67.8	76	CLOUDY	NONE	NONE	

Comments and Other Wildlife Noted:

W.T. DEER, GREEN FROG, NO. WATER SNAKE

QUIET. VERY LITTLE BAT ACTIVITY OBSERVED

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
MYCTICEIUS HUMERALIS	A	23:30	3.0	J	M	N	10.0	37	1	
EPTESICUS FUSCUS	B	02:00	4.0	A	M	N	19.8	49	0	

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 3 **Investigator(s):** L. DROPPELMAN, T. BROWN **Date:** 7/17/09

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	21:00	60.3	59	50% CLOUDY	NONE	SLIGHT	3/4
Mistnet End	02:00	55.8	78	CLEAR	NONE	NONE	

Comments and Other Wildlife Noted:

W.T. DEER, WILD TURKEY, SCREECH OWL

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
MYOTIS SEPTENTRIONALIS	B	22:15	3.0	J	F	N	5.5	38	0	
EPTESICUS FUSCUS	A	23:40	3.0	A	F	PL	19.0	48	0	
M. LUCIFUGUS	B	02:00	3.5	A	M	N	7.5	38	0	

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 4 **Investigator(s):** Scott Slankard, Travis Brown **Date:** 7-21-09

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	21:00	72°	NA	100% clouds	Ø	Ø	New Moon
Mistnet End	00:00	67°	NA	Rain	Ø	1-3 mph	

Comments and Other Wildlife Noted: Rana sylvatica (sight)

Closed site due to rain @ 00:00 (midnight)

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
L. borealis	A	21:10	3	J	F	NR	10.0	42	Ø	—
E. fuscus	A	00:00	6	A	M	TND	18.5	49	Ø	—

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 4 **Investigator(s):** Scott Slankard, Travis Brown **Date:** 7-22-09

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	21:00	68°	NA	100% Clouds	Ø	1-3	New Moon
Mistnet End	02:00	65°	NA	100% Clouds	Ø	1-3	

Comments and Other Wildlife Noted: Rana Catesbiana (heard & sighted)
Bufo fowleri (sight)

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
P. subflavus	B	23:40	5	A	F	PL	7.0	35	Ø	—
M. lucifugus	B	00:30	2	A	F	NR	9.0	38	Ø	0-3005

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 4 **Investigator(s):** Scott Slankard, Travis Brown **Date:** 7-23-09

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	21:00	68°	NA	Clear	Ø	Ø	New Moon
Mistnet End	02:00	63°	NA	Clear	Ø	Ø	

Comments and Other Wildlife Noted: Green Heron (sight)
Rana catesbiana (sight & sound)
Eastern Screech owl (sound)
whip-poor-will (sound)
canis latrans (sound)

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
M. lucifugus	A	22:20	3	A	F	PL	8.5	40	Ø	0-3006
P. subflavus	A	22:20	2	J	M	TND	5.0	34	Ø	—
M. septentrionalis	A	22:20	2	A	F	NR	7.5	36	Ø	0-3007
M. lucifugus	A	00:40	2.5	A	F	PL	7.0	39	Ø	0-3008
E. fuscus	A	01:30	4.5	A	M	TND	17.0	50	Ø	—

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 5 Investigator(s): L. DROPPELMAN Date: 7/21/09

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	21:00	73.8	56	CLOUDY	NONE	NONE	1/2
Mistnet End	23:30	67.8	100	RAIN	NONE	SLIGHT	

Comments and Other Wildlife Noted:

GRAY TREE FROG, BULL FROG, N. LEOPARD FROG LA. WATER THRUSH IN NET AT 21:20

RAINED OUT AT 23:30

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
EPTESICUS FUSCUS	A	21:20	4.0	A	M	N	15.2	47	1	
MYOTIS SEPTENTRIONALIS	A	21:20	4.0	J	M	N	5.4	34	0	
LASIURUS BOREALIS	A	21:40	1.0		M	—	EFN	—	—	
PERIMYOTIS SUBFLAVUS	A	21:40	2.0	A	F	L	7.4	35	1	
LASIURUS BOREALIS	A	22:30	3.0	J	F	N	8.6	40	0	
E. FUSCUS	A	22:40	1.5	A	M	N	17.0	45	1	

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 5 Investigator(s): L. DROOPERMAN Date: 7/22/09

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	21:00	68.3	90	CLOUDY	NONE	NONE	1/2
Mistnet End	02:00	65.1	91	CLOUDY	SLIGHT	SLIGHT	

Comments and Other Wildlife Noted:

RAIN TILL 19:30 VERY LITTLE BAT ACTIVITY OBSERVED

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
NO BATS										

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 5 Investigator(s): L. DROBELMAN Date: 7/23/09

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	21:00	75.7	73	P. CLOUDY	NONE	SLIGHT	1/2
Mistnet End	02:00	60.2	91	CLEAR	MODERATE	NONE	

Comments and Other Wildlife Noted:

GREAT HORNED OWL, N. LEOPARD FROG

RECENT RAINS SEEM TO HAVE DIMINISHED THE USE OF THIS STREAM AS A WATERING AND FORAGING LOCATION

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
LASIURUS BOREALIS	A	22:20	3.0	A	F	PL	14.1	42	1	—

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

APPENDIX D PHOTOGRAPHS

Mist net Site 1; Net A

Mist net Site 1; Net B

Mist net Site 2; Net A

Mist net Site 2; Net B

Mist net Site 3; Net A

Mist net Site 3; Net B

Mist net Site 4; Net A

Mist net Site 4; Net B

Mist net Site 5; Net A

Mist net Site 5; Net B

Potential cave investigated near mist net site 2.

Big brown bat (*Eptesicus fuscus*) captured at site 3.

Eastern red bat (*Lasiurus borealis*) captured at site 4.

Little brown bat (*Myotis lucifugus*) captured at site 3.

Northern long-eared bat (*Myotis septentrionalis*) captured at site 3.

Eastern pipistrelle (*Perimyotis subflavus*) captured at site 4.

Evening bat (*Nycticeius humeralis*) captured at site 3. This species is listed as endangered by the state of Indiana.

APPENDIX C

2012 INDIANA BAT SURVEY REPORT

MIST NET SURVEY FOR FEDERALLY LISTED BAT SPECIES FOR THE PROPOSED U.S. 50 NORTH VERNON BYPASS (EAST) IN JENNINGS COUNTY, INDIANA

Prepared for:
Indiana Department of Transportation
&
Parsons Corporation
Indianapolis, IN

Prepared by:
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Louisville, KY

September 2012

MIST NET SURVEY FOR FEDERALLY LISTED BAT SPECIES
FOR THE PROPOSED U.S. 50 NORTH VERNON BYPASS (EAST)
IN JENNINGS COUNTY, INDIANA

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1.0 INTRODUCTION

Eco-Tech Consultants was retained by Parsons Corporation and the Indiana Department of Transportation (INDOT) to conduct a summer mist net survey for the federally endangered Indiana bat (*Myotis sodalis*) and gray bat (*M. grisescens*) for the proposed US 50, North Vernon Bypass (East) in Jennings County, IN (Appendix A, Figures 1,2).

The purpose of this survey was to determine presence/likely absence of Indiana bat and gray bats within potential summer roosting habitat along the clearing limits of multiple potential alignments for the proposed bypass. This survey was performed in accordance with the Agency Draft Indiana Bat Revised Recovery Plan (USFWS 2007). A total of 11 sites were surveyed using standard mist netting protocol (Appendix A, Figure 3).

1.1 Description of Study Area

This survey was conducted within an approximately 1 km buffer of proposed clearing limits located in Jennings County, Indiana. The proposed project is situated entirely within the Eastern Corn Belt Plains (55) Level III Ecoregion as mapped by the US Environmental Protection Agency (USEPA 1997). This section of the Eastern Corn Belt Plains (55) is characterized by rolling plains with poorly drained soils and high stream biodiversity. Average annual precipitation is 35-40 inches. This area has been heavily cleared for agriculture, especially corn and soybeans.

The proposed project occurs in the North Vernon and Butlerville, Indiana USGS 7.5-Minute Topographic Quadrangles. Six alternative road alignments are currently being evaluated. Of these, two will be chosen for detailed evaluation in late summer of 2012. The alternatives begin at Highway 3 approximately 1.5 miles north of the intersection with Highway 7. From this western terminus, each alignment is directed in a southeasterly direction towards the eastern terminus at US 50. A Project Location Map is included in Appendix A (Figure 1,2). The immediate surrounding area is primarily agriculture, but small tracts of forested land are intermixed including Selmier State Forest. The alignment will cross the Vernon Fork of the Muscatatuck River, a potential flyway for bats which is largely forested throughout most of its watershed.

2.0 NATURAL HISTORY

2.1 Gray Bat (Myotis grisescens)

Species Status

The gray bat was listed as a federally endangered species on April 28, 1976 by the United States Fish and Wildlife Service (USFWS; 1982); affording it protection under the Endangered Species Act of 1973 (Public Law 93-205), as amended. USFWS biologists (i.e. the recovery team) subsequently developed and released a recovery plan several years later. Five primary causes for the decline in gray bat populations are outlined in the recovery plan: 1) direct human disturbance to individuals, 2) human disturbance to the environment, 3) destruction of roost caves by collapse or river impoundment, 4) cave commercialization, and 5) natural sources of mortality. Following the protection of hibernacula and maternity caves from human disturbance, gray bat populations started to recover at all protected caves. Harvey (2001) reported a population increase of 16.5 percent since the time of listing. Due to the increase in

numbers throughout their range, it was proposed in 2002 that the gray bat's status be reclassified ("downlisted") from endangered to threatened (Department of Interior 2002).

However, white-nose syndrome (WNS), a fungal disease first found in cave-hibernating bats during the winter of 2006-2007, presents a severe threat to gray bats. Having been found originally in New England, this malady has caused precipitous declines in bat populations in the eastern U.S. In subsequent years, the fungus associated with WNS (*Geomyces destructans*) has been found in bats within the primary hibernating range of gray bats. Although WNS has been found in few gray bats to date, the range of this disease continues to rapidly expand and it will likely affect all cave-dwelling bats (USFWS 2012a).

Distribution

The range of the gray bat is restricted to the cave regions of Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Kansas, Kentucky, Mississippi, Missouri, Oklahoma, Tennessee, and Virginia (Barbour and Davis 1969). Most of the large concentrations of gray bats occur in Alabama, Kentucky, Missouri, and Tennessee. The majority (95%) of the range-wide population hibernates in nine Priority 1 hibernacula (sites that currently and/or historically contained more than 25,000 individuals), which are located in Alabama (one site), Arkansas (one site), Kentucky (one site), Missouri (three sites), and Tennessee (three sites) (USFWS 1982).

Description

Gray bats are a member of the *Myotis* genus. The gray bat typically weighs 8-16 grams with a wingspan of 11-12 inches. Its diet consists primarily of insects. Water resources provide important hunting grounds. Unlike other *Myotis* species, the gray bat's wing membrane connects to its ankle instead of at the toe, and there is a prominent notch in its toe claws. Its fur is unicolored on the back and ranges in color from dark gray to chestnut brown or russet.

Habitat Requirements

Gray bats are year-round cave residents; however, they inhabit caves with different temperatures in the summer and winter months (Gore 1992). During winter months, gray bats hibernate in caves that are cooler than summer caves and have temperatures of 42 to 52 ºF (Harvey et al. 1999). These bats typically hibernate in large groups and hang loosely with their forearms stuck out at angles, rather than parallel to the body (Barbour and Davis 1969).

Prior to entering hibernacula, gray bats will swarm at the entrance of the cave (USFWS 1982). Individuals return to the same hibernaculum every year (Tuttle 1976a). Reproductively active females leave their summer habitat and arrive at the caves in September before males and juveniles arrive in October (Tuttle 1976a). By this time, males will be reproductively active and copulation takes place upon arrival at the cave (USFWS 1982). The majority of mating occurs in October and November (Barbour and Davis 1969). Females enter hibernation immediately after mating occurs, while males and some juveniles may stay active until early November (USFWS 1982). Supplemental copulation may occur during the period of hibernation (Guthrie 1933, Hall 1962, Miller 1939, Mumford 1958, Saugey 1978).

Gray bats may migrate long distances to and from their hibernacula. Hall and Wilson (1966), documented that gray bats would travel as far as 126 miles from a summer cave to a hibernaculum, when a bat banded in Hardin County, Illinois was recovered at Coach Cave in Edmonson County, Kentucky. Tuttle (1976a) found that the bats may travel 11 to 272 miles to and from hibernacula. Hall and Wilson (1966) point to the small number of hibernacula for a relatively wide-ranging species to account for this difference in migration distances.

Following six to seven months of hibernation, adult females emerge in late March or early April, followed by juveniles and adult males (Tuttle 1976a). During autumn and spring migration, gray bats may roost temporarily in caves, referred to as transitional caves, which may not otherwise be used for maternity or hibernation (Tuttle 1976a). Individuals or groups of gray bats may inhabit transitional caves for brief periods in March through April, and September through October before moving to summer roosts or hibernacula (Barbour and Davis 1969, Tuttle 1976a). Migration distances up to 326 miles have been reported (Tuttle 1976a).

Females congregate in maternity caves and give birth to a single young in late May or early June (Tuttle 1976b). Most males and non-reproductive females use non-maternity caves during this part of the summer (Thomas 1994). Maternity colonies may contain tens of thousands of females and their young (USFWS 1982). These caves are vulnerable to human disturbances because gray bats will fly from their roost sites quickly, knocking young to the floor (Tuttle and Stevenson 1977). If disturbances continue, gray bats will abandon nursery roosts (Barbour and Davis 1969, Tuttle and Stevenson 1977). Most young are volant within 20–25 days of birth (Saugey 1978). Lactation typically ends by late July, and most females and juveniles subsequently leave the maternity caves (LaVal and LaVal 1980).

During late July and August, gray bats of mixed ages and sexes roost in caves throughout the summering area, and frequently move among caves in the home range of the colony (LaVal and LaVal 1980, Thomas 1994). In September, females begin to congregate at transitional caves, and by the end of the month most females have left to return to hibernacula (Gore 1992, LaVal and LaVal 1980). Most male gray bats leave summer habitat by November, although a small number of males may remain in transitional caves through winter (LaVal and LaVal 1980, USFWS 1982). Mating occurs after autumn migration when gray bats arrive at hibernacula (Barbour and Davis 1969, USFWS 1982). Females store sperm through the winter and fertilization is delayed until after emergence from hibernation (Guthrie and Jeffers 1938).

Each summer colony occupies a home range that often contains several roost caves (Thomas 1994, Tuttle 1976a). Female gray bats often return to the same summer range each year (Tuttle 1976b). The colony home range may encompass up to 40 miles of river or reservoir shoreline (USFWS 1982). Thomas and Best (2000) found that gray bats in the Guntersville Reservoir area of northern Alabama had large home ranges with a minimum average size of 37.5 square miles. Individually, the bats exhibit fidelity to the colony home range, but may roost in several caves within the range (Goebel 1996, Tuttle 1976a, USFWS 1982).

Upon emergence from roosts, gray bats typically follow a stream path to foraging areas (Tuttle 1976b), though they may fly directly over land with little hydrological features to reach foraging

areas (Thomas 1994). Foraging areas consist of water bodies (streams, reservoirs, lakes, wetlands), and adjacent riparian vegetation along wide sections of rivers (LaVal et al. 1977, Mitchell and Martin 2002, Rabinowitz and Tuttle 1982). Newly volant young often forage in forests that provide feeding cover surrounding the maternity cave (USFWS 1982). Both large and small perennial streams provide suitable foraging habitat for gray bats (LaVal et al. 1977). Forested riparian zones may improve the suitability of a river or reservoir for foraging gray bats. For example, at one reservoir in Tennessee, gray bats typically were observed foraging over portions of the reservoir with slab rock bottom and forested riparian zones (USFWS 1982). In Missouri, a higher proportion of gray bats foraged along wooded bluffs than near cleared agricultural fields (LaVal et al. 1977, LaVal and LaVal 1980). Gray bats were also found foraging over wetland depressions at Arnold Air Force Base in Tennessee (Mitchell and Martin 2002).

Gray bats may fly great distances during nightly foraging trips (USFWS 1982). Tuttle (1976a) indicated gray bats regularly made trips of 9–21 miles in a single night. In Tennessee, gray bat foraging territories were identified up to 12 miles from the roost cave. In Missouri, gray bats were observed foraging as far as 12 miles from their roost cave, and other individuals traveled approximately 15 miles to reach a foraging area over a large lake (LaVal and LaVal 1980). In Alabama, gray bats foraged 3–13 miles from the roost cave (Goebel 1996).

During summer, gray bats (especially males and juveniles) have also been found day and night roosting under bridges (Johnson et al. 2002). Bridges may be important resting places during foraging for gray bats because of the long distances they travel. Moreover, bridges provide a thermal refuge due to their tendency to retain radiant heat better than other types of night roosts (Johnson et al. 2002).

2.2 Indiana Bat (Myotis sodalis)

The Indiana bat is a temperate, insectivorous, migratory bat that hibernates in caves and abandoned mines during winter and spends the summer season in forested areas. It was listed as an endangered species on March 11, 1967 by the USFWS. However, the Indiana bat did not receive protection until enactment of the Endangered Species Act in 1973 (Public Law 93-205), as amended. Critical habitat for the species was designated on September 24, 1976; it consisted of 11 caves and two mines in six states. Several years following its listing, an Indiana bat recovery plan was developed by biologists (i.e., the recovery team), which outlines habitat requirements, critical habitat, potential causes for declines, and recovery objectives. The recovery plan was reviewed and published by the USFWS in 1983 (Brady et al. 1983). An agency draft of a revised plan was published in 1999, but it was never finalized. The Indiana bat recovery team is currently utilizing new information and making revisions to the recovery plan (USFWS 2007).

Indiana bat estimated population numbers have consistently declined from 1965 to 2001. This steady overall decline can be attributed to several causes including human modifications to hibernacula and surrounding areas, disturbance and vandalism of hibernacula, natural catastrophes, and threats to summer habitat and migration pathways, including loss and degradation of forested habitat (USFWS 2007). Even with the discovery of many new, large hibernacula, the range wide population estimate dropped approximately 57 percent from 1965

to 2001. However, estimates of range wide Indiana bat population totals from surveys conducted post-2001 have actually increased. In 2005, a 15% population increase was found, yielding an approximate total of 457,000 Indiana bats (USFWS 2007). The USFWS views the apparent upward population trend as viable because the same surveyors have been consistently conducting the winter surveys at all large hibernacula over the past 20 years. Moreover, large increases in local populations at 34 known high-priority hibernacula in recent years have been observed. The USFWS (2007) anticipates that planned improvements in hibernacula survey methodology will soon provide an even greater confidence level in the overall population trend.

Distribution

The Indiana bat's range includes most of the eastern United States. It is known to occur from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida (Barbour and Davis 1969, Gardner and Cook 2002). The species' range is generally consistent with the presence of limestone caves that serve as hibernacula in the winter (Menzel et al. 2001). According to the USFWS (2007) winter survey results from 2005 indicated that there were a total of 23 Priority 1 hibernacula in seven states; including Illinois (one site), Indiana (seven sites), Kentucky (five sites), Missouri (six sites), New York (two sites), Tennessee (one site), and West Virginia (one site). Over 90 percent of the estimated range wide Indiana bat population hibernates in only five states, Indiana (45.2%), Missouri (14.2%), Kentucky (13.6%), Illinois (9.7%), and New York (9.1%).

Indiana bats are known to migrate up to 360 miles from their hibernacula to find suitable summer habitat to raise offspring (Kurta and Murray 2002, Winhold and Kurta 2006). Although, some migrate much shorter distances as evidenced by banded female Indiana bat recoveries from maternity colonies at Mammoth Cave National Park. Additionally, recent radio-telemetry studies in New York found that of 70 Indiana bats emerging from three hibernacula most migrated to summer habitat only 40 miles away (USFWS 2007). Until recently, it was thought that the entire species, with the exception of some males, migrated north and west from their hibernacula to forested areas in Missouri, Indiana, Kentucky, Iowa, Ohio, and Michigan during the summer (Barbour and Davis 1969). This migration pattern was illustrated by Barbour and Davis (1969), with summer band recoveries near the Wayne National Forest in southern Ohio of both male and female bats banded at Carter Caves State Resort Park, in Carter County, Kentucky. Moreover, reproductive Indiana bats have now been documented in the following states: Arkansas, Illinois, Indiana, Iowa, Kentucky, Michigan, Maryland, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Vermont, Virginia, and West Virginia (USFWS 2007).

Although Indiana bat maternity colonies occur throughout much of the mideastern United States (e.g., West Virginia, Virginia, Pennsylvania, New York), they appear to be relatively less abundant in these peripheral portions of their range (USFWS 2007). The regional differences in summer distribution and relative abundance are likely influenced by geographic distribution of important hibernacula and also by regional climate and elevation variation (USFWS 2007, Brack et al. 2002). Therefore, the understanding of how and to what extent these factors influence the distribution and abundance of maternity colonies is still evolving (USFWS 2007).

Autumn and Winter Habitat

Indiana bats use sloughing bark and cracks in dead, partially dead, and live trees as day roosts during autumn (Kiser and Elliott 1996, MacGregor et al.1999). Autumn roost trees range from 4.7 to 26.4 inches in diameter at breast height (dbh) and occur in forested, semi-forested, and open habitats (Kiser and Elliott 1996). Depending on local weather conditions, Indiana bats normally enter the hibernaculum in October and remain there through April (Hall 1962, LaVal et al. 1977, LaVal and LaVal 1980).

Prior to entering the hibernacula in autumn, swarming occurs at the entrances of either the hibernacula (Cope and Humphrey 1977) or other caves located near the hibernacula (LaVal et al. 1977). Swarming usually lasts for several weeks (August - September) and mating occurs toward the end of this period. Mated females usually enter directly into hibernation, whereas males may remain active through the end of November. Reproductive females store sperm through the winter, delaying fertilization until early May. During April and May the majority of the Indiana bat population emerges, leaving their cave areas to find suitable summer habitat. However, some male and non-reproductive female Indiana bats will remain near the hibernacula during the summer. Females usually start grouping into larger nursery colonies by mid-May and give birth to a single young between late June and early July (Easterla and Watkins 1969, Humphrey et al. 1977).

Indiana bats hibernate primarily in caves, but they have also been documented using abandoned mines. As of November 2006, the USFWS (2007) has winter records of 281 distinct hibernacula in 19 states that have been occupied continually since 1995. According to Barbour and Davis (1969), 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 to lower temperature areas of the cave as outside temperatures decrease. In mid-winter Indiana bats tend to roost in portions of the cave where temperatures are cool (37° to 43°F). Relative humidity in Indiana bat hibernacula tends to be high, usually above 74 percent, but not exceeding saturation (Hall 1962, Humphrey 1978, Kurta and Teramino 1994, LaVal et al. 1976).

Summer Habitat

Selection of roost trees by Indiana bat colonies are based on structural characteristics. Tree diameter, solar exposure, and height in canopy are among the most important (Romme et al. 1995, Kurta and Murray 2002). Male and female Indiana bats inhabit different habitats and choose roost trees with differing characteristics during the summer months (Kurta 2005). Reproductive females tend to choose roosts in mature forests with large trees, scattered gaps in the canopy, and an open understory (Gardner et al. 1991b, Callahan et al. 1997). The number of available roost trees in an area influences the suitability of habitat for female Indiana bats (Kurta 2005). Gardner et al. (1991b) found that of 39 roost trees evaluated, 31% were not suitable the following summer, and that 33% of the remaining trees were unavailable for use after two summers. Thus roost trees are an ephemeral resource.

Maternity colonies have been found under sloughing bark of dead, partially dead and live trees (Carter 2003, Gardner et al. 1991b, Kurta et al. 1993, Kurta et al. 2002, Romme et al. 1995). These colonies have been found in lowland forests (Cope et al. 1974, Humphrey et al. 1977),

and more recently in upland forests (Callahan et al. 1997, Clark et al. 1987, Gardner et al. 1991b, Kiser et al. 2002). Such colonies are usually located in large-diameter, standing dead trees, with direct exposure to sunlight (Callahan et al. 1997). Maternity roosts can contain over 350 individual bats during July and August (Kiser et al. 1998). During Callahan's study (1997), he arranged roost trees into two groups depending on the intensity of use and size of the colony that used each tree. Callahan (1993) classified any tree that was used more than once by greater than 30 bats each time as a primary roost tree, and any tree with less than 30 bats or used only once as an alternate roost tree. The primary roost trees had an average dbh of 22.4 inches, while open snags used as alternate roosts had an average dbh of 20.9 inches (Callahan et al. 1997).

Indiana bats require more than one roost tree to fulfill their needs during the summer (Callahan et al. 1997). Barclay and Kurta (2004) found one maternity colony that used 18 roost trees during a single summer. In addition, Indiana bats are known to roost in several different species of trees, selecting roost trees by the structural composition of each tree. Farmer et al. (1997) contends that structure is probably more important than tree species in selection of roost trees.

Twelve tree species are listed in the Habitat Suitability Index Model (Romme et al. 1995) as primary species (class 1 trees). The trees listed by Romme et al. (1995) 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*), northern red oak (*Quercus rubra*), post oak (*Q. stellata*), white oak (*Q. alba*), slippery elm (*Ulmus rubra*), and American elm (*U. americana*). In addition to these species, Romme et al. (1995) listed sugar maple (*A. saccharum*), shingle oak (*Q. imbricaria*), and sassafras (*Sassafras albidum*) as class 2 trees. The class 2 trees are those species believed to be less important, but still have the necessary characteristics to be used as roosts. Trees normally used as primary roosts are dead and have a dbh greater than 12 inches (Romme et al. 1995).

At least 33 tree species have been found to be roosts for reproductive female Indiana bats, and 87 percent of them are ashes (13%), elms (13%), hickories (22%), maples (15%), poplars (9%), and oaks (15%; USFWS 2007). It was previously believed that oak and hickory were used more commonly in the southern portion of the range (Callahan et al. 1997, Gardner et al. 1991b), and elm, ash, maple, and cottonwood were occupied more often in northern areas (Kurta et al. 1996, 2002; Whitaker and Brack 2002). However, more recent research reveals that Indiana bats occupy ash and elm most often in southern Illinois (Carter 2003) and hickories most often in Vermont (Palm 2003). Therefore, it appears that tree species use is more closely related to local availability and suitable structure than to broad regional preferences (USFWS 2007). Nonetheless, some common trees, such as American beech (*Fagus grandifolia*), basswood (*Tilia americana*), wild black cherry (*Prunus serotina*), box elder (*A. negundo*), and willow (*Salix* spp.), are rarely to never used, suggesting that they are typically not acceptable even when suitable structure is present, especially as a primary roost (USFWS 2007).

Most (97%) roost trees of female Indiana bats at maternity sites are deciduous species, except for a few coniferous trees discovered in the Great Smoky Mountains (Harvey 2002, Britzke et al. 2003) and in New England (Palm 2003). This more likely reflects availability rather than a preference for coniferous trees (USFWS 2007).

Food Habits

Historically, the Indiana bat was thought to prey primarily on moths (Lepidoptera), beetles (Coleoptera), true flies (Diptera), and caddisflies (Trichoptera) (Belwood 1979, Brack 1983, Brack and LaVal 1985). During a study by Belwood (1979), the primary insects consumed by females and juveniles in southern Indiana were Lepidoptera (57%), Diptera (18%), and Coleoptera (9%). Belwood's information was very similar to a three-year study conducted by Brack (1983) throughout Indiana. Brack (1983) found that Indiana bats consumed Lepidoptera (48%), Coleoptera (24%), and Diptera (8.5%). He also found Trichoptera (9.8%) to be an important food source. Studies by Lee (1993) and Kurta and Whitaker (1998) found that the same four insect orders were consumed by Indiana bats in central/northern Indiana and in Michigan. However, these studies showed that Indiana bats preyed much more heavily on caddisflies in central/northern Indiana and in Michigan. The female Indiana bats in central and northern Indiana consumed Lepidoptera (40%), Trichoptera (29%), Coleoptera (13%), and Diptera (9%) (Lee 1993). The most recent Indiana bat food habits study was conducted in Michigan at the northern limits of the species' range. These bats consumed primarily Trichoptera (55.1%) and Diptera (25.5%), which have aquatic larvae (Kurta and Whitaker 1998). These authors hypothesized that Indiana bats in northern portions of their range feed more on aquatic insects than southern populations because they forage primarily over streams and wetlands.

The only food habit information from Kentucky for Indiana bats is from Jackson County. Kiser and Elliott (1996) conducted a study to determine the food habits of male Indiana bats at a cave entrance. During the autumn of 1994 and 1995, male Indiana bats consumed primarily Lepidoptera (28.5% and 34.0%), Coleoptera (15.9% and 40.2%), Homoptera (15.3% and 4.5%), and Diptera (28.8 % and 18.8%). The increase in consumption of snout beetles (Coleoptera: Curculionidae) during the 1995 samples indicates that Indiana bats are opportunistic foragers (Kiser and Elliott 1996).

Indiana bats forage primarily in forested habitats (Cope et al. 1974, Humphrey et al. 1977, LaVal et al. 1977, Belwood 1979), but they will also forage in edges of forests and croplands, fallow fields, and areas of impounded water (Gardner et al. 1991a). Indiana bats may use as many as four different foraging areas during nightly foraging (Murray 1998), using the same travel corridor each night to move from the roost tree to the foraging areas. It has been documented that Indiana bats may travel up to three miles from their summer roosts to summer foraging areas and will visit these same areas each night. Reproductively active females traveled a maximum mean distance of 1.5 miles from their roost trees to foraging areas in Illinois (Gardner et al. 1991a). During a study by Pruitt et al. (1995) at the Jefferson Proving Ground (JPG), Jefferson County, Indiana, reproductive female bats were found to travel a mean distance of 1.7 miles from their original capture sites to their roost trees. Also at JPG, a male traveled 0.4

mile from the capture site to its roost; this distance is less, but similar to the distance of 0.7 mile found by Gardner et al. (1991a) for males in Illinois.

2.3 White-Nose Syndrome (WNS)

White-nose syndrome (WNS) is an emerging infectious fungal disease that has resulted in high levels of mortality in multiple cave dwelling bat species. The emergence of this pathogen has destabilized healthy bat populations and all, but eliminated vulnerable populations. Its alarming virulence and mortality, rapid spread, and epidemiological complexity has largely shaped the way contemporary bat research and management is conducted. Bat management and conservation in the WNS era has arisen as one of the top conservation issues of the 21st century.

WNS has been characterized as a condition affecting hibernating bats and was named for the white fungal growth located on hairless areas of the body such as the muzzle, ears, and/or wing/tail membranes (Blehert et al. 2009, Lorch et al. 2011, Meteyer et al*.,* 2011). Behavioral responses to WNS include movement to entrances of hibernacula, day flight during mid-winter, cluster formation on the ground, and other uncharacteristic winter/hibernating behavior (Blehert et al. 2009, Foley et al. 2011). Bats affected with WNS are thought to leave their hibernacula early in search of food and, subsequently, starve or freeze to death.

WNS was first documented by a photograph taken at Howes Cave, approximately 32 miles west of Albany, New York in February 2006 (Blehert et al. 2009). A caver photographed hibernating bats with an unusual white substance on their muzzles and observed several dead bats (USFWS 2009a). The following winter, New York Department of Environmental Conservation biologists documented WNS after observing bats exhibiting abnormal behavior, a white, powdery substance on the muzzle, and a few hundred dead bats in several caves in the Albany, NY area (USFWS 2009a). Since then, sick, dying and dead bats have been found in unprecedented numbers in and around caves and mines throughout the eastern United States.

USFWS now estimates mortality to be at least 5.7 million (USFWS 2012a). In some hibernaculum, 90 to 100 percent of infected bats are dying (USFWS 2009a). Since the 2010-2011 winters, WNS has spread to 19 states and four Canadian provinces including: Connecticut, Indiana, Kentucky, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia, New Brunswick (CAN), Nova Scotia (CAN), Ontario (CAN), and Quebec (CAN; USFWS 2011a). WNS threatens to spread further into the Midwest, Southeast, and West which are home to many federally endangered bat species as well as some the largest known bat populations in the country (USFWS 2009a).

Researchers associate a newly identified psychrophilic fungus (*Geomyces destructans*) as the etiologic agent of white-nose syndrome (Foley et al. 2011, Lorch et al. 2011, Blehert 2012, Reeder et al. 2012, Warnecke et al. 2012). This fungus thrives in the cold (3-15°C) and humid (>90%) conditions characteristic of the caves and mines used by bats (USFWS 2009b, Foley et al. 2011). Bats with obvious WNS symptoms have shown noticeable agitation and excessive grooming. Biologists believe that these infected bats may be waking up more often throughout

hibernation to groom themselves leading to an increased use of fat reserves needed for winter hibernation. However, once clean the bat will re-enter torpor allowing the fungus to re-establish. Cryan et al. (2010) suggested the fungus might directly interfere with important physiological functions leading to disruptions in homeostasis, thermoregulation, and respiration while also increasing the risk of dehydration, among other things. Specifically, this fungus has been observed to cause a higher metabolic rate in hibernating bats which can lead to more frequent arousals (Janicki, 2010, Reeder et al. 2012). This can also result in the reduction of adipose storage in bats hibernating in caves, usually followed by mortality (Frick et al., 2010). Nine bat species currently known to be affected by white-nose syndrome include the little brown bat (*Myotis lucifugus*), Indiana bat, eastern small-footed bat (*M. leibii*), northern long-eared bat (*M. septentrionalis*), gray bat (*M. grisescens*), tri-colored bat (*Perimyotis subflavus*), big brown bat (*Eptesicus fuscus*), cave bat (*M. velifer)* and the southeastern bat (*M. austroriparius)* (Foley et al. 2011). Both the federally listed Virginia big-eared bat (*Corynorhinus townsendii virginianus*) and Ozark big-eared bat (*Corynorhinus townsendii ingens*) are found in the affected area, but neither has been confirmed with white-nose syndrome of *G. destructans* infection.

The means of transmission of WNS has shown to be possible through direct contact among bats (Lorch et al. 2011). Evidence collected to date indicates that human activity in caves and mines may be assisting in the spread of WNS since some caves used by people have WNS affected bats, while other, nearby caves not used by people do not seem to be affected. It is likely that the fungus can be transported inadvertently from site-to-site on gear and boots of cave visitors (USFWS 2009a, Lindner et al. 2010). Adherence to the federal WNS disinfection protocol is required by all cavers, biologists, and tourists to reduce the human spread of this fungus (USFWS, 2012b).

Human health implications are not known and there is no information indicating that people or other animals have been affected after exposure to the white fungus (Blehert 2012).

3.0 MATERIALS AND METHODS

3.1 Mist Net Survey

This survey was conducted in accordance with the guidelines of Appendix 5 of the "Indiana Bat Draft Recovery Plan: First Revision" (USFWS 2007). These guidelines call for one net site to be netted for two calendar nights per 1 km for linear projects. Surveys must be conducted between May 15 and August 15 and are temperature and precipitation dependent.

In order to identify forest impacts, Eco-Tech biologists conducted a desktop review of the proposed bypass alternative combinations using current aerial photography, topographic maps, and the proposed project area map provided by the client. A 0.5 km buffer was placed around all alignments to serve as the potential survey extent. Altogether there is a total of 14 km of linear suitable habitat along the proposed alignments. However, there is significant overlap among the alignment buffers. After a map review of available habitat, potential mist net sites, and the proposed alignments during coordination with USFWS field office biologist Mike Litwin,

it was decided that 11 mist net sites would suitably sample all available habitat (concurrence, 8/1/12).

Mist net sites were chosen based on factors such as the presence of travel corridors and water, a relatively closed canopy cover, and potential access. The most current available aerial photography and topographic maps were used to determine the extent of tree clearing and presence or absence of potentially nettable features. Actual locations of mist net sites are depicted in Appendix A, Figure 3.

Each mist net site consisted of two net sets. One net set consisted of two to three mist nets hung between two poles. Poles were 20 to 30 feet high and had ropes affixed to them to raise and lower the nets. The mist nets used in this survey were constructed of 50 denier/2-ply nylon or monofilament, with a mesh size of 1.5 inches, and a length of 20 – 60 ft. Net sets were located so that the entire open portion of the flyway was covered by the nets. Nets were monitored from dusk and continued for a minimum of five hours. Mist nets were checked for bats every 10 minutes.

Upon capture, bats were removed from mist nets, identified to species, measured, and released unharmed at the capture site. Data recorded for each bat captured included species, age, gender, reproductive condition, right forearm length (RFA), wing scar score, and body weight. Bats were identified to species based upon distinctive morphological characteristics (e.g., body size, hair color, ear length, tragus length and shape, presence/absence of a keeled calcar). Adult female bats were classified as reproductive if they were pregnant (determined by palpation of abdomen) or lactating (i.e., teats conspicuous and enlarged, lack of hair around teats). Male bats with testicles descended into the scrotum were considered reproductive. Juveniles were distinguished from adults by examining epiphyseal closure (bone growth in phalangeal joints).

Weather conditions were documented each night to confirm that netting was conducted in accordance with Indiana Bat Recovery Team Guidance (USFWS 2007). The air temperature, wind speed, cloud cover, and precipitation were recorded at the beginning and end of each night of the survey. A digital or mercury thermometer was used to record temperature. Wind speed, percent cloud cover, and moon phase were estimated (Appendix D). All sites were photographed and their location recorded using a handheld GPS unit.

All netting was conducted in accordance to bat handling/disinfection protocols for summer bat field studies, as dictated by state and federal agencies to help prevent the spread of White Nose Syndrome (USFWS 2012b).

3.2 Radio-telemetry and Emergence Counts

Upon capturing a female Indiana bat, a 0.5 gram LB-2 Holohil transmitter with whip antenna was attached in order to determine maternity roost location (Appendix A, Figure 4). The transmitter was affixed dorsally between the shoulders using a skin-bonding agent, Skin Bond. All roads within 100 mi^2 around the capture location were driven by a pair of biologists during daylight hours while using a Wildlife Materials TRX-1000S radio-telemetry receiver with a 3-element Yagi antenna in order to find the individual's roost. Under normal circumstances, emergence counts would have been performed for a period of five consecutive nights on all

located roosts; however, no emergence counts were conducted during this survey as a result of the inability to track the individual to its roost location.

4.0 RESULTS

4.1 Mist Net Survey

A total of 11 sites were surveyed using mist nets from August 1-13, 2012 along the proposed bypass in Jennings County, Indiana (Appendix A, Figure 3). Biologists placed sites in areas deemed to have the highest chance of capture success in the area. These high probability areas include ponds, streams, forested roads and trails as well as some forested edges. A comprehensive capture summary table is included in Appendix B. Photographs of net sites are included in Appendix C. Detailed descriptions and sketches of each net site are included in Appendix D. Additional wildlife observed and general comments about each net site are included on survey data forms in Appendix D.

A total of 86 bats from six species were captured at 11 sites (44 net nights) within the proposed bypass alignments in Jennings County, Indiana. One federally endangered Indiana bat was captured. The big brown bat was the most commonly encountered species, composing 46.5% of the total capture. The eastern red bat (*Lasiurus borealis*) was the next most frequently captured bat, making up 31.4% of total captures. Other species captured included northern long-eared bats (9.3%), tri-colored bat (7.0%), little brown bats (4.7%), and an Indiana bat (1.2%). Sites 4 and 9 were found to be the most successful sites with 16 and 19 captures, respectively. An Indiana bat was captured at Site 1. Only Site 10 failed to record captures (Table 1).

4.2 Radio-telemetry and Emergence Counts

One juvenile female Indiana bat (Bat 00299) was captured and fitted with a transmitter. This individual left the survey area on August 6, but could not be located throughout the duration of the survey. All roads within a 100 mi^2 area around the capture site were driven daily during daylight hours for the duration of the survey for a total effort of 35 hours. Despite this effort no signal was detected. No emergence counts were conducted due to the inability to track the individual to its roost location.

5.0 SUMMARY

The mist net survey was conducted with the appropriate level of effort (44 net nights over 13 calendar nights at 11 sites) and under the appropriate conditions to investigate presence/likely absence of Indiana and gray bats during the maternity season along the proposed U.S. 50, North Vernon Bypass (East) in Jennings County, Indiana.

A total of 86 bats from six species were captured during this survey. An average of 7.8 bats was captured at each site. There was only one site during this survey that recorded zero captures. One Indiana bat was captured as a result of this mist net survey. No gray bats were captured.

The radio-tagged Indiana bat was not found post-release. Several possibilities exist for the failure to locate the bat. The bat might maintain its home range outside of our search area, well

beyond the project area. Transmitter failure could also account for the lack of relocation. Finally, the bat could locate itself in an area with the appropriate conditions to attenuate the radio-signal to the point where researchers cannot receive the signal with available equipment.

The results of this survey indicate that gray bats are not present in the project area, but that Indiana bats are present along the proposed bypass and in surrounding areas; however, no roost trees were found to be located within the boundaries of this project. Unfortunately, due to the unknown fate of our transmitter, a conclusive statement cannot be made regarding a relationship between potential maternity colony boundaries and the project area.

Table 1. Bat capture summary table by site for proposed U.S. 50 North Vernon Bypass (East), Jennings County, Indiana.

Site	Date	Site leader	Lat	Lon	*Eptesicus fuscus*	*Lasiurus borealis*	*Myotis lucifugus*	*Myotis septentrionalis*	*Myotis sodalis*	*Perimyotis subflavus*	Total
Site 1	8/6/12	S. Slankard	39.03190	-85.63053	1	1	0	1	1	0	**4**
	8/7/12	S. Slankard	39.03190	-85.63053	0	2	0	1	0	0	**3**
Site 2	8/8/12	S. Slankard	39.02246	-85.62102	3	0	0	0	0	0	**3**
	8/9/12	S. Slankard	39.02246	-85.62102	0	0	0	0	0	0	**0**
	8/10/12	S. Slankard	39.02246	-85.62102	1	0	0	0	0	0	**1**
Site 3	8/6/12	L. Droppelman	39.02955	-85.60368	1	0	0	1	0	0	**2**
	8/7/12	L. Droppelman	39.02955	-85.60368	2	1	0	1	0	0	**4**
Site 4	8/6/12	T. Brown	39.02197	-85.60528	3	4	0	1	0	2	**10**
	8/7/12	T. Brown	39.02197	-85.60528	2	3	0	0	0	1	**6**
Site 5	8/6/12	J. Salyers	39.01101	-85.36628	0	2	0	0	0	0	**2**
	8/7/12	J. Salyers	39.01101	-85.36628	5	4	0	0	0	1	**10**
Site 6	8/12/12	T. Brown	39.01326	-85.58460	1	0	1	0	0	0	**2**
	8/13/12	T. Brown	39.01293	-85.58492	1	0	0	0	0	0	**1**
Site 7	8/8/12	T. Brown	39.02136	-85.59115	0	1	0	1	0	0	**2**
	8/9/12	T. Brown	39.02339	-85.59040	1	0	0	0	0	0	**1**
	8/10/12	T. Brown	39.02339	-85.59040	0	0	0	0	0	0	**0**
Site 8	8/3/12	L. Droppelman	39.03571	-85.59126	1	4	1	0	0	1	**7**
	8/4/12	L. Droppelman	39.03571	-85.59126	3	1	1	0	0	0	**5**
Site 9	8/1/12	L. Droppelman	39.03563	-85.60100	9	3	1	1	0	0	**14**
	8/2/12	L. Droppelman	39.03563	-85.60100	4	0	0	0	0	1	**5**
Site 10	8/8/12	J. Salyers	39.03385	-85.57371	0	0	0	0	0	0	**0**
	8/9/12	J. Salyers	39.03385	-85.57371	0	0	0	0	0	0	**0**
Site 11	8/12/12	L. Droppelman	39.02359	-85.55164	0	1	0	1	0	0	**2**
	8/13/12	L. Droppelman	39.02359	-85.55164	2	0	0	0	0	0	**2**
				Total	**40**	**27**	**4**	**8**	**1**	**6**	**86**

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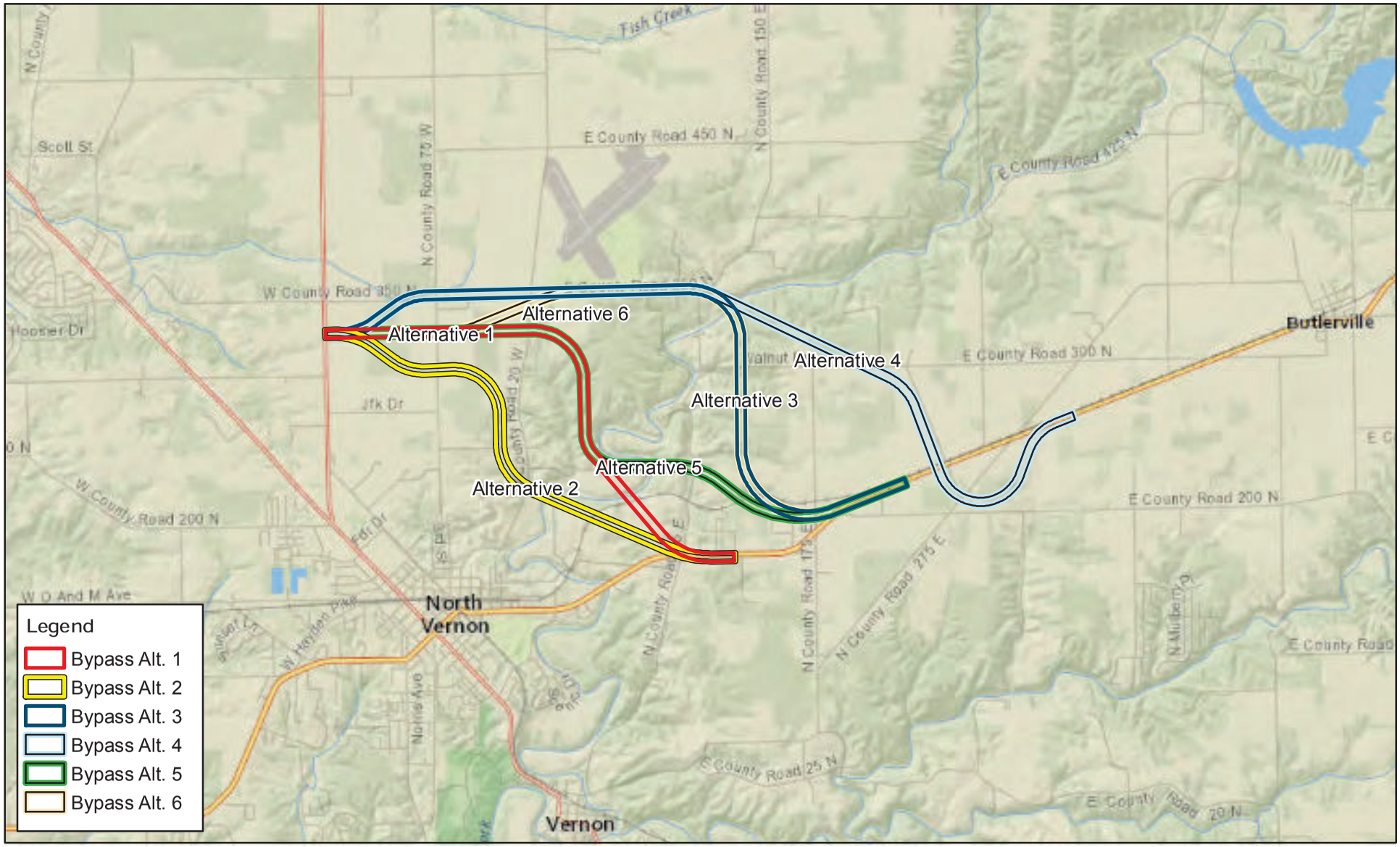
APPENDIX A - MAPS



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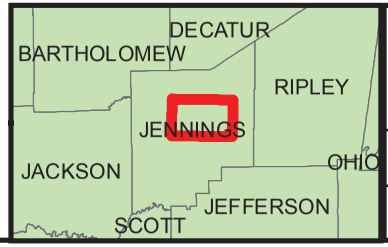


U.S. 50 North Vernon Bypass (East)
Jennings County, IN

1:60,000

0 395 790 1,580 2,370 3,160 Meters

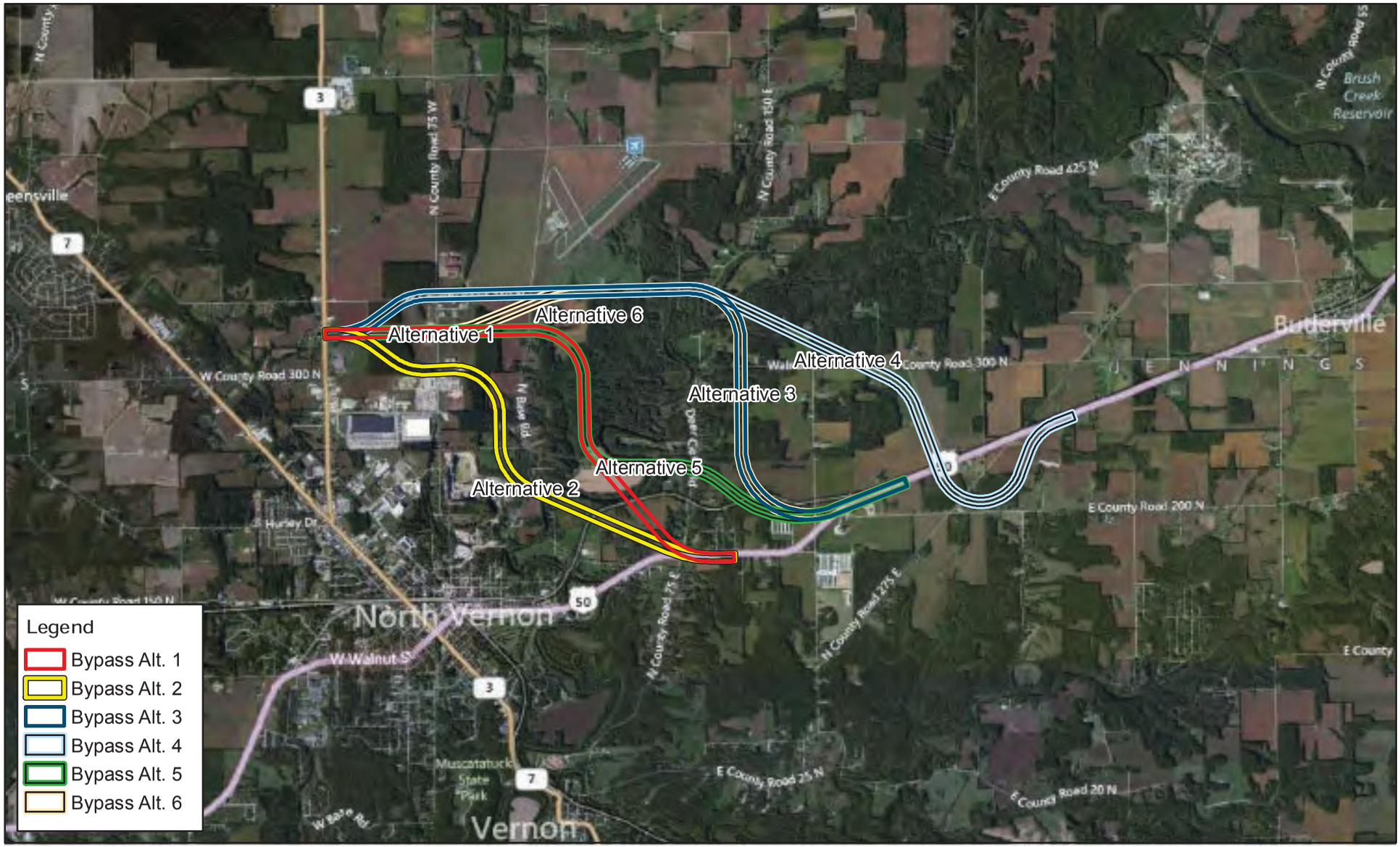
Imagery Source: Bing/National Geographic

FIGURE 1

Topographic Overview

Eco-Tech CONSULTANTS

Drawn by: NGB	Print Date:09/05/12
Prepared For: INDOT/Parsons Corp.	
ETC File: LV2012019	



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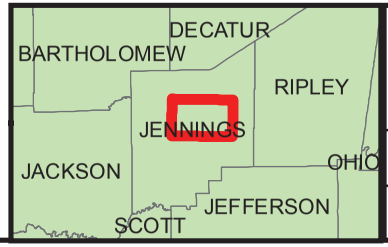


U.S. 50 North Vernon Bypass (East)
Jennings County, IN

1:60,000

0 395 790 1,580 2,370 3,160 Meters

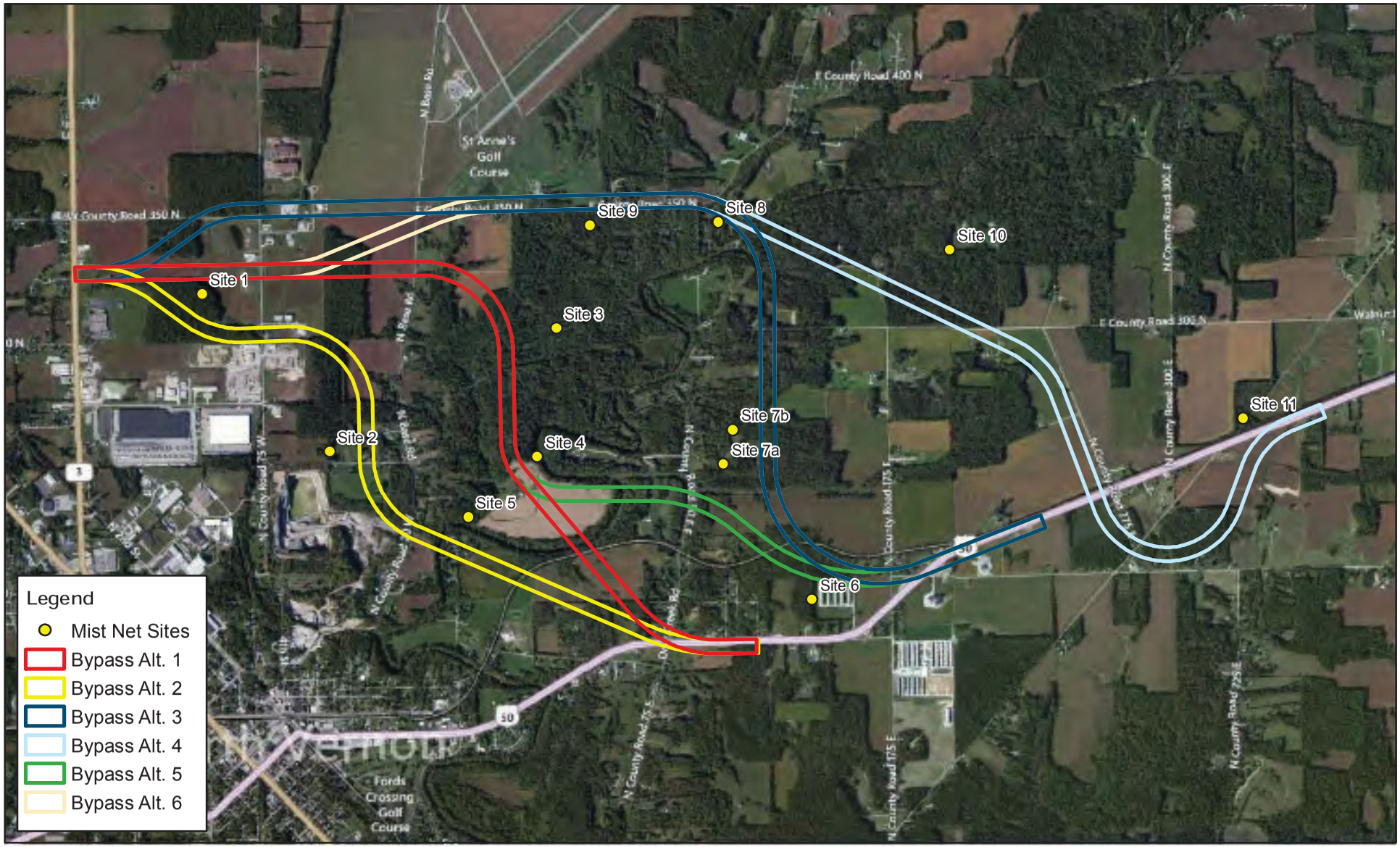
Imagery Source: Bing

FIGURE 2

Aerial Overview

Eco-Tech CONSULTANTS

Drawn by: NGB	Print Date:09/05/12
Prepared For: INDOT/Parsons Corp.	
ETC File: LV2012019	



N

U.S. 50 North Vernon Bypass (East)
Jennings County, IN

1:36,000

0 237.5 475 950 1,425 1,900 Meters

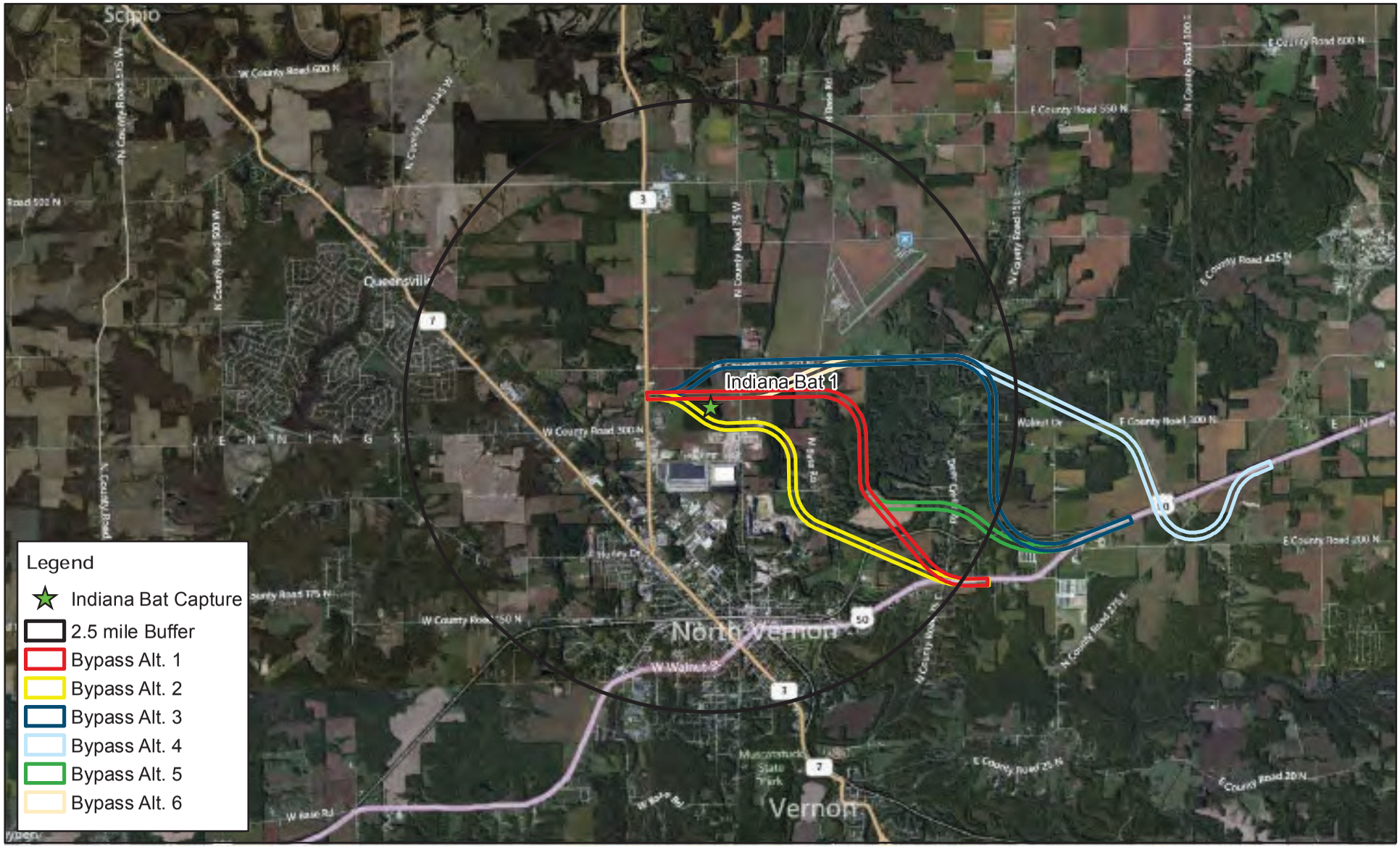
Imagery Source: Bing

FIGURE 3

Location of Mist Net Sites

Eco-Tech CONSULTANTS

Drawn by: NGB	Print Date:09/05/12
Prepared For: INDOT/Parsons Corp.	
ETC File: LV2012019	



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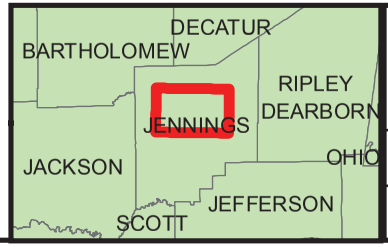


U.S. 50 North Vernon Bypass (East)
Jennings County, IN

1:72,000

0 475 950 1,900 2,850 3,800 Meters

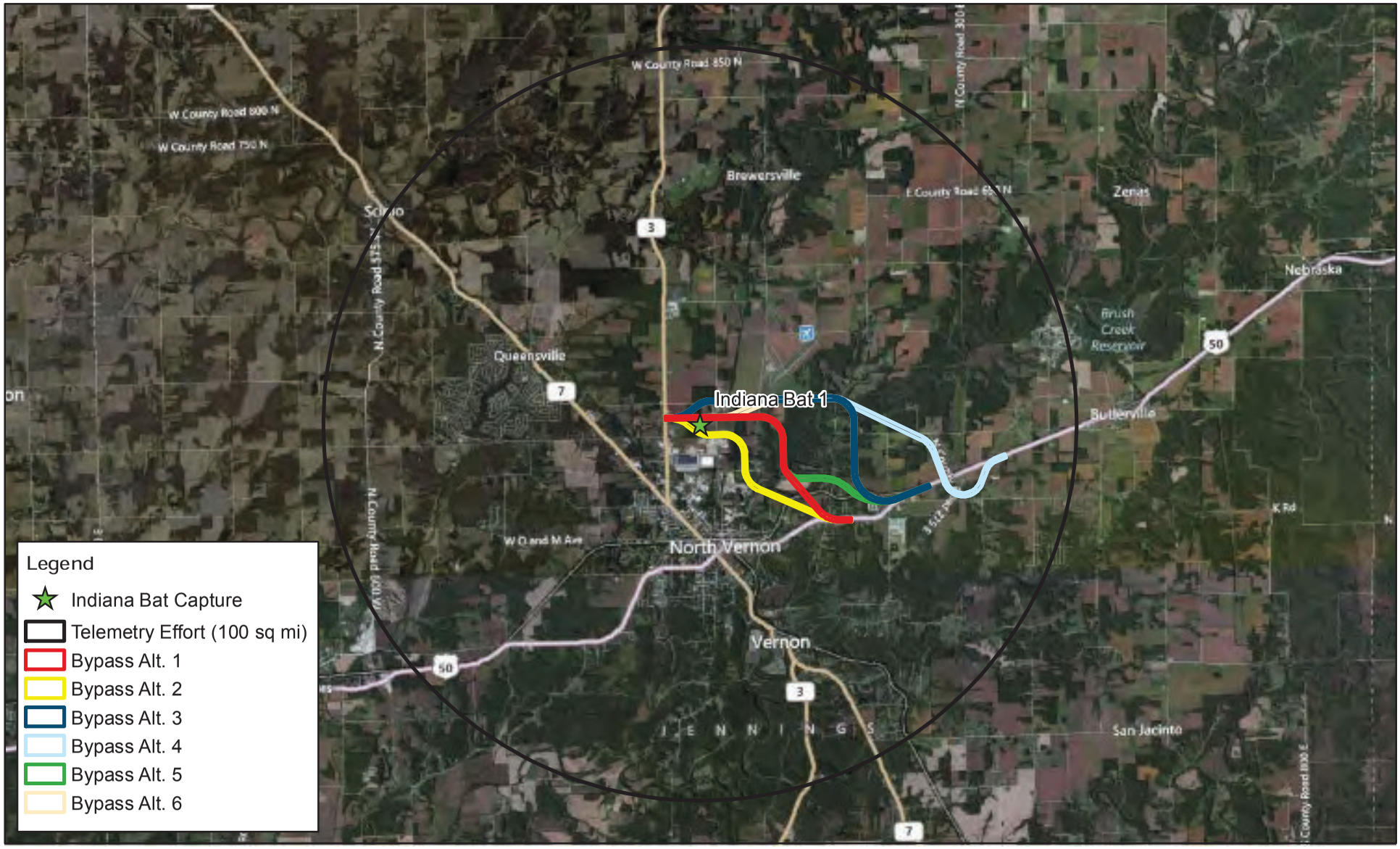
Imagery Source: Bing

FIGURE 4

Location of Indiana Bat Capture with 2.5 mile Buffer

Eco-Tech CONSULTANTS

Drawn by: NGB	Print Date:09/05/12
Prepared For: INDOT/Parsons Corp.	
ETC File: LV2012019	



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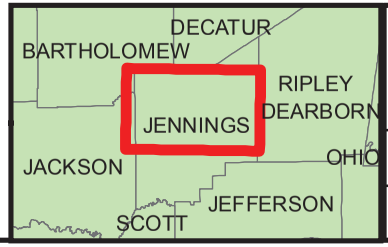


U.S. 50 North Vernon Bypass (East)
Jennings County, IN

1:132,000

0 850 1,700 3,400 5,100 6,800 Meters

Imagery Source: Bing

FIGURE 5

Indiana Bat Radio-Telemetry Survey Coverage

Eco-Tech CONSULTANTS

Drawn by: NGB	Print Date:09/05/12
Prepared For: INDOT/Parsons Corp.	
ETC File: LV2012019	

APPENDIX B – COMPREHENSIVE BAT CAPTURE DATA TABLE

Site	Date	Scientific Name	Net	Time	Age	Sex	Repro. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
1	8/6/2012	*Lasiurus borealis*	B	22:30	A	M	TD	12.8	43	0	-
		Myotis septentrionalis	B	22:30	A	F	N	6.8	35	0	-
		Myotis sodalis	B	23:30	J	F	N	6.6	39	0	Eco-Tech 00299
		Eptesicus fuscus	B	23:40	A	F	N	17.3	47	0	-
	8/7/2012	*Lasiurus borealis*	B	22:40	J	F	N	12.3	42	0	-
		Lasiurus borealis	B	23:10	J	M	N	8.4	41	0	-
		Myotis septentrionalis	A	23:15	A	F	N	6.9	34	0	-
											7 Total
2	8/8/2012	*Eptesicus fuscus*	A	22:40	A	M	TD	18.8	48	0	-
		Eptesicus fuscus	A	23:50	A	M	TD	16.2	47	0	-
		Eptesicus fuscus	A	0:00	A	M	TD	17.1	47	0	-
	8/9/2012	No captures									
	8/10/2012	*Eptesicus fuscus*	A	21:30	A	M	TD	17.1	46	0	-
											4 Total
3	8/6/2012	*Eptesicus fuscus*	A	21:40	A	F	PL	19.5	48	1	-
		Myotis septentrionalis	A	22:00	A	M	TD	6	34	0	-
	8/7/2012	*Lasiurus borealis*	B	21:20	J	M	N	8.6	39	0	-
		Eptesicus fuscus	A	21:40	A	M	TD	17.5	45	1	-
		Eptesicus fuscus	B	22:20	A	F	PL	19.1	47	1	-
		Myotis septentrionalis	A	23:50	J	M	N	5.6	35	0	-
											6 Total

Site	Date	Scientific Name	Net	Time	Age	Sex	Repro. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
4		*Eptesicus fuscus*	A	22:05	A	M	TD	19.3	52	0	-
		Lasiurus borealis	A	22:05	A	M	N	9.5	40	0	-
		Eptesicus fuscus	B	22:07	A	M	N	15.9	49	0	-
		Perimyotis subflavus	A	22:40	A	F	PL	6.9	37	0	-
		Lasiurus borealis	A	23:00	A	F	N	10.9	43	0	-
		Perimyotis subflavus	A	23:00	A	F	N	7.3	36	0	-
		Eptesicus fuscus	A	23:25	J	F	N	17	50	0	-
		Lasiurus borealis	A	0:25	A	F	N	12.5	43	0	-
		Myotis septentrionalis	A	1:10	A	M	N	6.2	37	0	-
	8/6/2012	*Lasiurus borealis*	A	1:10	A	F	N	11.5	42	0	-
		Lasiurus borealis	A	21:25	A	M	N	9.3	41	0	-
		Lasiurus borealis	A	23:00	A	M	TD	10.5	43	0	-
		Eptesicus fuscus	B	23:15	A	M	TD	18	49	0	-
		Perimyotis subflavus	A	0:10	A	M	N	5.5	35	0	-
		Lasiurus borealis	A	0:10	A	M	N	9.5	40	0	-
	8/7/2012	*Eptesicus fuscus*	A	1:05	A	M	TD	16	48	1	-
											16 Total
5		*Lasiurus borealis*	A	21:15	J	M	TD	13	39	0	-
	8/6/2012	*Lasiurus borealis*	B	22:22	J	M	TD	11.5	43	0	-
		Lasiurus borealis	A	21:10	J	M	N	11	41	0	-
		Lasiurus borealis	A	21:15	J	M	TD	10	39	0	-
		Lasiurus borealis	A	21:35	J	M	TD	10.5	39	0	-
		Lasiurus borealis	B	22:00	J	M	TD	10	39	0	-
		Eptesicus fuscus	A	22:10	J	M	TD	16	44	0	-
		Eptesicus fuscus	A	22:45	J	F	N	19	46	1	-
		Eptesicus fuscus	A	23:45	J	M	N	16	46	1	-
		Eptesicus fuscus	B	23:50	J	M	N	16	48	0	-
		Eptesicus fuscus	A	0:00	J	M	N	16	46	0	-
	8/7/2012	*Perimyotis subflavus*	B	0:30	A	F	PL	6	34	0	-
											12 Total

Site	Date	Scientific Name	Net	Time	Age	Sex	Repro. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
6	8/12/2012	*Eptesicus fuscus*	A	22:10	A	F	N	19	49	0	-
		Myotis lucifugus	A	22:40	A	M	N	8	40	0	-
	8/13/2012	*Eptesicus fuscus*	A	22:00	A	M	TD	14.2	46	1	-
											3 Total
7	8/8/2012	*Myotis septentrionalis*	B	0:15	A	M	N	5.5	37	0	-
		Lasiurus borealis	B	0:45	A	M	TD	10.7	42	0	-
	8/9/2012	*Eptesicus fuscus*	B	23:25	A	F	N	18.5	48	0	-
	8/10/2012	No captures									
											3 Total
8	8/3/2012	*Eptesicus fuscus*	A	21:15	A	M	TD	16.2	46	1	-
		Lasiurus borealis	B	22:10	J	F	N	11.1	39	0	-
		Lasiurus borealis	A	22:15	A	F	PL	11.9	42	0	-
		Lasiurus borealis	B	23:20	J	M	TD	9	38	0	-
		Lasiurus borealis	A	1:30	J	F	N	10.6	38	0	-
		Perimyotis subflavus	B	2:00	A	F	PL	7	34	1	-
		Myotis lucifugus	B	2:00	A	M	TD	7.6	39	1	-
	8/4/2012	*Lasiurus borealis*	A	22:15	J	F	N	12.6	42	0	-
		Eptesicus fuscus	B	23:05	J	M	N	15.1	45	0	-
		Eptesicus fuscus	A	12:20	A	M	N	18.9	49	1	-
		Eptesicus fuscus	A	1:15	A	M	TD	20.4	45	0	-
		Myotis lucifugus	B	1:45	A	M	N	7.9	38	0	-
											12 Total

Site	Date	Scientific Name	Net	Time	Age	Sex	Repro. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
9		*Lasiurus borealis*	B	21:00	J	M	N	11.2	41	0	-
		Lasiurus borealis	A	21:40	J	F	N	10.9	41	0	-
		Eptesicus fuscus	B	22:00	A	F	PL	19.7	48	1	-
		Eptesicus fuscus	B	22:00	A	M	TD	18.4	44	0	-
		Eptesicus fuscus	B	22:00	A	M	TD	15	45	1	-
		Myotis lucifugus	B	22:00	J	F	N	7.6	38	0	-
		Eptesicus fuscus	B	22:20	A	F	PL	16.9	46	1	-
		Eptesicus fuscus	A	23:15	A	F	N	17.1	50	0	-
		Myotis septentrionalis	A	23:15	A	M	N	5.6	35	0	-
		Eptesicus fuscus	A	0:25	A	F	PL	16	51	1	-
		Eptesicus fuscus	A	0:26	A	M	TD	16.6	46	1	-
		Eptesicus fuscus	A	0:35	A	M	TD	20.5	46	1	-
		Eptesicus fuscus	A	1:45	J	M	N	18.3	45	0	-
	8/1/2012	*Lasiurus borealis*	A	1:45	A	F	PL	12.2	41	0	-
		Perimyotis subflavus	B	21:00	A	F	PL	6.1	35	0	-
		Eptesicus fuscus	B	22:10	A	F	PL	18.3	49	1	-
		Eptesicus fuscus	A	22:10	A	F	PL	20	48	1	-
		Eptesicus fuscus	A	22:10	J	M	N	15.8	46	1	-
	8/2/2012	*Eptesicus fuscus*	A	22:25	A	F	PL	20	50	0	-
											19 Total
10	8/8/2012	No captures									
	8/9/2012	No captures									
											0 Total
11		*Myotis septentrionalis*	21:40	1.5	A	M	N	6.6	36	0	-
	8/12/2012	*Lasiurus borealis*	1:40	5	J	M	N	9.5	38	0	-
		Eptesicus fuscus	21:40	4	A	F	PL	20.5	47	1	-
	8/13/2012	*Eptesicus fuscus*	0:40	4	A	M	TD	21.2	49	0	-
											4 Total

Age: A=adult, J=juvenile; Sex: F=female, M=male; Reproductive Condition: N=non-reproductive, L=lactating, P=post-lactating, TD=Testes Descended

APPENDIX C – PHOTOGRAPHS

Mist Net Sites

Mist Net Site 1; Net A

Mist Net Site 1; Net B

Mist Net Site 2; Net A

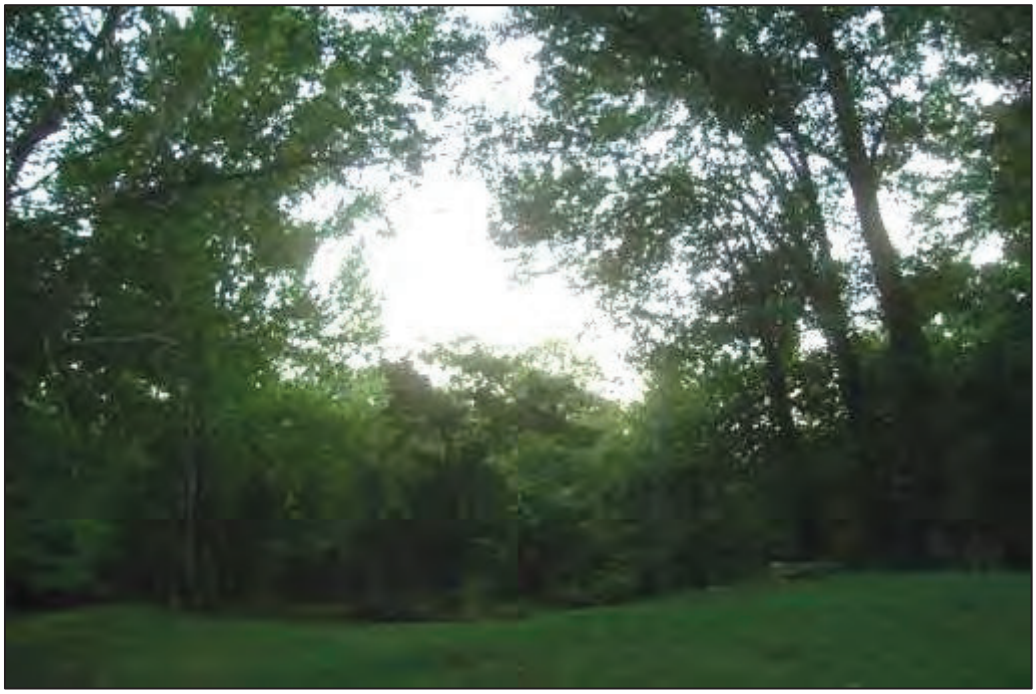
Mist Net Site 2; Net B

Mist Net Site 3; Net A

Mist Net Site 3; Net B

Mist Net Site 4; Net A

Mist Net Site 4; Net B



Mist Net Site 5; Net A

Mist Net Site 5; Net B

Mist Net Site 6; Net A

Mist Net Site 6; Net B

Mist Net Site 7; Net A Night 1

Mist Net Site 7; Net B Night 1

Mist Net Site 7; Net A Night 2

Mist Net Site 7; Net B Night 2

Mist Net Site 8; Net A

Mist Net Site 8; Net B

Mist Net Site 9; Net A

Mist Net Site 9; Net B

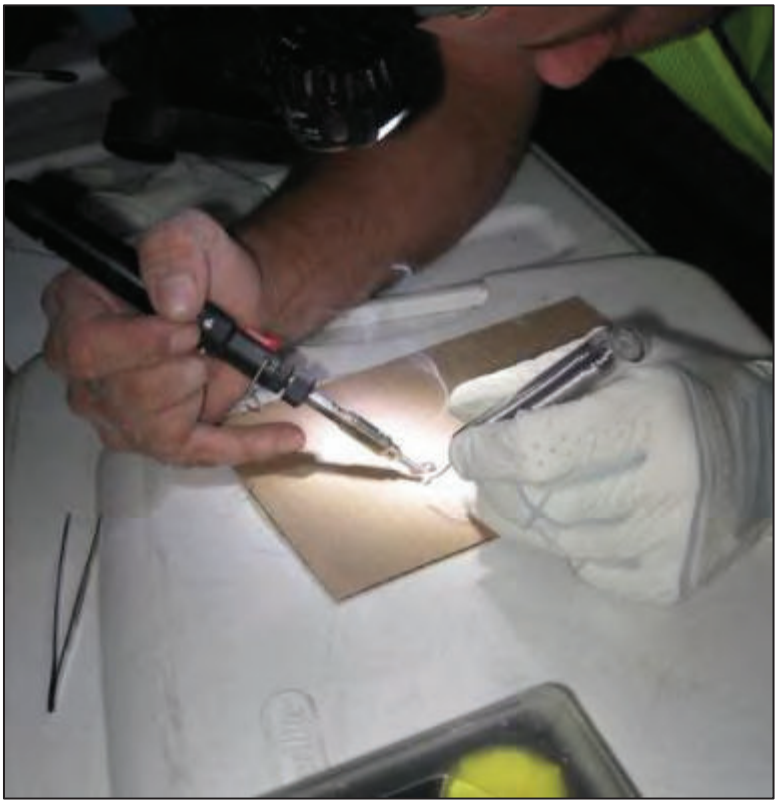
Mist Net Site 10; Net A

Mist Net Site 10; Net B

Mist Net Site 11; Net A

Mist Net Site 11; Net B

Indiana bat (*Myotis sodalis*) telemetry



Biologist preparing transmitter for application

Biologist shaving Indiana bat for transmitter application

Biologist applying medical glue to Indiana bat for transmitter application

Indiana bat with transmitter attached to back

Eco-Tech biologist performing daytime tracking to locate radio-transmittered Indiana bat.

Bat Photographs

Big brown bat (*Eptesicus fuscus*)

Eastern red bat (*Lasiurus borealis*)

Little brown bat (*Myotis lucifugus*)

An abundance of toe hairs is an important characteristic for distinguishing the little brown bat from the similar Indiana bat.

The Indiana bat displays a relative lack of toe hairs when compared to the little brown bat (above).

Northern long-eared bat (*Myotis septentrionalis*)

Indiana bat

Indiana bat: A keeled calcar and lack of toe hair are two of the primary diagnostic characteristics for this species.

Tri-colored bat (*Perimyotis subflavus*)

APPENDIX D - SITE DESCRIPTIONS AND DATA SHEETS

Eco-Tech Consultants

NET SITE DESCRIPTION

Site: 1 **Project:** N. Vernon By-Pass - INDOT **Dates:** 8-6/7-2012

ID by: Scott Slankard **Quad:** North Vernon **County:** Jennings **State:** IN

Net A	**Width (ft):** 45	**Height (ft):** 30	**Lat/Lon:** 39.03190 / -85.63053
Net B	**Width (ft):** 60	**Height (ft):** 20	**Lat/Lon:** 39.03250 / -85.63023

Vegetation

Dominant Canopy Species:
1) C. ovata
2) Q. palustris
3) Q. bicolor

Percent Canopy Closure:
Net A 100%
Net B 10%

Average Canopy DBH (in): 18"

Dominant Understory Species:
1) F. grandifolia
2) L. benzoin
3) A. rubrum

Understory Density:
Very Dense [ ]
Moderate [ ]
Clear [X]

Average Understory DBH (in): 4"

Stream

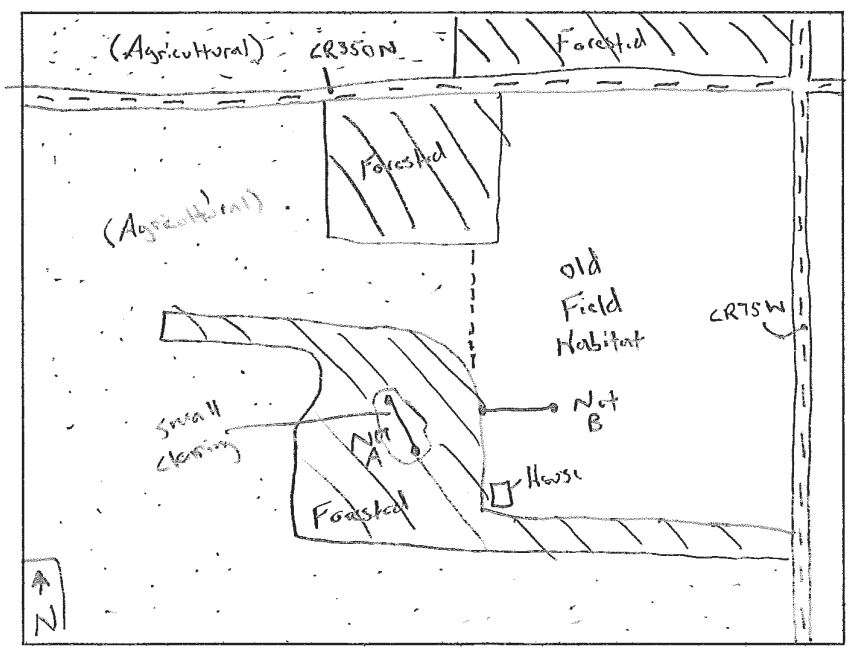
Bank Height (ft): ____
Channel Width (ft): NA
Water Width (ft): ____

Average Water Depth (ft): ____
Dominant Substrate: ~~NA~~
Turbidity (clear/cloudy): ____

Comments/Descriptions

Site is a small, isolated woodlot that appears to be a forested wetland. Woods are very mature & dominated by shagbark hickory, pin oak & swamp white oak in the overstory. Understory density is mostly clear & dominated by American beech, spicebush & red maple. Net A is within a small clearing in the woodlot. Net B is set perpendicular to the eastern edge of the woodlot.

Site Drawing



BAT CAPTURE DATA FORM

Site: 1 **Investigator(s):** Scott Slankard **Date:** 8-6-2012

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	2100	76	59	clear	Ø	Ø	waning Gibbous
Mistnet End	0000	64	82	clear	Ø	Ø	

Comments and Other Wildlife Noted: * Freq. = 172.823

metal eco-tech band #00299

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
LABO	B	22:30	2m	A	M	TD	12.8g	43mm	Ø	—
MYSE	B	2230	3m	A	F	N	6.8g	35mm	Ø	—
* MYSO	B	2330	2m	J	F	N	6.6g	39mm	Ø	Eco-Tech 00299
EPFU	B	2340	3m	A	F	N	17.3g	47mm	Ø	—

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 1 **Investigator(s):** Scott Slankard **Date:** 8-7-2012

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	2100	87°	50%	Clear	Ø	Ø	Waning
Mistnet End	0200	65°	79%	clear	Ø	Ø	Gibbous

Comments and Other Wildlife Noted: catbird (vocal)
E. towhee (vocal)

Escaped from net LABO @ 2130

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
LABO	B	2240	5m	J	F	N	12.3g	42mm	Ø	—
LABO	B	2310	3m	J	M	N	8.4g	41mm	Ø	—
MYSE	A	2315	1m	A	F	N	6.9g	34mm	Ø	—

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

Eco-Tech Consultants

NET SITE DESCRIPTION

Site: 2 **Project:** N. Vernon By-Pass - INDOT **Dates:** 8-8/10-2012

ID by: Scott Slankard **Quad:** Butlerville **County:** Jennings **State:** IN

Net A	**Width (ft):** 30	**Height (ft):** 30	**Lat/Lon:**	39.02246	-85.62102
Net B	**Width (ft):** 20	**Height (ft):** 20	**Lat/Lon:**	39.02295	-85.62096

Vegetation

Dominant Canopy Species:
1) Q. alba
2) A. rubrum
3) F. americana

Percent Canopy Closure:
Net A 100%
Net B 90%

Average Canopy DBH (in): 18"

Dominant Understory Species:
1) S. albidum
2) P. serotina
3) L. tulipifera

Understory Density:
Very Dense [ ]
Moderate [X]
Clear [ ]

Average Understory DBH (in): 3"

Stream

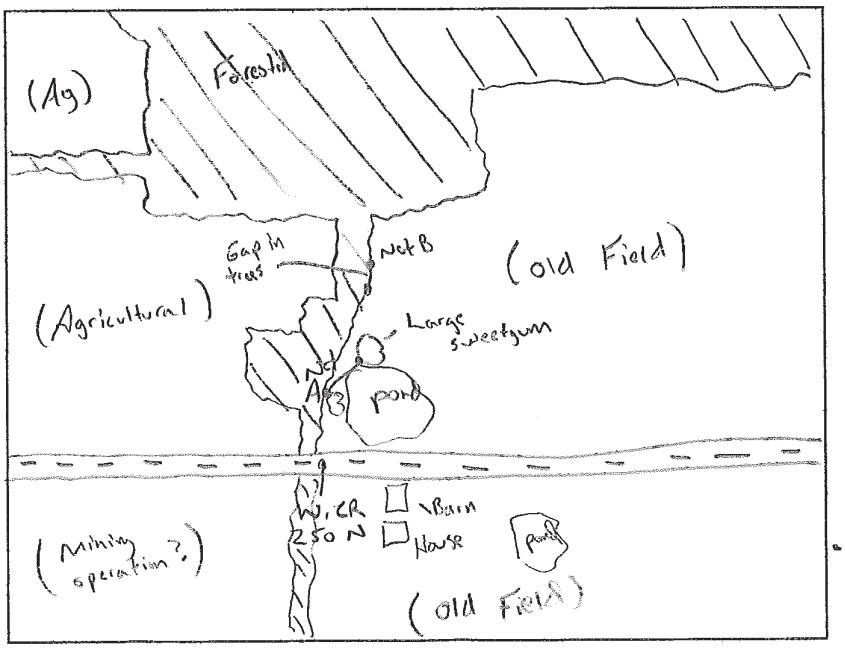
Bank Height (ft): _____
Channel Width (ft): NA
Water Width (ft): _____

Average Water Depth (ft): _____
Dominant Substrate: NA
Turbidity (clear/cloudy): _____

Comments/Descriptions

Net A is placed along edge of pond between a forest edge and a large sweetgum with over hanging branches. Net B is placed across a gap in treeline leading to open field area. Forestal area is somewhat mature & dominated by white oak, red maple & American ash in the overstory. Understory density is moderate. Understory dominated by sassafras, black cherry, & tulip poplar.

Site Drawing



BAT CAPTURE DATA FORM

Site: 2 **Investigator(s):** Scott Slankard **Date:** 8-8-2012

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	2100	84°	51%	Mostly Cloudy	Ø	1-3mph	Waning
Mistnet End	0200	72°	82%	Mostly Cloudy	Ø	1-3mph	Gibbous

Comments and Other Wildlife Noted: * Bats observed foraging over pond & field @ dusk.
- flying very high @ 50 ft plus

- N. Cardinal (caught in net)

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
EPFU	A	2240	1m	A	M	TD	18.8	48mm	Ø	—
EPFU	A	2350	5m	✓	EFN					
EPFU	A	2350	2m	A	M	TD	16.2	47	Ø	—
EPFU	A	.0020	4m	A	M	TD	17.1	47	Ø	—

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 2 **Investigator(s):** Scott Slankard **Date:** 8-9-2012

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	2100	75°	76%	Mostly Cloudy	Ø	4-6mph	Last Quarter
Mistnet End	0040	—	—	Thunderstorms	Ø	High	

Comments and Other Wildlife Noted:

*Escaped as I approached net

(Rain starts @ 0010 / rained out @ 0040)

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
* LABO	B	2220	2m	~	F	~	EFN	~	~	~
	☆ RAIN OUT @ 0040 ☆									

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 2 Investigator(s): Scott Slankard Date: 8-10-2012

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	2100	69	70	Partly Cloudy	Ø	Ø-3 mph	Last Quarter
Mistnet End	2300	59	85	clear	Ø	Ø	

Comments and Other Wildlife Noted:

* Survey was makeup night due to rain on 8-9-2012. Netted until 2300 to make up lost hours on 8-9-2012

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
EPFU	A	2130	3m	A	M	TD	17.1	46	Ø	—

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

NET SITE DESCRIPTION

Site: 3 **Project:** NORTH VERNON BYPASS **Dates:** 8/6-8/7/12

ID by: L. DROPPELMAN **Quad:** Butlerville **County:** JENNINGS **State:** IN

Net A	**Width (ft):**	20	**Height (ft):**	20	**Lat/Lon:**	39.02955 / -85.60368
Net B	**Width (ft):**	20	**Height (ft):**	20	**Lat/Lon:**	39.02968 / -85.60502

Vegetation

Dominant Canopy Species:
1) LIQUIDAMBAR STYRACIFLUA
2) LIRIODENDRON TULIPIFERA
3) PINUS STROBUS

Percent Canopy Closure:
Net A 100
Net B 90

Average Canopy DBH (in): 20

Dominant Understory Species:
1) FAGUS GRANDIFOLIA
2) LIRIODENDRON TULIPIFERA
3) LIQUIDAMBAR STYRACIFLUA

Understory Density:

Very Dense	
Moderate	X
Clear	

Average Understory DBH (in): 6

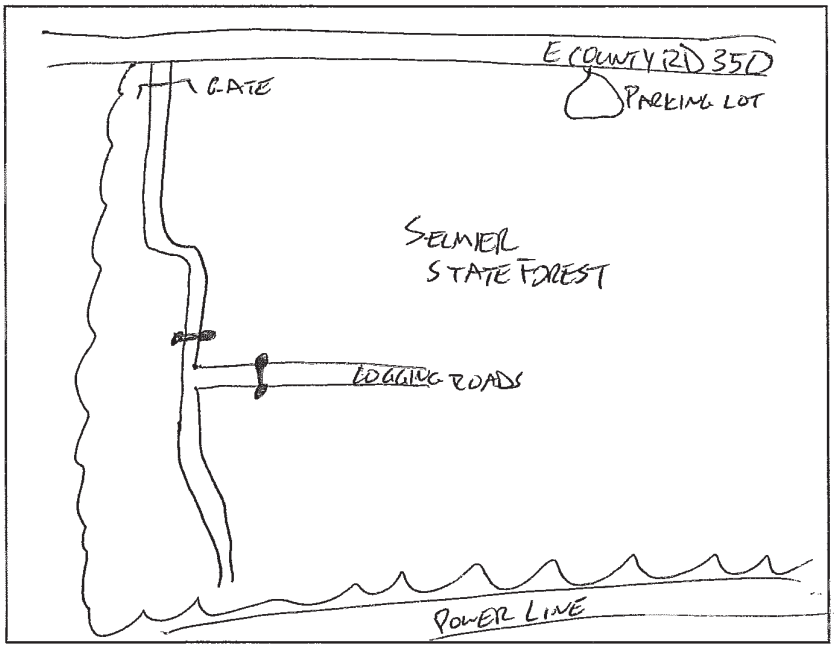
Stream

Bank Height (ft): N/A
Channel Width (ft): _____
Water Width (ft): _____
Average Water Depth (ft): _____
Dominant Substrate: _____
Turbidity (clear/cloudy): _____

Comments/Descriptions

SITE LOCATED ON WEST SIDE OF SELMIER STATE FOREST. ACCESS OFF CR 350 ON GATED FOREST ROAD RUNNING NORTH/SOUTH. SEVERAL E/W LOGGING TRAILS PRESENT. WOODS ARE MATURE BUT HAVE BEEN SELECTIVELY LOGGED ON A CONTINUAL ROTATION. ROAD CORRIDORS ARE UNCLUTTERED WITH NICE CANOPY CLOSURE. NO WATER PRESENT.

Site Drawing



BAT CAPTURE DATA FORM

Site: 3 Investigator(s): L. DROPPELMAN Date: 8/6/12

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	2100	83.5	48	CLEAR	NONE	NONE	Waning gibbous
Mistnet End	0200	70.5	65	CLEAR	NONE	NONE	

Comments and Other Wildlife Noted:

N. FLYING SQUIRREL
BARRED OWL

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
EPFU	A	2140	2	A	F	PL	19.5	48	1	—
MYSE	A	2200	2	A	M	TD	6.0	34	0	—

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 3 Investigator(s): L. DROPPELMAN Date: 8/7/12

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	2100	84.7	47	CLEAR	NONE	NONE	Waning gibbous
Mistnet End	0200	71.9	62	CLEAR	NONE	SLIGHT	

Comments and Other Wildlife Noted:

G. H. OWL
W.T. DEER

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
LABO	B	2120	3	J	M	N	8.6	39	0	
EPFU	A	2140	2	A	M	TD	17.5	45	1	
EPFU	B	2220	2	A	F	PL	19.1	47	1	
MYSE	A	2350	3	J	M	N	5.6	35	0	

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

NET SITE DESCRIPTION

Site: 4 Project: Travis Brown, Ward Wilson Dates: 8/6-7/12

ID by: T. Brown Quad: Butlerville County: Jennings State: IN

Net A	Width (ft): 60	Height (ft): 30	Lat/Lon: 39.02197 / -85.60528
Net B	Width (ft): 42	Height (ft): 30	Lat/Lon: 39.02225 / -85.60520

Vegetation

Dominant Canopy Species:
1) Platanus occidentalis
2) Acer negundo
3) Acer saccharum

Percent Canopy Closure:
Net A 45
Net B 35

Average Canopy DBH (in): 24"

Dominant Understory Species:
1) Acer negundo
2) Fraxinus pennsylvanicus
3) Acer saccharum

Understory Density:

Very Dense	
Moderate	X
Clear	

Average Understory DBH (in): 2"

Stream

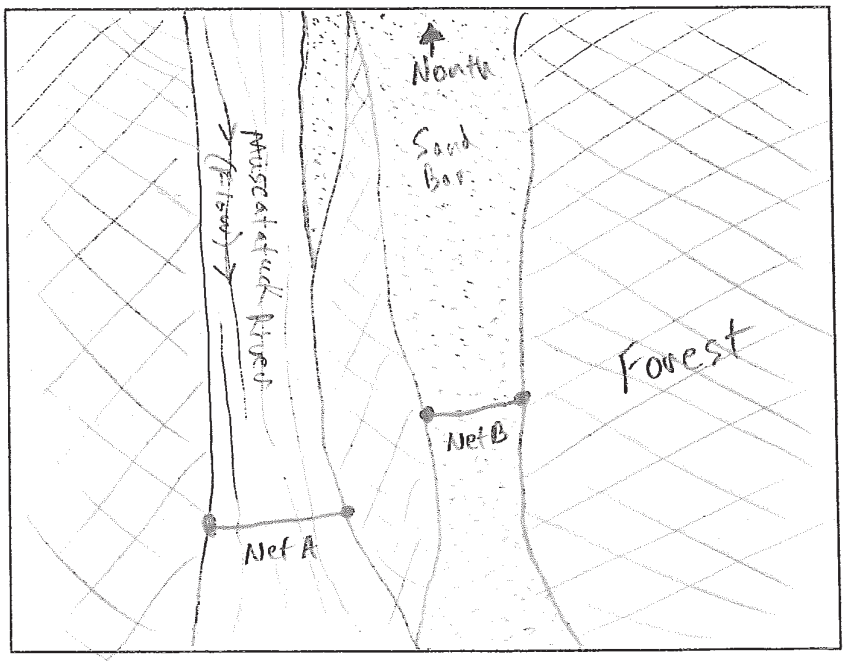
Bank Height (ft): 15'
Channel Width (ft): 120'
Water Width (ft): 40'

Average Water Depth (ft): 1.5'
Dominant Substrate: Cobble/Bedrock
Turbidity (clear/cloudy): Clear

Comments/Descriptions

Site is located over a river pool at a point where an island of trees creates a corridor over the water & another corridor over a dry sandy side channel.

Site Drawing



BAT CAPTURE DATA FORM

Site: 4 Investigator(s): Travis Brown, Ward Wilson Date: 8-6-12

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	20:40	77.7	59.4	Clear	0	0	Waxing Gibbous
Mistnet End	2:20	65.6	83.9	Clear	0	0	

Comments and Other Wildlife Noted:

American Goldfinch (in net)
Acadian Flycatcher (in net)
Luna Moth (in net)

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
EPFU	A	10:05	8	Adult	M	TD	19.3	52	Ø	
LABO	A	10:05	1	Adult	M	NR	9.5	40	Ø	
EPFU	B	10:07	8	Adult	M	NR	15.9	49	Ø	
PESU	A	10:40	2	A	F	PL	6.9	37	Ø	
LABO	A	11:00	1	A	F	NR	10.9	43	Ø	
PESU	A	11:00	9.5	A	F	NR	7.3	36	Ø	
EPFU	A	11:25	9.5	J	F	NR	~~17~~ 12.2	50	Ø	
LABO	A	12:25	3	A	F	NR	12.5	43	Ø	
MYSE	A	01:10	3	A	M	NR	6.2	37	Ø	
LABO	A	01:10	3	A	F	NR	11.5	42	Ø	

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 4 **Investigator(s):** T. Travis Brown, Ward Wilson **Date:** Tuesday 8/7/2012

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	2120	77.5°	64.4	Clear	none	none	waning gibbous 70%
Mistnet End	01:50	68.1	85.1	Clear	0	0	

Comments and Other Wildlife Noted: Sunset is 2047

- In stream Live
Notarus minus
Labidesthes sicculus
Lampsilis cardium
Amblyrus natalis
Lampsilis siliquoidea
Fresh dead shells
Fusconaia flava
Toxolasma parvus
Villosa lienosa c.f.

In Net
S.E. flying squirrel
Glaucomys volans

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
LABO	A	2125	0.5	A	M	NR	9.3	41	Ø	
LABO	A	~~22~~ 2300	1.5	A	M	TD	10.5	43	Ø	
EPFU	B	2315	7	A	M	TD	18.0	49	Ø	
PESU	A	00:10	8	A	M	NR	5.5	35	Ø	
LABO	A	00:10	5	A	M	NR	9.5	40	Ø	
EPFU	A	01:05	1.5	A	M	TD	16.0	48	1	
PESU	A	01:00	Release as taking down							

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

NET SITE DESCRIPTION

Site: 5 Project: N. Vernon Dates: 4/7 Aug '12

ID by: J Salyers Quad: Butlerville County: Jennings State: IN

Net A Width (ft): 30' Height (ft): 30' Lat/Lon: 39.018457/-85.610579

Net B Width (ft): 20' Height (ft): 20' Lat/Lon: 39.018209/-85.610222

Vegetation

Dominant Canopy Species:
1) Q. rubra
2) P. occidentalis
3) J. nigra

Percent Canopy Closure:
Net A 100
Net B 100

Average Canopy DBH (in): 18

Dominant Understory Species:
1) U. americana
2) C. canadensis
3) P. occidentalis

Understory Density:
Very Dense
Moderate ✓
Clear

Average Understory DBH (in): 10

Stream → Net B

Bank Height (ft): 2'

Channel Width (ft): 25'

Water Width (ft): dry w/ puddles

Average Water Depth (ft): 1/2" in puddles

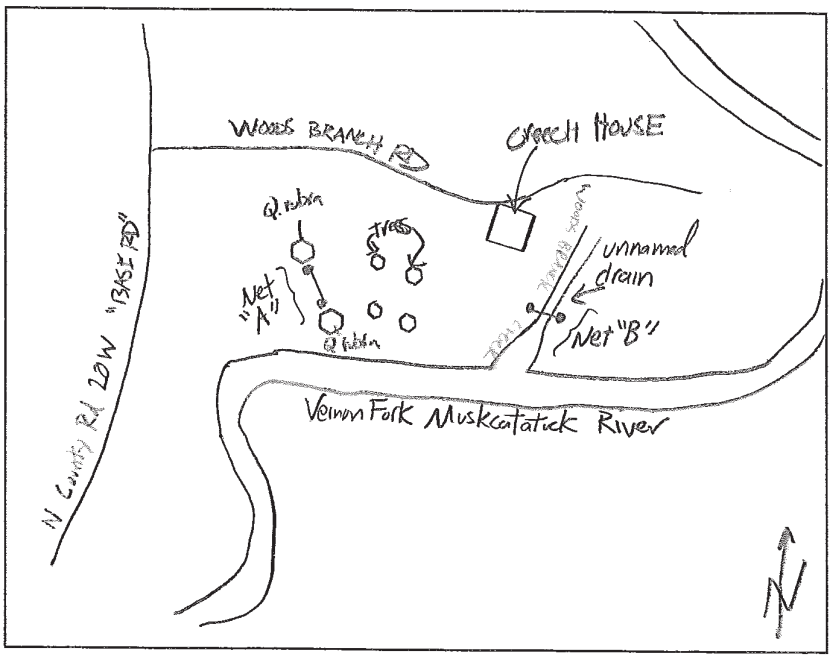
Dominant Substrate: cobble, muck

Turbidity (clear/cloudy): NA

Comments/Descriptions

Creech's back yard and drainage to river.

Site Drawing



BAT CAPTURE DATA FORM

Site: 5 Investigator(s): J. Salyers, C. Chandler Date: 08/06/2012

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	2100	84°	48	clear	no	calm	waning gibbous
Mistnet End	0200	64°	65	clear	no	calm	

Comments and Other Wildlife Noted:

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
LABO	A	21:15	4.0	J	M	TD	13.0	39	0	
LABO	B	21:43	1.0	—	—	—	—	—	—	ESCAPE
LABO	B	22:22	3.0	J	M	TD	11.5	43	0	

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 5 Investigator(s): J. Salyers, C. Chandler Date: 8/7/2012

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	20:45	86°	47	clear	no	calm	Waning gibbous
Mistnet End	02:45	70°	62	clear	no	calm	

Comments and Other Wildlife Noted:

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
LABO	A	21:10	5.0	J	M	N	11.0	41.0	0	
LABO	A	21:15	4.0	J	M	TD	10.0	39	0	
LABO	A	21:35	4.0	J	M	TD	10.5	39	0	
LABO	B	22:00	2.0	J	M	TD	10.0	39	0	
EPFU	A	22:10	6.0	J	M	TD	16.0	44	0	
EPFU	A	22:10	4.0							Escape
EPFU	A	22:45	4.0	J	F	NP	19.0	46	1	
EPFU	A	23:45	4.0	J	M	N	16.0	46	1	
EPFU	B	23:50	3.0	J	M	N	16.0	48	0	
EPFU	A	24:00	5.0	J	M	N	16.0	46	0	
PISU	B	24:30	3.0	A	F	PL	6.0	34	0	

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

NET SITE DESCRIPTION

Site: 6 **Project:** North Vernon US50 Bypass **Dates:** 8/12-13/12

ID by: Travis Brown **Quad:** Butlerville **County:** Jennings **State:** IN

Net A	**Width (ft):**	40	**Height (ft):**	30	**Lat/Lon:**	39.01326 / -85.58460
Net B	**Width (ft):**	20	**Height (ft):**	20	**Lat/Lon:**	39.01293 / -85.58492

Vegetation

Dominant Canopy Species:
1) Acer rubrum
2) Carya ovata
3) Liquidambar styraciflua

Percent Canopy Closure:
Net A: 40
Net B: 95

Average Canopy DBH (in): 14"

Dominant Understory Species:
1) Lindera benzoin
2) Aralia spinosa
3) Acer saccharum

Understory Density:

Very Dense	X
Moderate	
Clear	

Average Understory DBH (in): 1"

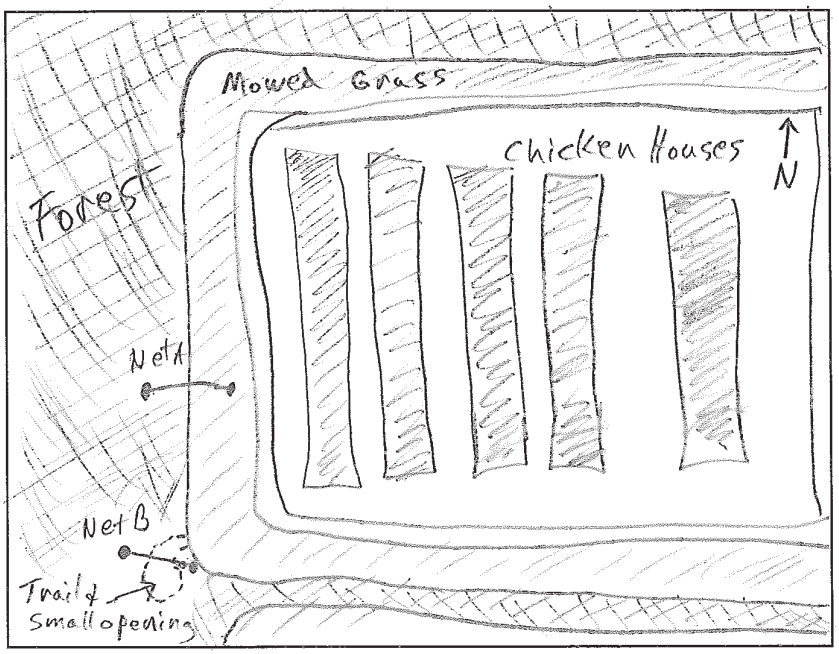
Stream

Bank Height (ft): —
Channel Width (ft): —
Water Width (ft): —
Average Water Depth (ft): —
Dominant Substrate: —
Turbidity (clear/cloudy): —

Comments/Descriptions

Site is located in a reasonably mature forest stand next to a chicken farm. One net (A) is in a woodland opening and net B is perpendicular to the edge of the forest stand in an area with a very open understory.

Site Drawing



BAT CAPTURE DATA FORM

Site: 6 Investigator(s): Travis Brown Date: 8-12-12

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	20:30	72.5	74.6	Overcast	0	0	waning crescent
Mistnet End	02:10	65.4	89.5	overcast	0	0	

Comments and Other Wildlife Noted:

3 Bats seen at 20:45
Light rain for 20 minutes starting 22:10 ~~22:40~~

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
EPFU	A	22:10	4	A	F	NR	19	49	0	—
MYLU	A	22:40	4	A	M	NR	8	40	0	—

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 6 Investigator(s): Travis Brown Date: 8-13-12

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	20:30	71.2	84.0	Overcast	0	0	Waning crescent
Mistnet End	01:45	67.8	96.4	overcast	0	0	

Comments and Other Wildlife Noted:

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
EPFU	X	22:00	5	A	M	TD	14.2	46	1	—

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

Eco-Tech Consultants

NET SITE DESCRIPTION

Site: 7 **Project:** North Vernon US 50 Bypass **Dates:** 8/8-10/12

ID by: Travis Brown **Quad:** Butlerville **County:** Jennings **State:** IN

Net A	**Width (ft):** Night 1 20 / Night 2-3 42	**Height (ft):** 20	**Lat/Lon:** Night 1 39.02136/-85.59115	N 2+3 39.023389/-85.5903		
Net B	**Width (ft):** 20	**Height (ft):** 20	**Lat/Lon:** 39.02101/-85.59137	39.022855/-85.5980		

Vegetation

Dominant Canopy Species:
1) Quercus alba
2) Carya ovata
3) Liriodendron tulipifera

Percent Canopy Closure:
Net A Night 1 90 / Night 2-3 40
Net B 90

Average Canopy DBH (in): 14"

Dominant Understory Species:
1) Liquidambar styraciflua
2) Ulmus rubra
3) Acer saccharum

Understory Density:

Very Dense	
Moderate	X
Clear	

Average Understory DBH (in): 3

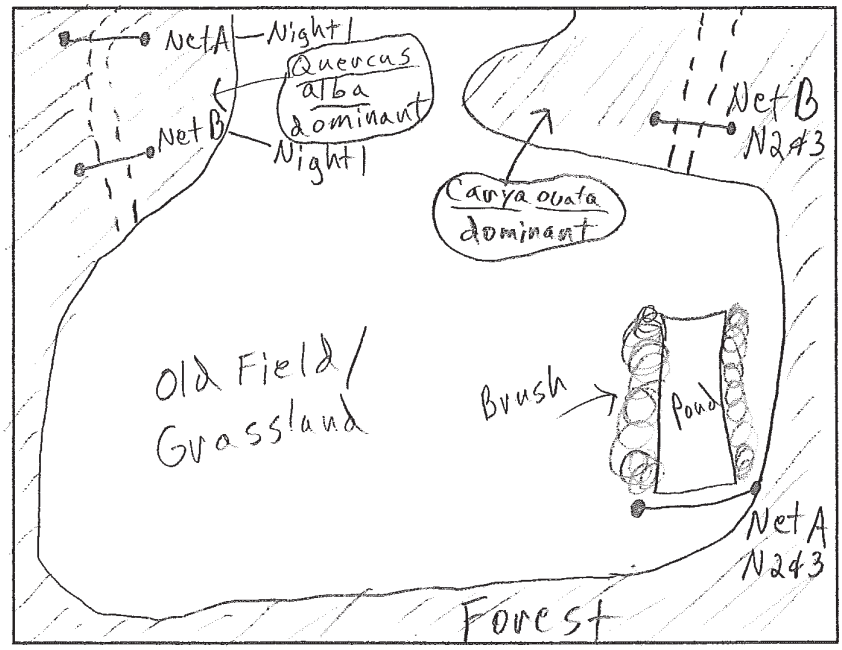
Stream

Bank Height (ft): —
Channel Width (ft): —
Water Width (ft): —
Average Water Depth (ft): —
Dominant Substrate: —
Turbidity (clear/cloudy): —

Comments/Descriptions

Site is located in mature oak/hickory forest. On the first night we noticed a substantial amount of bat activity (4-5 bats) at the pond and the brush seemed to direct their activity along a linear path thru the pond, so we moved our net's there on the second night (rainout) and third night.

Site Drawing



BAT CAPTURE DATA FORM

Site: 7 Investigator(s): Travis Brown, Ward Wilson Date: 8-8-12

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	20:30	80.9	62.2	Part Cloud	0	0-5MPH	Last Quarter
Mistnet End	01:45	71.6	85.5	Most Cloud	0	0	

Comments and Other Wildlife Noted:
Thunderstorms passed to the north around 10 pm - lightning frequent

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
Myotis sp.	B	21:50	1m	Escape	from	Net				
MYSE	B	00:15	1	A	M	NR	5.5	37	Ø	
LABO	B	00:45	1	A	M	TD	10.7	42	Ø	

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 7 Investigator(s): Travis Brown, Ward Wilson Date: 8-9-12

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	20:30	76.0	74.0	Clear	0	0-5 MPH	Waning
Mistnet End	00:15	Rained out		Cloudy	0	0-15 MPH	Crescent

Comments and Other Wildlife Noted:

Lithobates clamitans

Strong thunderstorms @ 00:15

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
EPFU	B	2325	4	A	F	NR	18.5	48	Ø	

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 7 Investigator(s): Travis Brown Date: 8-10-12

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	20:30	74.1	67.1	Few Clouds	0	0-1MPH	Waning
Mistnet End	22:50	57.7	94.3	Clear	0	0	Crescent

Comments and Other Wildlife Noted:

Netting at least 2 hours tonight because of last night's rainout--as per Mike Litwin instructions.

Odocoileus virginianus

Lithobates catesbeianus

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
NO BATS										

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

Eco-Tech Consultants

NET SITE DESCRIPTION

Site: 8 Project: North Vernon US 50 Bypass Dates: 08/03-08/04/2012

ID by: L. Droppelman Quad: Butlerville County: Jennings State: IN

Net A Width (ft): 30 Height (ft): 20 Lat/Lon: 39.03571/085.59126

Net B Width (ft): 20 Height (ft): 20 Lat/Lon: 39.03526/085.59096

Vegetation

Dominant Canopy Species:
1) Platanus occidentalis
2) Juglans nigra
3)

Percent Canopy Closure:
Net A 80%
Net B 90%

Average Canopy DBH (in): 20

Dominant Understory Species:
1) Platanus occidentalis
2) Juglans nigra
3)

Understory Density:
Very Dense [ ]
Moderate [✓]
Clear [ ]

Average Understory DBH (in): 12

Stream

Bank Height (ft): 10

Channel Width (ft): 30

Water Width (ft): 5

Average Water Depth (ft): 3"

Dominant Substrate: fractured bedrock

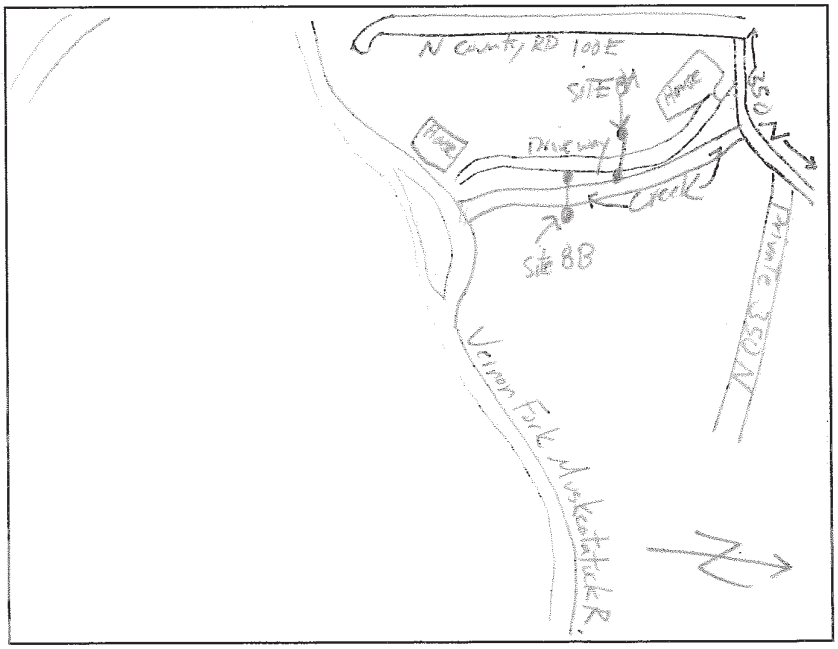
Turbidity (clear/cloudy): clear

Comments/Descriptions

SITE A

SITE B

Site Drawing



BAT CAPTURE DATA FORM

Site: 8 Investigator(s): L. Dieppelman, C. Chandler Date: 08/03/2012

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	2100	82.2	66	cloudy	no	calm	Waning gibbous
Mistnet End	0200	74.4	86	cloudy	no	calm	

Comments and Other Wildlife Noted:

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
EPFU	A	21:15	3.0	A	M	TD	16.2	46	1	
LABO	B	22:10	2.0	J	F	NR	11.1	39	0	
LABO	A	22:15	4.0	A	F	PL	11.9	42	0	
LABO	B	23:20	2.0	J	M	TD	9.0	38	0	
LABO	A	01:30	3.0	J	F	NR	10.6	38	0	
PESU	B	02:00	3.0	A	F	PL	7.0	34	1	
MYLU	B	02:00	4.0	A	M	TD	7.6	39	1	

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 8 Investigator(s): L. Droppelman, C. Chandler Date: 08/4/2012

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	2100	85.1	52	cloudy	no	calm	Waning gibbous
Mistnet End	0200	66.9	86	clear	no	calm	

Comments and Other Wildlife Noted:

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
LABO	A	22:15	3.0	J	F	NR	12.6	42	0	
EPFU	B	23:05	3.0	J	M	NR	15.1	45	0	
EPFU	A	12:20	4.0	A	M	NR	18.9	49	1	
EPFU	A	01:15	3.0	A	M	TD	20.4	45	0	
MYLU	B	01:45	3.0	A	M	NR	7.9	38	0	

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

Eco-Tech Consultants

NET SITE DESCRIPTION

Site: 9 Project: North Vernon US 50 Bypass Dates: 8/01-8/02/2012

ID by: L. Droppelman Quad: Butlerville County: Jennings State: IN

Net A Width (ft): 20 Height (ft): 20 Lat/Lon: 39.03563/085.60100

Net B Width (ft): 30 Height (ft): 20 Lat/Lon: 39.03578/085.60028

Vegetation

Dominant Canopy Species:
1) Quercus Alba
2) Quercus Rubra
3)

Percent Canopy Closure:
Net A 90
Net B 90

Average Canopy DBH (in): 16

Dominant Understory Species:
1) Quercus Alba
2) Acer negundo
3)

Understory Density:
Very Dense ✓
Moderate
Clear

Average Understory DBH (in): 8

Stream

Bank Height (ft):

Channel Width (ft):

Water Width (ft):

Average Water Depth (ft):

Dominant Substrate:

Turbidity (clear/cloudy):

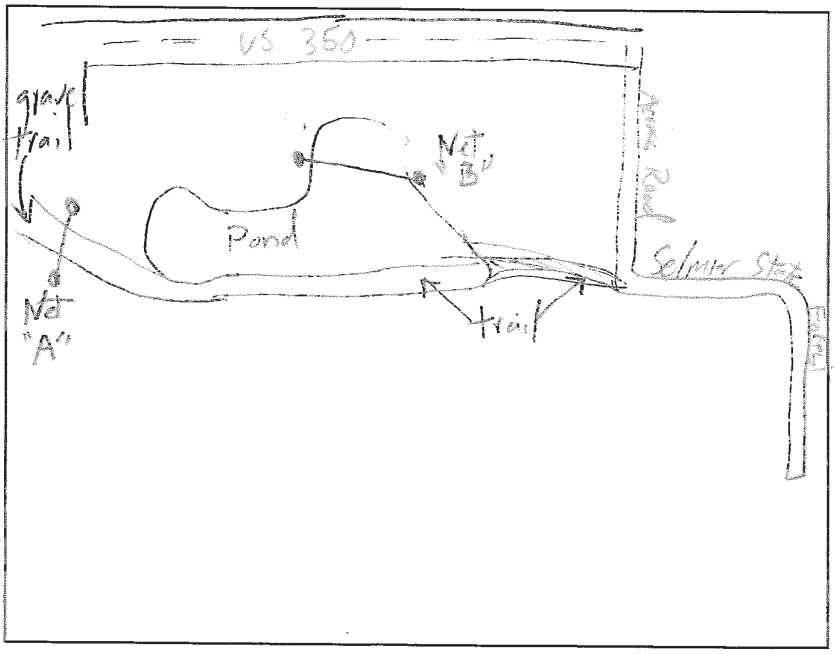
Comments/Descriptions

Net A setup along a grass trailing to small woodland pond.

Net B along trail leading to Pond Area.

Surrounding woods are mature with some selective logging in the state forest.

Site Drawing



BAT CAPTURE DATA FORM

Site: 9 Investigator(s): L. DROSSELMAN, C. CHANDLER Date: 8/1/12

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	2100	75.4	66	CLEAR	NONE	SLIGHT	FULL
Mistnet End	0200	65.1	84	CLEAR	NONE	SLIGHT	

Comments and Other Wildlife Noted:

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
LABO	B	2100	3.0	J	M	NR	11.2	41mm	0	
LABO	A	2140	3.0	J	F	NR	10.9	41	0	
EPFU	B	2200	3.0	A	F	PL	19.7	48	1	
EPFU	B	2200	3.0	A	M	TD	18.4	44	0	
EPFU	B	2200	3.0	A	M	TD	15.0	45	1	
MYLU	B	2200	3.0	J	F	NR	7.6	38	0	
EPFU	B	2220	3.0	A	F	PL	16.9	46	1	
EPFU	A	2315	4.0	A	F	NR	17.1	50	0	
MYSE	A	2315	4.0	A	M	NR	5.6	35	0	
EPFU	A	0025	4.0	A	F	PL	16.0	51	1	
EPFU	A	0026	4.0	A	M	TD	16.6	46	1	
EPFU	A	0035	3.0	A	M	TD	20.5	46	1	
EPFU	A	0145	4.0	J	M	NR	18.3	45	0	
LABO	A	0145	4.0	A	F	PL	12.2	41	0	

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 9 Investigator(s): L Dieppelman, C Chandler Date: 08/2/2012

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	2100	80.7	56	Clear	no	no	Full
Mistnet End	0200	73.2	78	cloudy	NO	NO	

Comments and Other Wildlife Noted:

SCREECH OWL, GREEN FROG

BAT ACTIVITY DIMINISHING WITH APPROACHING COLD FRONT

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
PESU	B	2100	3.0	A	F	PL	6.1	35	0	
EPFU	B	2210	3.0	A	F	PL	18.3	49	1	
EPFU	A	2210	3.0	A	F	PL	20.0	48	1	
EPFU	A	2210	3.0	J	M	NR	15.8	46	1	
EPFU	A	2225	2.0	A	F	PL	20.0	50	0	

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

Eco-Tech Consultants

NET SITE DESCRIPTION

Site: 10 Project: North Vernon / Parsons Dates: 08/08-8/09/2012

ID by: J. Salyers Quad: Butlerville County: Jennings State: IN

Net A Width (ft): 30 Height (ft): 30 Lat/Lon: 39.03385/085.57371

Net B Width (ft): 20 Height (ft): 20 Lat/Lon: 39.03381/085.57478

Vegetation

Dominant Canopy Species:
1) A. saccharum
2) L. tulipifera
3) L. styraciflua

Percent Canopy Closure:
Net A 100
Net B 100

Average Canopy DBH (in): 18

Dominant Understory Species:
1) A saccharum
2) A. triloba
3) R pseudoacacia

Understory Density:
Very Dense ☐
Moderate ☑
Clear ☐

Average Understory DBH (in): 12

Stream

Bank Height (ft): _____

Channel Width (ft): _____

Water Width (ft): _____

Average Water Depth (ft): _____

Dominant Substrate: _____

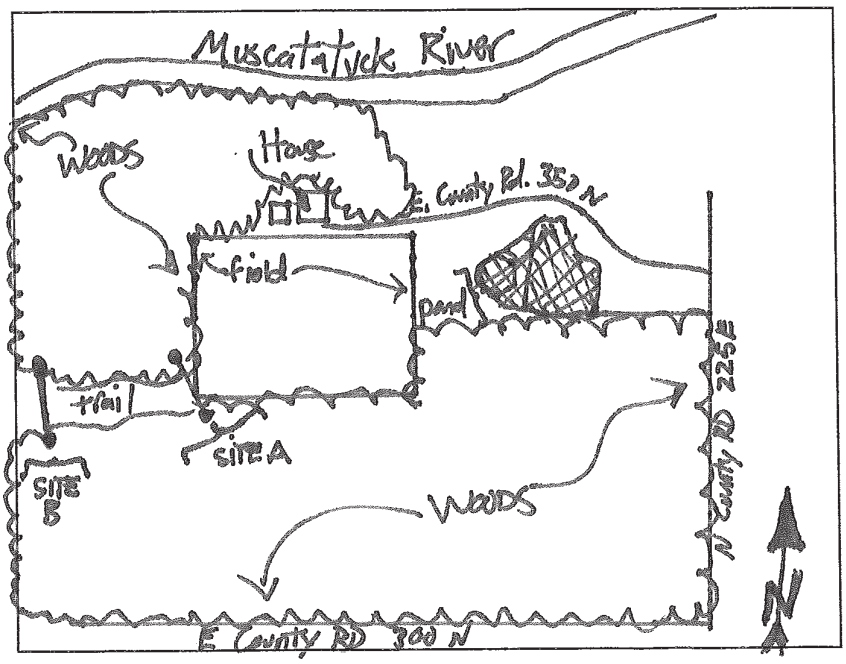
Turbidity (clear/cloudy): _____

Comments/Descriptions

SITE A: net captures the continuance of two 8-10' trails as they enter the open field. Pond in open field.

SITE B: net closes trail about 100 yards into the woods from the field and Site A.

Site Drawing



BAT CAPTURE DATA FORM

Site: 10 Investigator(s): J. Salyers, C. Chandler Date: 08/08/2012

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	2100	85°	51	storm to the north	no	gusty	1/2
Mistnet End	0200	70°	82	cloudy	no	breezy	

Comments and Other Wildlife Noted:

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 10 Investigator(s): J. Salyers, C. Chandler Date: 08/09/2012

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	2100	78°	65%	starting to rain, some clouds	no	calm	1/2
Mistnet End	24:00	68°		rain	no	5-10 mph	

Comments and Other Wildlife Noted: rained out at :12:00 AM

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

Eco-Tech Consultants

NET SITE DESCRIPTION

Site: 11 Project: NORTH VERNON BYPASS Dates: 8/12-8/13/12

ID by: L. DROPPELMAN Quad: Butlerville County: JENNINGS State: IN

Net A	Width (ft): 20	Height (ft): 20	Lat/Lon:	39.023592 / -85.551636
Net B	Width (ft): 20	Height (ft): 20	Lat/Lon:	39.023191 / -85.552103

Vegetation

Dominant Canopy Species:
1) ACER RUBRUM
2) FRAXINUS PENNSYLVANICA
3) LIQUIDAMBAR STYRACIFLUA

Percent Canopy Closure:
Net A 80
Net B 70

Average Canopy DBH (in): 14

Dominant Understory Species:
1) ACER RUBRUM
2) PLATANUS OCCIDENTALIS
3) ULMUS RUBRA

Understory Density:
Very Dense [ ]
Moderate [X]
Clear [ ]

Average Understory DBH (in): 7

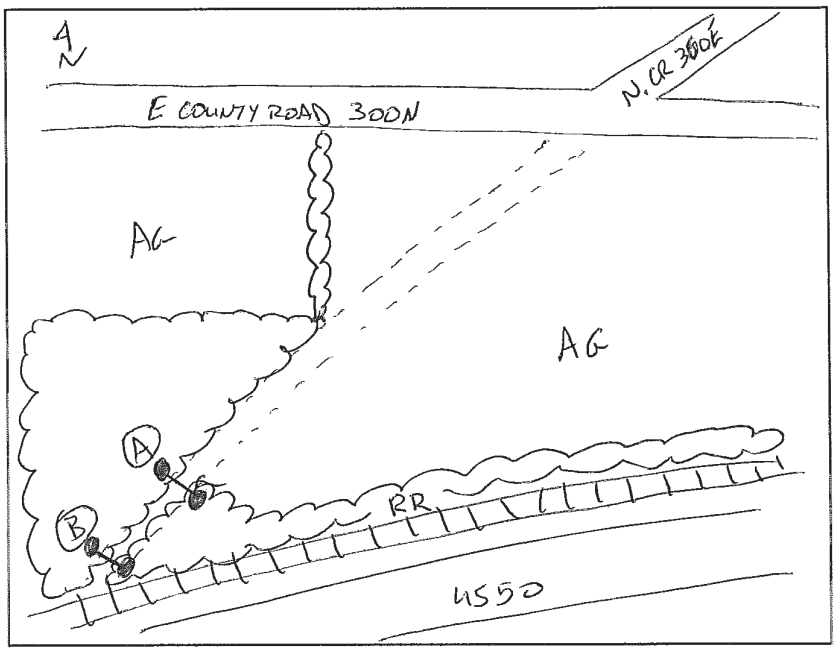
Stream

Bank Height (ft): N/A
Channel Width (ft): _____
Water Width (ft): _____
Average Water Depth (ft): _____
Dominant Substrate: _____
Turbidity (clear/cloudy): _____

Comments/Descriptions

SITE LOCATED WITHIN FORMER GRAVEL COUNTY ROAD BED, NOW UNMAINTAINED. WOODLOT TO WEST SELECTIVELY LOGGED <5 YRS. WETLAND POCKETS (DRY) SURROUND FORMER ROAD BED. FOREST <30 YRS WITH 1 LARGE GREEN ASH LOCATED WITH POTENTIAL ROOST FEATURES (40")

Site Drawing



BAT CAPTURE DATA FORM

Site: 116 Investigator(s): L. DROPPERMAN Date: 8/12/12

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	20:50	73.5	60	CLOUDY	NONE	NONE	Waning crescent
Mistnet End	02:00	64.7	86	CLOUDY	NONE		

Comments and Other Wildlife Noted:

G. H. OWL

RAIN (VERY LIGHT) 2210-2230. NETS REMAINED DRY

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
MYSE	A	2140	1.5	A	M	N	6.6	36	0	
LABO	B	0140	5.0	J	M	N	9.5	38	0	

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

BAT CAPTURE DATA FORM

Site: 11 Investigator(s): L. Droppelman Date: 8/13/12

	Time	Temp. (F)	Relative Humidity (%)	Sky Conditions	Fog	Wind	Moon Phase
Mistnet Start	2045	73.4	70	CLOUDY	NONE	NONE	Waning crescent
Mistnet End	0200	68.7	85	CLOUDY	NONE	NONE	

Comments and Other Wildlife Noted:

Species	Net	Time	Height in net (m)	Age	Sex	Reprod. Cond.	Weight (g)	RFA (mm)	Wing Scar Score	Band Number
EPFU	A	2140	4	A	F	PL	20.5	47	1	
EPFU	A	0040	4	A	M	TD	21.2	49	0	

Reproductive Condition: N: non-reproductive; L: lactating; P: pregnant; PL: post-lactating; TD: testes descended
Age: A: adult; J: juvenile Sex: M: male; F: female

APPENDIX D

2012 INDIANA BAT HABITAT IMPACT ASSESSMENT REPORT

INDIANA BAT (*MYOTIS SODALIS*) SUMMER HABITAT IMPACT ANALYSIS FOR THE PROPOSED U.S. HIGHWAY 50 NORTH VERNON BYPASS JENNINGS COUNTY, INDIANA

Prepared for:
INDOT/ Parsons Transportation Group Inc.

Prepared by:
Eco-Tech Consultants, Inc.
Louisville, KY

December 2012

INDIANA BAT (*MYOTIS SODALIS*) HABITITAT SUITABILITY ASSESSMENT AND POTENTIAL ROOST TREE SURVEY FOR THE NORTH VERNON U.S. 50 BYPASS (EAST) JENNINGS COUNTY, INDIANA

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Table 1. Average values of quantifiable parameters for habitats ranked as high, moderate, or low suitability for Indiana bats during the habitat assessment conducted for the North Vernon Bypass (U.S. 50) project, Jennings County, Indiana.

Table 2. Indiana bat summer habitat impacts associated with the seven alternatives proposed for the U.S. 50 Bypass, North Vernon, IN. Impacts are broken down by habitat quality. Percentage of forested habitat removed within a 2.5 km buffer of the project is given as an indication of landscape-scale effects of forest removal.

Table 3. Measurements of habitat fragmentation of Indiana bat summer habitat associated with two alternatives proposed for the U.S. 50 Bypass, North Vernon, IN.

Table 4. Summary of parameters used in assessment of the effect of alignment alternatives on Indiana bat habitat for the U.S. 50 Bypass, North Vernon, IN.

FIGURES

Figure 1. Frequency of tree species (percent of sample points occupied) in forest stands assessed for the North Vernon Bypass (U.S. 50) project, Jennings County, Indiana.

Figure 2. Habitat quality composition within the project survey limits for the North Vernon Bypass (U.S. 50) project, Jennings County, Indiana

APPENDICES

APPENDIX A EXHIBITS
APPENDIX B SURVEY DATA SHEETS
APPENDIX C REPRESENTATIVE PHOTOGRAPHS
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1.0 INTRODUCTION

Eco-Tech Consultants, Inc. was contracted by Parsons Transportation Group (Parsons) to conduct an assessment of habitat suitability for the federally endangered Indiana bat (*Myotis sodalis*) on U.S. 50 Bypass (East) in Jennings County, Indiana (Appendix A – Exhibit 1). The purpose of this report is to provide a description of the amount and quality of summer roosting/foraging habitat present within the project area and surrounding landscape and to determine the potential effects of the bypass on Indiana bat habitat.

1.1 Project Overview

INDOT has initiated the U.S. 50 North Vernon Bypass – East project to study a proposed extension of the new roadway currently under construction between C.R. 400W and S.R. 3. This extension would run from S.R. 3 on the north side of North Vernon east and south to rejoin existing U.S. 50 east of North Vernon, thus completing a northern bypass of North Vernon.

The U.S. 50 project involves construction of a highway bypass around the city of North Vernon in Jennings County. Construction on the western half of the project, which consists of a new two-lane road from U.S. 50 northeast to SR 3 north of North Vernon, began in March 2012. The approximate length of this roadway is 4.5 miles.

The eastern half of this project – from S.R. 3 southeast to U.S. 50 – is now in the planning stage. A range of alternatives for this section of the roadway will be evaluated. When completed, the project will reduce congestion in and around North Vernon, improve safety, improve accessibility, and meet local and state planning objectives.

1.2 Purpose and Need

The purpose of this project is to resolve four documented transportation problems in the U.S. 50/North Vernon area. Specifically, the project will:

- Reduce congestion along U.S. 50 and S.R. 3/S.R. 7 through and around North Vernon;
- Provide a safer transportation facility for both truck and passenger vehicles through and around North Vernon;
- Provide an efficient transportation link between the existing and growing industrial area on the north side of North Vernon to U.S. 50; and
- Support State and local transportation planning.

Besides the four primary objectives above, the alternatives will also be judged on how well they meet the following non-transportation goals:

- Minimize impacts to environmental and cultural resources.
- Minimize social and economic impacts due to right-of-way acquisitions and relocations.
- Support local community needs and interests.

- Provide a transportation facility consistent with local development plans.

Information about the project is available at: http://www.in.gov/indot/projects/2429.htm

2.0 DESCRIPTION OF THE STUDY AREA

The proposed project is located in Jennings County, Indiana, east of the City of North Vernon. The project falls within the North Vernon and Butlerville, Indiana USGS 7.5-Minute Topographic Quadrangles. Seven alternative road alignments are currently being evaluated. The alternatives begin at Highway 3 approximately 1.5 miles north of the intersection with Highway 7. From this western terminus, each alignment is directed in a southeasterly direction towards the eastern terminus at US 50. A map of the alternatives is included in Appendix A (Exhibit 2). Land use within the immediate surrounding area consists primarily of agriculture, forested land, and residential land. Prominent ecological features in the vicinity of the project include a relatively large forest block associated with Selmier State Forest and the Vernon Fork of the Muscatatuck River. The Vernon Fork has an approximate drainage area of 110 mi^2, much of which is forested.

The project is situated entirely within the Eastern Corn Belt Plains (55) Level III Ecoregion as mapped by the US Environmental Protection Agency (USEPA 1997). This section of the Eastern Corn Belt Plains (55) is characterized by rolling plains with poorly drained soils and high stream biodiversity. Average annual precipitation is 35-40 inches. This area has been heavily cleared for agriculture, especially corn and soybeans.

3.0 BACKGROUND INFORMATION

3.1 Summary of Prior Indiana Bat Presence

On August 6, 2012 a juvenile female Indiana bat was captured on the western side of the project area. Radio-tracking was unsuccessful; therefore, no information regarding foraging habitat or roost tree location is available for this bat. The results of this survey are detailed in a previous report from Eco-Tech Consultants, Inc. (dated September 2012).

According to Indiana Department of Natural Resources (IDNR) Natural Heritage data the nearest documented case of Indiana bat presence is approximately five miles northeast of the project area along the Vernon Fork of the Muscatatuck River. This survey was conducted in the late 1990's. Additionally, other documented cases of Indiana bat presence were found in Big Oaks National Wildlife Refuge, approximately 5 miles east of the project area (Ronald Hellmich, Indiana Division of Nature Preserves, pers. comm.; Appendix D).

Further consultation with an additional specialist within the Indiana Department of Natural Resources, yielded information involving an acoustic study performed on Selmeier State Forest from May 11 to 15, 2012 (Scott Haulton, IDNR Wildlife Specialist, pers. comm.). Four acoustic detectors (Anabat SD2s) were deployed for five nights at random locations within state forest property. Detectors started recording at least 30 minutes before sunset and stopped greater than 30 minutes after sunrise. The Echoclass software (Britzke, 2012) was used to identify calls

to species. No pulses were identified as Indiana bats. Detailed correspondence from IDNR representative Scott Haulton is available in Appendix D.

3.2 Characteristics of Indiana Bat Summer Habitat

Selection of roost trees by Indiana bat colonies is based on structural characteristics. Tree diameter, solar exposure, and height in canopy are among the most important (Rommé et al. 1995, Kurta and Murray 2002). Male and female Indiana bats inhabit different habitats and choose roost trees with differing characteristics during the summer months (Kurta 2005). Reproductive females tend to choose roosts in mature forests with large trees, scattered gaps in the canopy, and an open understory (Gardner et al. 1991a, Callahan et al. 1997). The number of available roost trees in an area influences the suitability of habitat for female Indiana bats (Farmer et al. 2002, Kurta 2005). Gardner et al. (1991a) found that of 39 roost trees evaluated, 31% were not suitable the following summer, and that 33% of the remaining trees were unavailable for use after two summers. Thus roost trees are an ephemeral resource.

Maternity colonies have been found under sloughing bark of dead, partially dead, and live trees (Carter 2003, Gardner et al. 1991a, Kurta et al. 1993, Kurta et al. 2002, Rommé et al. 1995). These colonies have been found in lowland forests (Cope et al. 1974, Humphrey et al. 1977), and more recently in upland forests (Callahan et al. 1997, Clark et al. 1987, Gardner et al. 1991a, Kiser et al. 2002). Such colonies are usually located in large-diameter, standing dead trees, with direct exposure to sunlight (Callahan et al. 1997). Maternity roosts can contain over 350 individual bats during July and August (Kiser et al. 1998). During Callahan's study (1997), he arranged roost trees into two groups depending on the intensity of use and size of the colony that used each tree. Callahan (1993) classified any tree that was used more than once by greater than 30 bats each time as a primary roost tree, and any tree with less than 30 bats or used only once as an alternate roost tree. Primary roost trees had an average DBH of 22.4 inches, while open snags used as alternate roosts had an average DBH of 20.9 inches (Callahan et al. 1997).

Indiana bats require more than one roost tree to fulfill their needs during the summer (Callahan et al. 1997). Barclay and Kurta (2004) found one maternity colony that used 18 roost trees during a single summer. In addition, Indiana bats are known to roost in several different species of trees, selecting roost trees by the structural composition of each tree. Farmer et al. (1997) contends that structure is probably more important than tree species in selection of roost trees.

Twelve tree species are listed in the Habitat Suitability Index Model (Rommé et al. 1995) as primary species (class 1 trees). The trees listed by Rommé et al. (1995) 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*), northern red oak (*Quercus rubra*), post oak (*Q. stellata*), white oak (*Q. alba*), slippery elm (*Ulmus rubra*), and American elm (*U. americana*). In addition to these species, Rommé et al. (1995) listed sugar maple (*A. saccharum*), shingle oak (*Q. imbricaria*), and sassafras (*Sassafras albidum*) as class 2 trees. The class 2 trees are those

species believed to be less important, but still have the necessary characteristics to be used as roosts. Trees normally used as primary roosts are dead and have a DBH greater than 12 inches (Rommé et al. 1995).

At least 33 tree species have been found to be roosts for reproductive female Indiana bats, and most of them are hickories (22%), maples (15%), oaks (15%), ashes (13%), elms (13%), and poplars (9%) (USFWS 2007). It was previously believed that oak and hickory were used more commonly in the southern portion of the range (Callahan et al. 1997, Gardner et al. 1991a), and elm, ash, maple, and cottonwood were occupied more often in northern areas (Kurta et al. 1996, 2002; Whitaker and Brack 2002). However, more recent research reveals that Indiana bats occupy ash and elm most often in southern Illinois (Carter 2003) and hickories most often in Vermont (Palm 2003). Therefore, it appears that tree species use is more closely related to local availability and suitable structure than to broad regional preferences (USFWS 2007). Nonetheless, some common trees, such as American beech (*Fagus grandifolia*), basswood (*Tilia americana*), wild black cherry (*Prunus serotina*), box elder (*A. negundo*), and willow (*Salix* spp.), are rarely to never used, suggesting that they are typically not acceptable even when suitable structure is present, especially as a primary roost (USFWS 2007).

Most (97%) roost trees of female Indiana bats at maternity sites are deciduous species, except for a few coniferous trees discovered in the Great Smoky Mountains (Harvey 2002, Britzke et al. 2003) and in New England (Palm 2003). This more likely reflects availability rather than a preference for deciduous trees (USFWS 2007).

4.0 METHODS

4.1 Indiana Bat Habitat Assessment

The first step in calculating potential direct, indirect, and cumulative impacts was to assess the quality of habitat which may be impacted by the proposed alternatives. A variety of methods have been used to characterize Indiana bat summer roosting habitat. For instance, Rommé et al. (1995) developed a Habitat Suitability Index that included a large number of parameters. In contrast, Farmer et al. (2002) found that the density of suitable roost trees was the single most useful predictor of habitat use by Indiana bats. The methodology employed in this report closely follows the USFWS 2012 Indiana bat Survey Protocol Appendix A: Summer Habitat Assessments (USFWS 2012).

Habitat was initially evaluated in forested areas of the clearing limits with 30 predetermined locations. However, after discussion of preliminary results with the agencies, the habitat assessment area was expanded to include additional forest stands that may be affected by fragmentation, resulting in the addition of five sample points. Sample points were limited to forested areas (Appendix A – Exhibit 2). At each sample point, a 15 meter radius evaluation plot was established. Data collected within each circular plot consisted of a qualitative evaluation of the following parameters:

1. Average % canopy, midstory, and understory cover
2. Dominant tree species in canopy, midstory and understory
3. Average vegetation density at canopy, midstory and understory
4. Percentage of trees with exfoliating bark
5. Size composition of live trees (small: 4-8”; medium: 9-15”; large >15”)
6. Water resources
7. Number of potential roost trees, based on: condition-(live, live/damaged, snag), % exfoliating bark, solar exposure, tree size, species

GPS coordinates and four representative photos (in the four cardinal directions) from each sample point were obtained. Each plot was assigned a suitability rating of "*Low, Medium,* or *High*", based on the parameters above. Forested stands falling within the project area survey limits were assigned a qualitative rating of Low, Medium, or High based on information collected during the habitat assessment and interpretation of aerial photography.

4.2 Indiana Bat Impact Analysis

At the time this habitat assessment was initiated there were a total of seven alignment alternatives, following two major pathways (Appendix A – Exhibit 2). Forested habitat impacts are reported for each alignment. However, design refinements have eliminated five of these alignments, and more detailed discussion of the potential effects of fragmentation and loss of connectivity are provided for the final two alignments under consideration (6D and 4NB1).

Direct Effects

All forested stands within the project survey limits were digitized in ArcGIS (ver 10.0) using recent aerial photography. Polygons within the survey limits (and expanded survey limits as requested by the agencies) were given values of “Low, Medium, or High” based on information gathered in the habitat assessment. Georeferenced clearing limits were then used to calculate the amount of forested habitat that would be impacted by each alternative (i.e., the forested habitat shapefile was clipped using the clearing limits shapefiles). This approach was used to determine the loss of potential Indiana bat habitat categorized by habitat quality.

Indirect Effects

Indirect impacts to Indiana bat habitat include habitat fragmentation (splitting of large blocks into smaller blocks) and loss of connectivity between forested patches. While field surveys of habitat quality were limited to a habitat assessment area directly adjacent to the alternatives, analysis of habitat impacts must also take into account landscape-level effects. For assessment of landscape effects, the boundary of each forested stand within 2.5 km of the project area was digitized in ArcGIS (ver 10.0) using recent aerial photography.

In order to assess the indirect impact of the project on Indiana bat habitat within the local landscape the following common, intuitive habitat fragmentation metrics were calculated using ArcGIS (ver 10.0):

1. *Number of patches* = total number of separate forest patches within 2.5 km

2. *Mean patch area* = sum of patch area/number of patches
3. *Mean perimeter to area ratio* = (∑(perimeter of each patch in ft/area of each patch in ft^2))/total number of patches
4. *Patch density* (number of patches per 100 ha) = (number of patches/total area surveyed in m^2)*10,000*100
5. *Total edge* = ∑(perimeter of all patches)

While no single number provides a complete measure of habitat fragmentation (Strand et al. 2007), the metrics listed above provide a means to quantify some of the landscape changes that will be brought about by the two alignments. Relationships between bat habitat use and at least two of the metrics listed above (patch density and patch area) have been found in the past (Medlin et al. 2010). However, making comparisons to studies completed at different scales and using different metrics is problematic.

Additional qualitative analysis of habitat and connectivity was also conducted based on interpretation of aerial photography.

Cumulative Effects

Information regarding additional access points was obtained from the design team. In addition, comparisons of the probable cumulative effect of development associated with the alternatives were derived from land use comparisons based on interpretation of aerial photography.

5.0 RESULTS AND DISCUSSION

5.1 Habitat Assessment

The Indiana bat habitat assessment area, which surrounds the alignment alternatives and includes relevant forest stands, encompassed approximately 1,817 acres. Of this area, 562 acres (31%) are forested. The landscape within 2.5 km of the survey limits encompasses approximately 18,732 ac, 7,400 ac of which (40%) are forested. Tulip poplar and shagbark hickory were the most commonly encountered tree species (present at 26% of all points sampled). Red maple (23%), sassafras (20%), and white oak (20%) were the next most frequently encountered trees (Figure 1).

Based on the data collected, 11 locations were classified as high suitability, 14 as moderate, and 10 as low. High quality areas had characteristics favorable for foraging, roosting, and/or commuting by Indiana bats, such as the presence of 1 or more PRTs, low density midstory and/or understory, flight corridors to adjacent foraging areas, good canopy closure, and/or close proximity to water.

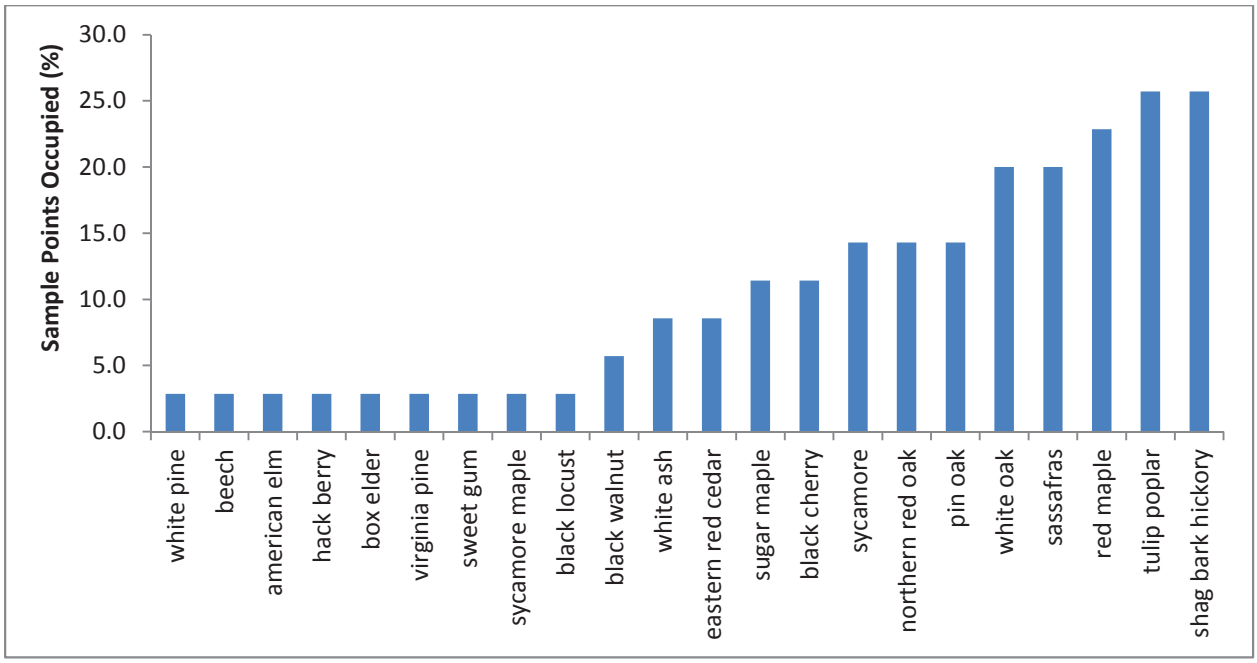

Figure 1. Frequency of tree species (percent of sample points occupied) in forest stands assessed for the North Vernon Bypass (U.S. 50) project, Jennings County, Indiana.

Best professional judgment was ultimately used to categorize habitat at each survey point; however, several quantifiable parameters support these characterizations. For instance, average midstory density in areas of high suitability was 33% whereas moderate and low suitability were 52% and 75%, respectively. In addition, the average number of potential roost trees (PRTs) and percent of trees with exfoliating bark were highest at high quality sites and lowest at low quality sites. Conversely, average distance to water was relatively similar among sites, and it did not directly correspond to habitat suitability rankings (Table 1).

Table 1. Average values of quantifiable parameters for habitats ranked as high, moderate, or low suitability for Indiana bats during the habitat assessment conducted for the North Vernon Bypass (U.S. 50) project, Jennings County, Indiana.

	Percent Cover					
Suitability	**Canopy**	**Midstory**	**Understory**	**Average Number of PRTs**	**Percent of Trees with Exfoliating Bark**	**Average Distance to Water**
High	81%	33%	53%	1.36	20.9%	499 m
Moderate	83%	52%	65%	1.14	8.6%	418 m
Low	83%	75%	74%	0.00	0.5%	467 m

The project survey limits included a substantial percentage (69%) of non-habitat, with smaller areas of medium (14%), high (10%), and low (7%) quality Indiana bat habitat (Figure 2).

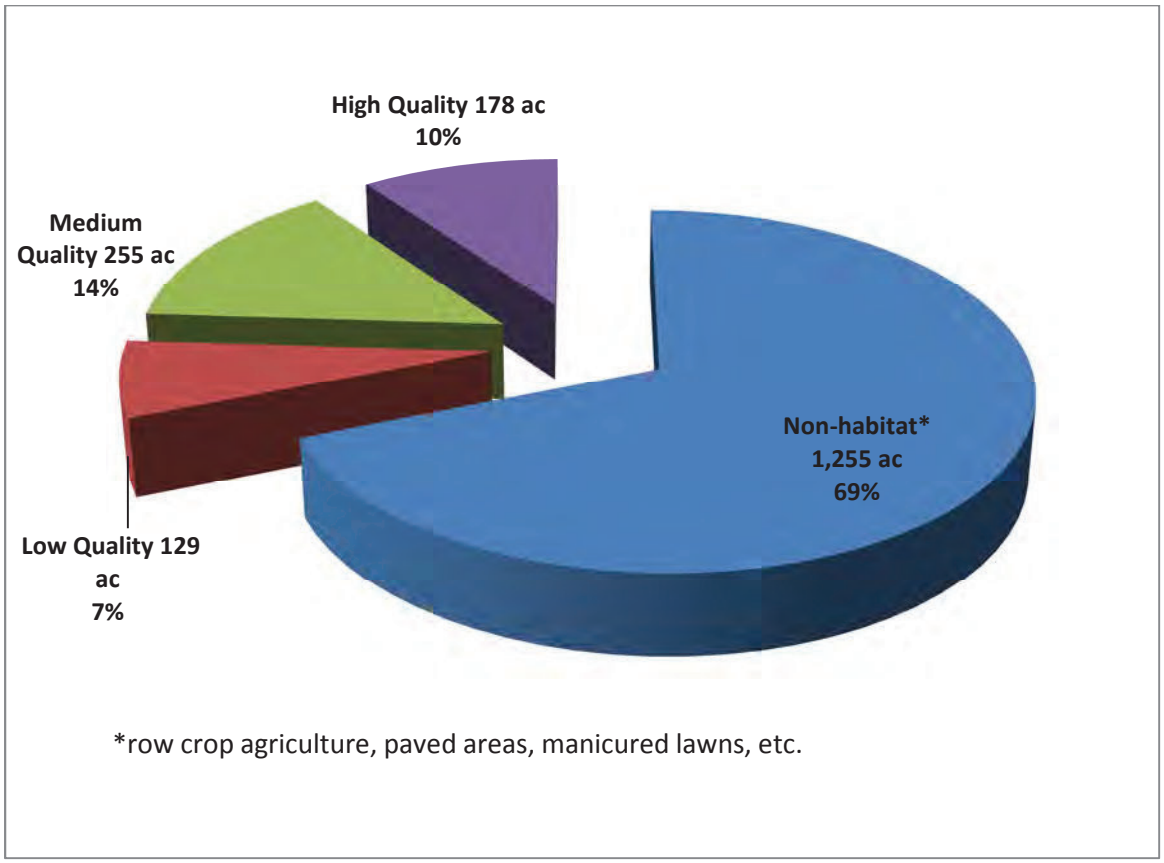

Figure 2. Habitat quality composition within the project survey limits for the North Vernon Bypass (U.S. 50) project, Jennings County, Indiana

5.2 Impact Analysis

Direct Impacts

In terms of direct impact to forested habitat resulting from this project, the seven alternatives range from 38.04 ac (Alt. 6D) to 52.87 ac (Alt. 4SB1). Alt. 4SB1 would result in loss of the most high quality habitat (26.61 ac), while Alt. 6D would result in the least (12.82 ac). Of the two alternatives selected for more detailed analysis (Alt. 6D and Alt. 4NB1), Alt. 6D would clearly be the least deleterious alternative in terms of direct loss of suitable Indiana bat summer habitat (Table 1; Appendix A – Exhibit 3).

Table 2. Indiana bat summer habitat impacts associated with the seven alternatives proposed for the U.S. 50 Bypass, North Vernon, IN.

	Alternative						
	6D*	**4SB1**	**4SB2**	**4MB1**	**4MB2**	**4NB1***	**4NB2**
Indiana Bat Habitat Impacts							
High Quality	12.82	26.61	25.46	21.15	20.15	18.58	17.01
Medium Quality	6.64	19.14	14.82	16.89	13.36	15.64	10.81
Low Quality	18.58	7.12	8.99	7.39	8.76	8.69	10.52
Total Forested Impact	**38.04**	**52.87**	**49.26**	**45.43**	**42.27**	**42.90**	**38.34**

*Selected for detailed analysis.

Indirect Impacts

Fragmentation of forested stands will reduce the amount of habitat available for Indiana bat roosting and foraging. In addition, the creation of wide expanses of pavement and manicured right-of-way may disrupt movement corridors that bats use to travel between roosting/foraging habitats.

Of the 7,400 ac of forest within 2.5 km of the project limits, Alt. 6D will result in loss of a slightly smaller percentage of habitat (38.04 ac, 0.51%) than Alt. 4NB1 (42.90 ac, 0.58%) (Table 2).

In terms of change to forest patch characteristics, the two alternatives selected for detailed analysis will fragment the landscape to different extents (Appendix A – Exhibit 4) (Table 3.). Alt. 4NB1 will fragment the existing forest into more patches, thereby reducing the average size of a patch of forest in the project area. It will also create more perimeter or "edge" habitat than Alt. 6D, increasing the average perimeter to area ratio approximately three-fold (Table 2). This increase is due to the fact that as the average size of a patch decreases, the perimeter to area ratio increases. Alt. 4NB1 divides a very large, contiguous block of forest and creates several small blocks, whereas Alt. 6D intersects much smaller blocks of forest.

Table 3. Measurements of habitat fragmentation of Indiana bat summer habitat associated with two alternatives proposed for the U.S. 50 Bypass, North Vernon, IN.

Forested Patch Characteristics	Baseline	6D	4NB1	Expected Direction With Increased Fragmentation
Number of Patches	83	88	94	Increase
Mean Patch Area (ac)	89.2	83.7	78.3	Decrease
Mean Perimeter/Area Ratio	0.014	0.014	0.040	Increase
Patch Density	1.09	1.16	1.24	Increase
Total Edge (ft)	1,118,423	1,112,957	1,116,951	Increase

While certain wildlife species are favored by early-successional habitats produced along forest edge, research indicates that Indiana bats are favored by preservation of large blocks of forest (Menzel et al. 2005). Therefore, Alt. 6D would be favorable in terms of bat habitat fragmentation.

Habitat connectivity will also be affected differently by the two alternatives, except at the western end of the project where the two alignments coincide. Here, both alignments have potential to affect connectivity between a forested stand where an Indiana bat was captured and high quality habitat approximately 0.25 mile to the north. These areas are currently separated by agricultural land and a two-lane county road; however, it is likely that the proposed road will present a more substantial movement barrier than existing agricultural land.

Both alternatives intersect the Muscatatuck River, which provides an important movement corridor and source of emerging aquatic insects for bats. However, Alt. 6D intersects the river close to an area of existing residential development, whereas Alt. 4NB1 crosses the river

through a large tract of more contiguous forest. Alt. 4NB1 would create an interruption between a large block of forest that includes Selmier State Forest and additional large blocks of forest to the east. According to IDNR Natural Heritage data there are records of Indiana bats approximately five miles to the east along the Muscatatuck River; therefore, Alt. 4NB1 has more potential to affect movement by these bats. In addition, much of the forest in the area where Alt. 4NB1 would cross this contiguous forest block was classified as high quality Indiana bat habitat. Therefore, the effect of Alt. 4NB1 on habitat connectivity would be much more deleterious than the effect of Alt. 6D.

Cumulative Effect

The ultimate effect of this project must be considered in combination with all other past, present, and reasonably foreseeable activities in the area.

Because both alternatives begin within the same footprint on the west side of the project area, other portions of the proposed U.S. 50 bypass to the west will have the same cumulative effect on Indiana bat habitat regardless of which alternative is chosen. Similarly, the planned expansion of the airport located north of Alt. 4NB1 could likely have a cumulative effect with either alternative.

In contrast, the two alternatives would likely differ in terms of new development, which often accompanies new roads. Potential expansion of residential and industrial areas adjacent to Alt. 6D would occur near an area that is already affected by development, while incidental increases in development associated with Alt. 4NB1 would occur in an area that is currently less affected by human expansion.

There is also a substantial difference in the number of new access points required for each alternative. Alt. 6D would require one new access point (CR 75 W). In contrast, Alt. 4NB1 would result in four new access points (CR 75 W, CR 20 W, CR 350 N, and CR 300 N). The result is likely to be a greater cumulative effect on bat habitat associated with Alt. 4NB1.

6.0 SUMMARY AND CONCLUSIONS

The proposed project will result in impacts to known Indiana bat habitat through direct removal of high quality suitable Indiana bat habitat; however, this report may serve as a basis to avoid and minimize effects to this species' habitat. The direct effects of seven alternatives to suitable Indiana bat habitat were considered, and two alternatives (Alt. 6D and Alt. 4NB1) were chosen for a more detailed comparison of indirect and cumulative impacts on suitable Indiana bat habitat.

Of the seven alternatives, Alt. 6D would have the least direct impact to Indiana bat habitat, and Alt. 4SB1 would have the most direct impact to Indiana bat habitat. Of the two alternatives selected for detailed analysis (6D and 4NB1), Alt. 6D would directly affect less Indiana bat habitat, in terms of both high quality habitat and the overall amount of habitat.

Alt. 6D would also have fewer indirect effects on Indiana bat habitat at the local landscape

level. Every metric of habitat fragmentation, including number of patches, mean patch area, mean perimeter/area ratio, patch density, and total edge, indicates that less habitat fragmentation would be caused by Alt. 6D. In terms of habitat connectivity, Alt. 6D would have less effect on large, continuous forest tracts along the Muscatatuck River that could potentially serve as habitat and movement corridors for Indiana bats.

It is also likely that the cumulative effect of Alt. 6D would be less because it requires far fewer new access points and would be less likely than Alt. 4NB1 to cause increased development in habitat that is currently isolated from the more developed land associated with North Vernon.

In conclusion, Alt. 6D would create less impact to Indiana bat habitat in terms of direct habitat loss, indirect effects due to fragmentation and loss of connectivity, and cumulative effects caused by reasonably foreseeable development in the area (Table 4).

Table 4. Summary of parameters used in assessment of the effect of alignment alternatives on Indiana bat habitat for the U.S. 50 Bypass, North Vernon, IN.

Assessment Parameter	Alternative with Least Impact
Direct Effects	
High quality Indiana bat habitat impacted	Alternative 6D
Total forest impact	Alternative 6D
Indirect Effects	
Number of patches	Alternative 6D
Mean patch area	Alternative 6D
Mean perimeter/area ratio	Alternative 6D
Patch density	Alternative 6D
Total edge	Alternative 6D
Habitat connectivity	Alternative 6D
Cumulative Effects	
Number of new access points	Alternative 6D
New development in currently isolated areas	Alternative 6D

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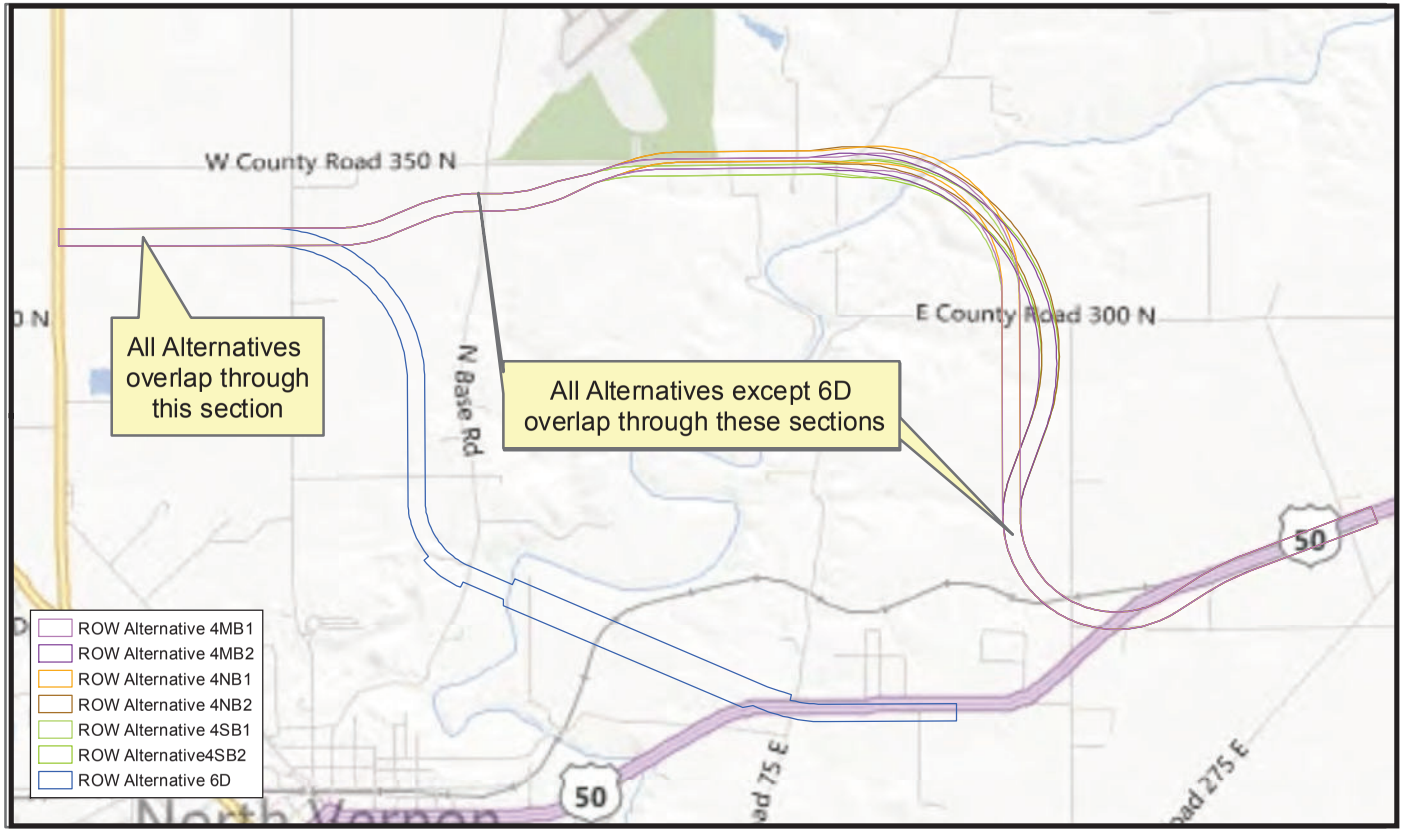
APPENDIX A MAPS

Exhibit 1	**Project Location and Alternatives**
Exhibit 2	**Habitat Assessment Area**
Exhibit 3	**Indiana Bat Habitat Impact Comparison**
Exhibit 4	**Indiana Bat Indirect Effects: Fragmentation and Connectivity**

Enlargement of the area of divergence for the 6 northern alternatives:
4MB1, 4MB2, 4NB1, 4NB2, 4SB1, 4SB2.



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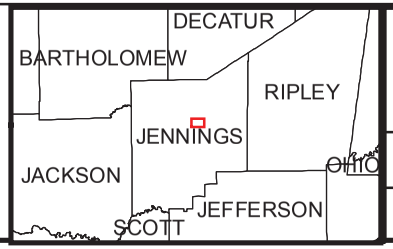


U.S. 50 North Vernon Bypass (East)
Jennings County, IN

1:12,577

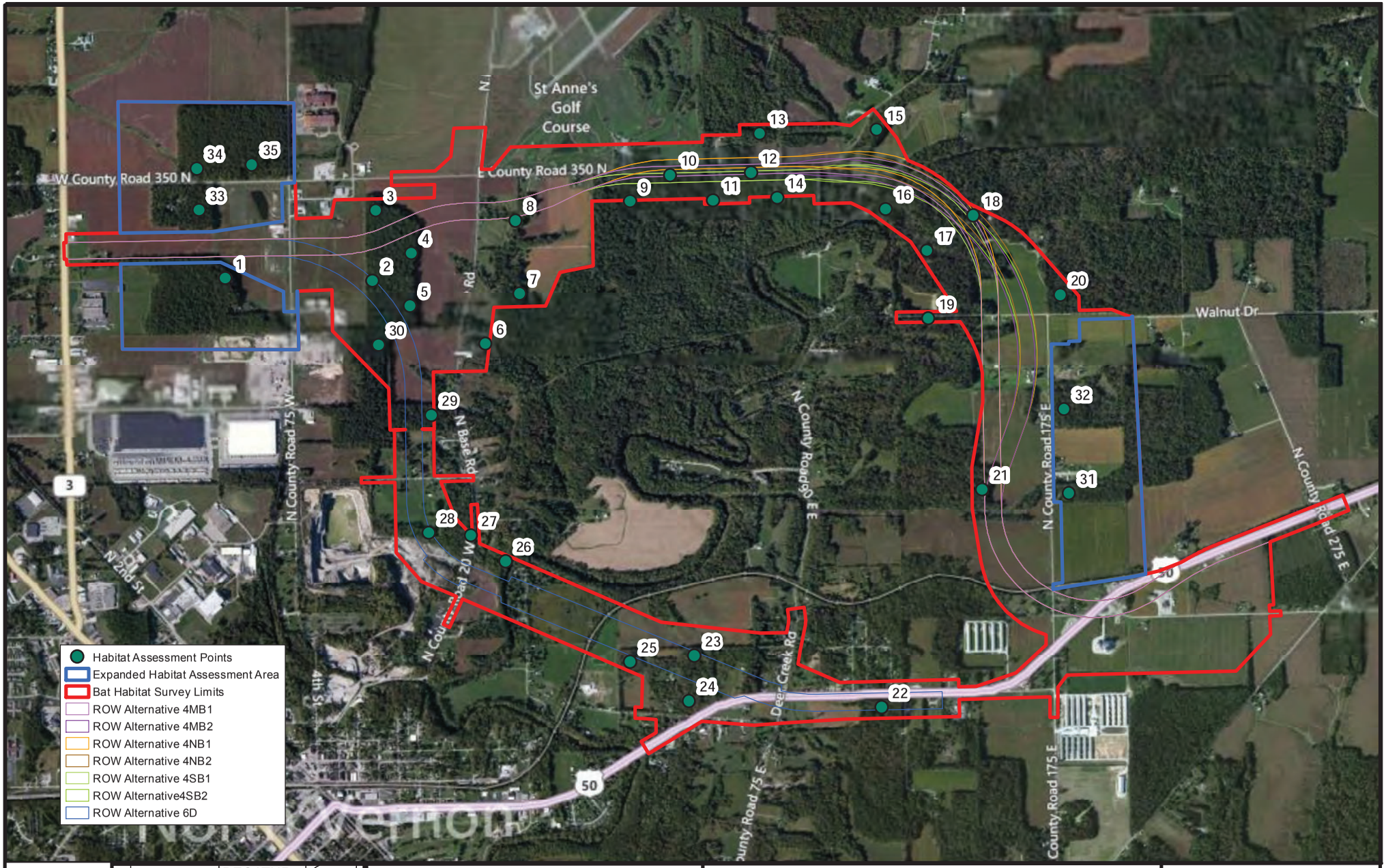
0 80 160 320 480 640 Meters

Imagery Source: Bing Maps Hybrid 2012

Exhibit 1
Project Location and Alternatives

Eco-Tech CONSULTANTS

Drawn by: RWE	Print Date:12/12/12
Prepared For: INDOT/Parsons Corp.	
ETC File: LV2012028	



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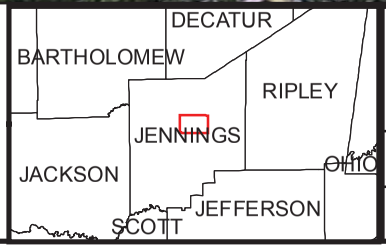


U.S. 50 North Vernon Bypass (East)
Jennings County, IN

1:28,000

0 185 370 740 1,110 1,480 Meters

Imagery Source: Bing Maps Hybrid 2012

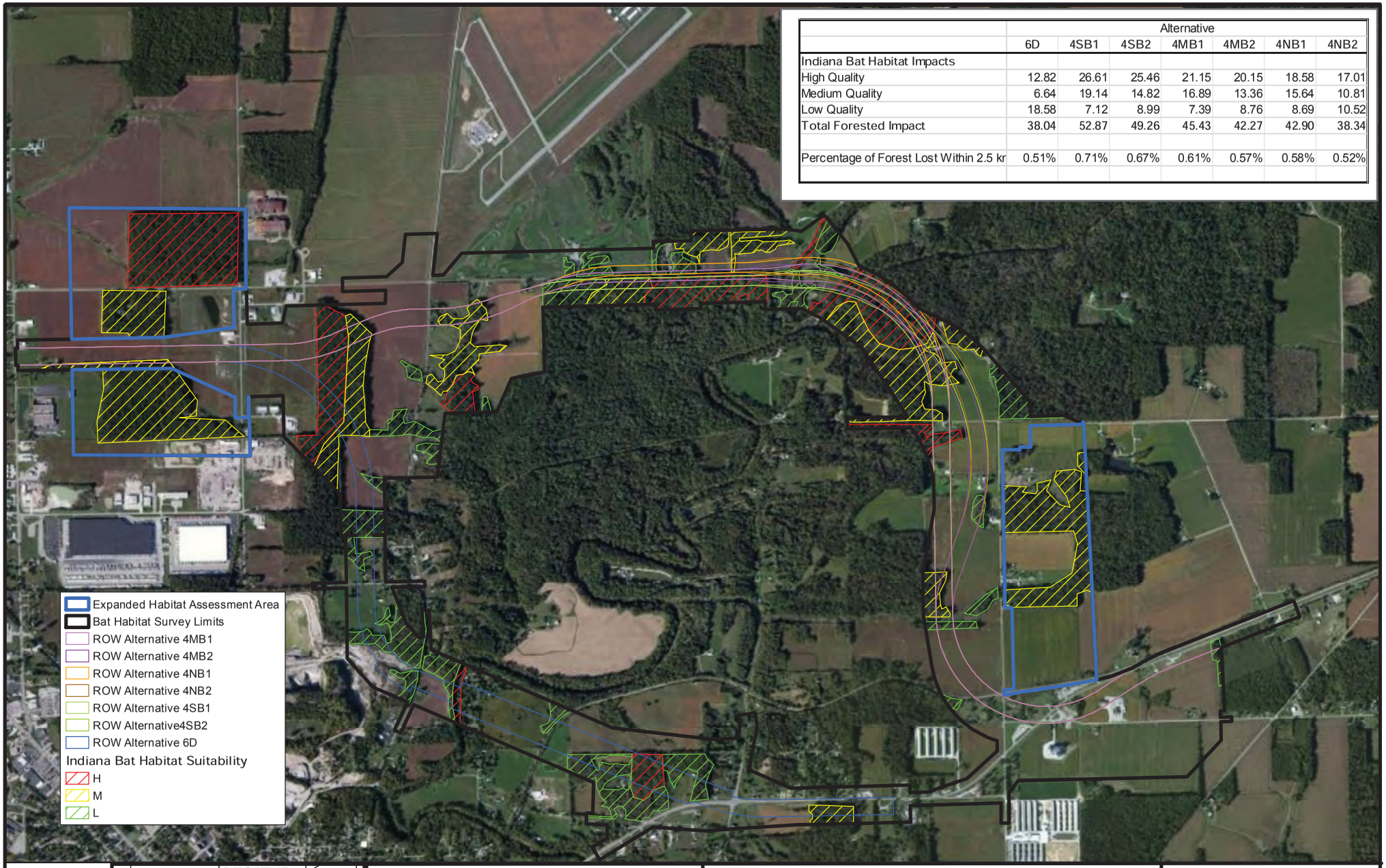
Exhibit 2

Habitat Assessment Area

Eco-Tech CONSULTANTS

Drawn by: TTB	Print Date:12/12/12
Prepared For: INDOT/Parsons Corp.	
ETC File: LV2012028	

	Alternative						
	6D	4SB1	4SB2	4MB1	4MB2	4NB1	4NB2
Indiana Bat Habitat Impacts							
High Quality	12.82	26.61	25.46	21.15	20.15	18.58	17.01
Medium Quality	6.64	19.14	14.82	16.89	13.36	15.64	10.81
Low Quality	18.58	7.12	8.99	7.39	8.76	8.69	10.52
Total Forested Impact	38.04	52.87	49.26	45.43	42.27	42.90	38.34
Percentage of Forest Lost Within 2.5 kr	0.51%	0.71%	0.67%	0.61%	0.57%	0.58%	0.52%



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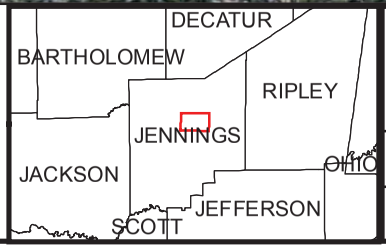


U.S. 50 North Vernon Bypass (East)
Jennings County, IN

1:28,000

0 185 370 740 1,110 1,480 Meters

Imagery Source: Bing Maps Hybrid 2012

Exhibit 3

Indiana Bat Habitat Impact Comparison

Eco-Tech CONSULTANTS

Drawn by: TTB | Print Date:12/12/12

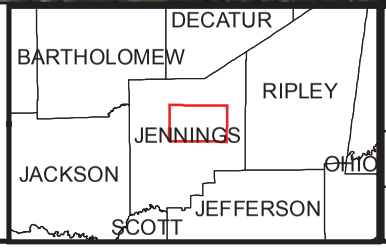
Prepared For: INDOT/Parsons Corp.

ETC File: LV2012028

Forested Patch Characteristics	Baseline	6D	4NB1	Expected Direction With Increased Fragmentation
Number of Patches	83	88	94	Increase
Mean Patch Area (ac)	89.2	83.7	78.3	Decrease
Mean Perimeter/Area Rati	589.2	595.6	1,758.4	Increase
Total Edge (ft)	1,118,423	1,112,957	1,116,951	Increase

2.5 km Buffer
ROW Alternative 4NB1
ROW Alternative 6D
Forest

N



U.S. 50 North Vernon Bypass (East)
Jennings County, IN

1:57,121

0 375 750 1,500 2,250 3,000 Meters

Imagery Source: Bing Aerial

Exhibit 4
Indiana Bat Habitat
Indirect Effects: Fragmentation and Connectivity

Eco-Tech CONSULTANTS

Drawn by: TTB | Print Date:12/12/12

Prepared For: INDOT/Parsons Corp.

ETC File: LV2012028

APPENDIX B SURVEY DATA SHEETS

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 NV Surveyor(s): TB, NB Date: 11/6/12
Sample Site Number: 1
Latitude/Longitude (DD, WGS 84): 39.03179 -85.63007
UTM: Zone (16) Easting 618574 Northing 4321197

Brief Project Description

~~Project Area~~
~~Total Acres: ___~~
~~Forest Acres: ___ (% of site: __ ,% within 1 mile: __)~~
~~Open Acres: ___ (% of site: __ ,% within 1 mile: __)~~

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

—

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)
Agricultural

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 / 6 Midstory: 6 / 5 Understory: 5 / 5
Dominant Canopy Species: Red maple
Dominant Midstory Species: Red maple, Am. beech
Dominant Understory Species: Spicebush, Am. Beech

Percentage of Trees with Exfoliating Bark 10
Size Composition of Live Trees (%) Small (4-8 in): 35 Med. (9-15 in): 55 Large (>15 in): 10
___ 1 PRT Shagbark
Number of Suitable Roost Tree Snags Observed

No snags

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: ____ Width: ____

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Site of In. but capture.
No evidence of clearing

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Site Number: 1

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 NV Surveyor(s): BH, RE Date: 11/6/12
Sample Site Number: 2
Latitude/Longitude (DD, WGS 84): 39.02151 -85.62089
UTM: Zone ( ) Easting 16 0193609 Northing 4321178

Brief Project Description

Project Area
Total Acres: ___
Forest Acres: ___ (% of site: ___ ,% within 1 mile: ___)
Open Acres: ___ (% of site: ___ ,% within 1 mile: ___)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 1 Understory: 5

Dominant Canopy Species: Red maple, white oak, pin oak
Dominant Midstory Species: red maple, white oak
Dominant Understory Species: beech, shag bark, sweet gum

Percentage of Trees with Exfoliating Bark 20%
Size Composition of Live Trees (%) Small (4-8 in): 5 Med. (9-15 in): 75 Large (>15 in): 20

Number of Suitable Roost Tree Snags Observed

1 PRT

Water Resources at Sample Site
Stream Type: Ephemeral Intermittent Perennial Depth: ____ Width: ____

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

abundance of coarse woody debris

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

BTH field camera: 0388-0391

Site Number: 2

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: US 50 N.V. Surveyor(s): BTM, RE Date: 11/6/12
Sample Site Number: 3
Latitude/Longitude (DD, WGS 84): 39.03495 85.62058
UTM: Zone ( ) Easting ~~39.03495~~ Northing ~~85.62058~~
16 619390 4321560

Brief Project Description

Project Area
Total Acres: ___
Forest Acres: ___ (% of site: ___ ,% within 1 mile: ___)
Open Acres: ___ (% of site: ___ ,% within 1 mile: ___)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?
—

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 1 Understory: 2

Dominant Canopy Species: white oak, tulip poplar, red maple
Dominant Midstory Species: red maple
Dominant Understory Species: beech, black gum, spice bush

Percentage of Trees with Exfoliating Bark 15
Size Composition of Live Trees (%) Small (4-8 in): 25 Med. (9-15 in): 60 Large (>15 in): 15

Number of Suitable Roost Tree Snags Observed
1 PRT
2 ART

Water Resources at Sample Site

~~Stream Type: Ephemeral Intermittent Perennial Depth: ____ Width: ____~~

~~Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal~~

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

White tailed Buck
turkey (~8)
Chipmunk
Fox squirrel

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

2324 - 2328

Site Number: 3

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: US 50 - N. Vernon IN Surveyor(s): BH, RE Date: 11/6/12
Sample Site Number: 4
Latitude/Longitude (DD, WGS 84): 39.03283 -85.61841
UTM: Zone (10) Easting 619581 Northing 4321528

Brief Project Description

Project Area
Total Acres: ____
Forest Acres: ____ (% of site: ____ ,% within 1 mile: ____)
Open Acres: ____ (% of site: ____ ,% within 1 mile: ____)

Tree Removal (ac)
Completely cleared: ____ Partially cleared (with remnant trees): ____ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?
____

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 5 Understory: 5

Dominant Canopy Species: shag bark, red maple
Dominant Midstory Species: sassafras, white oak
Dominant Understory Species: beech, ~~black gum~~ elm, white oak, red oak

Percentage of Trees with Exfoliating Bark 30%
Size Composition of Live Trees (%) Small (4-8 in): 40 Med. (9-15 in): 50 Large (>15 in): 10

____
Number of Suitable Roost Tree (Snags) Observed:
4 PTR

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: ____ Width: ____

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ____

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

pics - 0418 - 0421

Site Number: 4

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: US. 50 NV Surveyor(s): BM, NB Date: 11/8/12
Sample Site Number: 5
Latitude/Longitude (DD, WGS 84): 39.03025 -85.61855
UTM: Zone ( ) Easting 16 619574 Northing 4321041

Brief Project Description

~~Project Area~~
~~Total Acres: ____~~
~~Forest Acres: ___ (% of site: ___ ,% within 1 mile: __)~~
~~Open Acres: ___ (% of site: __ ,% within 1 mile: __)~~

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 5 Understory: 6

Dominant Canopy Species: shag bark, sassafras
Dominant Midstory Species: shag bark, red maple, sassafras
Dominant Understory Species: beech, red maple

Percentage of Trees with Exfoliating Bark 25%
Size Composition of Live Trees (%) Small (4-8 in): 20 Med. (9-15 in): 60 Large (>15 in): 20

Number of Suitable Roost Tree (Snags) Observed : 7

Site Number: 5

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: ____ Width: ____

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/Seasonal

Approximate size (ac.): X

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

BTH: 0410-0413

Site Number: 5

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 NV Surveyor(s): TB, NB Date: 11/6/12
Sample Site Number: 6
Latitude/Longitude (DD, WGS 84): 39.02851 -85.61375
UTM: Zone (16) Easting 619992 Northing 4320854

Brief Project Description

Project Area
Total Acres: ___
Forest Acres: ___ (% of site: __ ,% within 1 mile: __)
Open Acres: ___ (% of site: __ ,% within 1 mile: __)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 6 Understory: 5

Dominant Canopy Species: J. nigra, Juniperus virginiana
Dominant Midstory Species: J. virg., Rosa multiflora, Celtis occidentalis
Dominant Understory Species:

Percentage of Trees with Exfoliating Bark 0
Size Composition of Live Trees (%) Small (4-8 in): 50 Med. (9-15 in): 50 Large (>15 in): 0

Number of Suitable Roost Tree Snags Observed

0

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: 6" Width: 1 Ft

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Plane on building home 275m NW

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

1899-1902

Site Number: 6

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 NV Surveyor(s): TB, NB Date: 11/6/12
Sample Site Number: 7
Latitude/Longitude (DD, WGS 84): 39.03077 -85.61191
UTM: Zone (16) Easting 620148 Northing 4321108

Brief Project Description

~~Project Area~~
~~Total Acres: ___~~
~~Forest Acres: ___ (% of site: ___, % within 1 mile: ___)~~
~~Open Acres: ___ (% of site: ___, % within 1 mile: ___)~~

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6/5 Midstory: 4/4 Understory: 5/5
Dominant Canopy Species: Quercus alba, L. tulipifera
Dominant Midstory Species: Shagbark hickory, Am. beech
Dominant Understory Species: Am beech, green ash, Viburnum sp.

Percentage of Trees with Exfoliating Bark 20%
Size Composition of Live Trees (%) Small (4-8 in): 10 Med. (9-15 in): 0 Large (>15 in): 90
No PRT 3 ALT white oak
Number of Suitable Roost Tree Snags Observed
1 ALT

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: ____ Width: ____

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

A lot of roost quality white oaks outside of plot.

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Site Number: 7

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 NV Surveyor(s): NB, NB Date: 11/6/12
Sample Site Number: 8
Latitude/Longitude (DD, WGS 84): 39.04437 -85.61183
UTM: Zone ( ) Easting 620148 Northing 4321507

Brief Project Description

Project Area
Total Acres: ____
Forest Acres: ____ (% of site: __ ,% within 1 mile: __)
Open Acres: ____ (% of site: __ ,% within 1 mile: __)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 5 5 Understory: 6 6

Dominant Canopy Species: Platanus occidentalis, Quercus palustris, Fraxinus americana
Dominant Midstory Species: Sweetgum,
Dominant Understory Species: sweetgum, sassafras

Percentage of Trees with Exfoliating Bark 0
Size Composition of Live Trees (%) Small (4-8 in): 50 Med. (9-15 in): 20 Large (>15 in): 30

____ 0 Live roosts
Number of Suitable Roost Tree Snags Observed
0

Site Number: 8

Water Resources at Sample Site

Stream Type: ~~Ephemeral~~ Intermittent Perennial Depth: 2 Ft Width: 4 Ft

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Good Foraging

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

1907-1910

Site Number: 8

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: US. 50 N,V. Surveyor(s): TB, NB, BH, RE Date: 11/6/12
Sample Site Number: 9
Latitude/Longitude (DD, WGS 84): 39.0533, -85.60437
UTM: Zone (16) Easting ~~620768~~ 620769 Northing 4321608

Brief Project Description

Project Area
Total Acres: ___
Forest Acres: ___ (% of site: ___ ,% within 1 mile: ___)
Open Acres: ___ (% of site: ___ ,% within 1 mile: ___)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)? Ø

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: ~~3~~ 3 Understory: ~~6~~ 6

Dominant Canopy Species: LITU, ~~PLOC~~
Dominant Midstory Species: FAGR, ACRU, ~~ACSA~~
Dominant Understory Species: spicebush,

Percentage of Trees with Exfoliating Bark Ø
Size Composition of Live Trees (%) Small (4-8 in): 25 Med. (9-15 in): 50 Large (>15 in): 25

Number of Suitable Roost Tree Snags Observed

Ø PRT, Ø ART

Site Number: 9

Water Resources at Sample Site

Stream Type: ~~Ephemeral~~ Intermittent Perennial Depth: ____ Width: ____

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS? yes

IF SUITABLE HIGH MODERATE LOW

Additional Comments: Same as site 10

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

pic 2290-2293
S, W, N, E

Site Number: 9

INDIANA BAT HABITAT ASSESSMENT DATASHEET

15m radius

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N.V. Surveyor(s): TB, NB Date: 11-6-12
Sample Site Number: 10
Latitude/Longitude (DD, WGS 84): 39.03642 -85.60202
UTM: Zone (16) Easting 620987 Northing 4321747

Brief Project Description

Project Area
~~Total Acres: ___~~
~~Forest Acres: ___ (% of site: ___ ,% within 1 mile: ___)~~
~~Open Acres: ___ (% of site: ___ ,% within 1 mile: ___)~~

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/~~Density~~ 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Closure Canopy: 6 Midstory: 1 Understory: 4
Density 6 2 5
Dominant Canopy Species: Quercus rubra, Sassafrass albidum,
Dominant Midstory Species: Quercus alba, Acer saccharum
Dominant Understory Species: Cornus florida, Fagus grandifolia

Percentage of Trees with Exfoliating Bark 10%
Size Composition of Live Trees (%) Small (4-8 in): 60 Med. (9-15 in): 30 Large (>15 in): 10

Number of Suitable Roost Tree Snags Observed

0 PRT
5 ART

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: 1 Width: 3

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___ None visible

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Mature forest, a few coppiced trees, timber management evider

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Photos 2284 – 2287
South, W, N, E

Site Number: 10

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: US. 50 NV Surveyor(s): BTH, RE Date: 11/6/12
Sample Site Number: 11
Latitude/Longitude (DD, WGS 84): 39.03531 N 85.59953 W
UTM: Zone (16) Easting 621219 Northing 4321614

Brief Project Description

Project Area
~~Total Acres:~~ ____
Forest Acres: ___ (~~% of site:~~ ___ ,% within 1 mile: ___)
Open Acres: ___ (~~% of site:~~ ___ ~~,% within 1 mile:~~ ___)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

—

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 5 Midstory: 5 Understory: 6

Dominant Canopy Species: Sycamore, white oak
Dominant Midstory Species: beech, sugar maple, american elm
Dominant Understory Species: beech, white pine

Percentage of Trees with Exfoliating Bark 10%
Size Composition of Live Trees (%) Small (4-8 in): 10 Med. (9-15 in): 70 Large (>15 in): 20

Number of Suitable Roost Tree Snags Observed

0

Site Number: 11

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent (Perennial) Depth: 3' Width: ~~10~~ 20'

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE (HIGH) MODERATE LOW

Additional Comments:

2 APRT sat trees

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

photo: 2297 - 2300

Site Number: 11

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 NV Surveyor(s): BTH, RE Date: 11/6/12
Sample Site Number: 12
Latitude/Longitude (DD, WGS 84): 39.03640 N 85.59715 W
UTM: Zone ( ) Easting 602424 Northing 4321765

Brief Project Description

Project Area
Total Acres: ____
Forest Acres: ___ (% of site: __ ,% within 1 mile: __)
Open Acres: ___ (% of site: __ ,% within 1 mile: __)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): X No clearing: ___
selectively logged

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 4 Midstory: 1 Understory: 2

Dominant Canopy Species: N. red oak, white oak
Dominant Midstory Species: sugar maple
Dominant Understory Species: sugar maple

Percentage of Trees with Exfoliating Bark 3 (10-20%) ~15%
Size Composition of Live Trees (%) Small (4-8 in): 5 Med. (9-15 in): 15 Large (>15 in): 80

Number of Suitable Roost Tree Snags Observed
0 RTT
(0 ART)

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: ____ Width: 30

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

2316 - 2319

Site Number: 12

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N.V. Surveyor(s): BTH, NGB Date: 11/8/12
Sample Site Number: 13
Latitude/Longitude (DD, WGS 84): 39.03846 -85.59641
UTM: Zone ( ) Easting _____ Northing _____

Brief Project Description

Project Area
Total Acres: _____
~~Forest Acres: ___ (% of site: ___ ,% within 1 mile: ___)~~
~~Open Acres: ___ (% of site: ___ ,% within 1 mile: ___)~~

~~Tree Removal (ac)~~
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

—

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 5 Understory: 4

Dominant Canopy Species: sycamore, white ash
Dominant Midstory Species: silver maple, american elm
Dominant Understory Species: spice bush, american elm

Percentage of Trees with Exfoliating Bark 0
Composition of Live Trees (%) Small (4-8 in): 60 Med. (9-15 in): 20 Large (>15 in): 20
Number of Suitable Roost Tree Snags Observed: 0

1 PRT (Shag bark) - just outside plot

Water Resources at Sample Site (40 m from pt)

Stream Type: Ephemeral Intermittent (Perennial) Depth: 3 Width: 12

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH (MODERATE) LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

BTH 0422-0425

Site Number: 13

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: US. 50 N V Surveyor(s): BH-1, NGB Date: 11/8/12
Sample Site Number: 14
Latitude/Longitude (DD, WGS 84): 39.03580 -85.59829
UTM: Zone (16) Easting 621319 Northing 4321684

Brief Project Description

~~Project Area~~
~~Total Acres: ___ (% of site: ___ ,% within 1 mile: ___)~~
~~Forest Acres: ___ (% of site: ___ ,% within 1 mile: ___)~~
~~Open Acres: ___ (% of site: ___ ,% within 1 mile: ___)~~

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 5 Midstory: 5 Understory: 6

Dominant Canopy Species: white pine, white oak, tulip poplar
Dominant Midstory Species: ~~tulip poplar~~ white pine, beech
Dominant Understory Species: beech

Percentage of Trees with Exfoliating Bark 10%
Size Composition of Live Trees (%) Small (4-8 in): 40 Med. (9-15 in): ~~18~~ 40 Large (>15 in): 20

Number of Suitable Roost Tree Snags Observed
1 ART
4 ART

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: ____ Width: ____

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

white pines, 80yrs

survey location on logging path

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

2319-2323

2320

Site Number: 14

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N.V. Surveyor(s): TB, NB Date: 11/6/12
Sample Site Number: 15
Latitude/Longitude (DD, WGS 84): 39.03847 -85.58904
UTM: Zone (IL) Easting 622114 Northing 4321992

Brief Project Description

~~Project Area~~
~~Total Acres: ___~~
~~Forest Acres: ___ (% of site: ___, % within 1 mile: ___)~~
~~Open Acres: ___ (% of site: ___, % within 1 mile: ___)~~

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): X No clearing: ___

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 2 / 2 Midstory: 2 / 3 Understory: 5 / 4
Dominant Canopy Species: white pine, black cherry
Dominant Midstory Species: black cherry
Dominant Understory Species: black cherry

Percentage of Trees with Exfoliating Bark 0
Size Composition of Live Trees (%) Small (4-8 in): 70 Med. (9-15 in): 20 Large (>15 in): 10
No live roosts
Number of Suitable Roost Tree Snags Observed
0

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: ____ Width: ____

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

No suitable roost trees White pine plantation & adjacent to black walnut plantation.. Heavily cleared.

Small perennial stream ~60m away.

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Site Number: 15

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: US, 50 NV Surveyor(s): BTH, NGB Date: 11/8/12
Sample Site Number: 16
Latitude/Longitude (DD, WGS 84): 39.03468 85.58860
UTM: Zone ( ) Easting 632155 Northing 4321567

Brief Project Description

Project Area
~~Total Acres: ___~~
~~Forest Acres: ___ (% of site: __ ,% within 1 mile: __)~~
~~Open Acres: ___ (% of site: ___ ,% within 1 mile: __)~~

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?
yes - site situated at intersection of several ATV trails

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 5 Midstory: 6 Understory: 5

Dominant Canopy Species: ~~Sassafras~~, Black Cherry, Sycamore, Tulip
Dominant Midstory Species: Sugar maple
Dominant Understory Species: Sugar maple, beech, m rose

Percentage of Trees with Exfoliating Bark 0
Composition of Live Trees (%) Small (4-8 in): 10 Med. (9-15 in): 60 Large (>15 in): 30
Number of Suitable Roost Tree Snags Observed: 0

Water Resources at Sample Site river located 100 m away
Stream Type: Ephemeral Intermittent Perennial Depth: ____ Width: ____

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

near by river (Moskatitch)

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

(BTH) 0482-0485

Site Number: 16

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: US. 50 N. V. Surveyor(s): BTH/ NGB Date: 11/8/12
Sample Site Number: 17
Latitude/Longitude (DD, WGS 84): 39.03260 85.58607
UTM: Zone ( ) Easting 622380 Northing 4321341

Brief Project Description

Project Area
Total Acres: ___
Forest Acres: ___ (% of site: ___ ,% within 1 mile: ___)
Open Acres: ___ (% of site: ___ % within 1 mile: ___)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): X No clearing: ___

Landscape within 3 mile radius
Flight corridors to other forested areas present?
no

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 5 Midstory: 4 Understory: 6

Dominant Canopy Species: N. Red Oak, Sugar maple
Dominant Midstory Species: sugar maple
Dominant Understory Species: maple, beech, white ash

Percentage of Trees with Exfoliating Bark 5% (n=1)
Composition of Live Trees (%) Small (4-8 in): 10 Med. (9-15 in): 20 Large (>15 in): 70
Number of Suitable Roost Tree Snags Observed: 0

1 live shagbark Hickory

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: 1' Width: 5'

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

BTH: 0478 - 0481

Site Number: 7

Arnold w/ Parsons

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N.V. Surveyor(s): BTH, NGB Date: 11/8/17
Sample Site Number: 18
Latitude/Longitude (DD, WGS 84): 39.03429 85.58311
UTM: Zone ( ) Easting 622634 Northing ~~X~~ 4321535

Brief Project Description

Project Area
Total Acres: ___
Forest Acres: ___ (% of site: ___ ,% within 1 mile: ___)
Open Acres: ___ (% of site: ___ ,% within 1 mile: ___)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): X No clearing: ___

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 4 Understory: 4

Dominant Canopy Species: Sassafras, White oak, Shagbark, white ash
Dominant Midstory Species: Sugar maple,
Dominant Understory Species: sugar maple, beech

Percentage of Trees with Exfoliating Bark 30
Composition of Live Trees (%) Small (4-8 in): 10 Med. (9-15 in): 80 Large (>15 in): 10
Number of Suitable Roost Tree Snags Observed: 1 (prim)

several live shag barks (n=6)

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: X Width: X

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): X

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

picture #5?

0474-0477.

Site Number: 18

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N.V. Surveyor(s): BTH, NBG Date: 11/8/12
Sample Site Number: 19
Latitude/Longitude (DD, WGS 84): 39.02880 85.58563
UTM: Zone ( ) Easting 622425 Northing 4320927

Brief Project Description

Project Area
~~Total Acres:~~
Forest Acres: ___ ~~(% of site: ___ ,% within 1 mile: ___)~~
Open Acres: ___ ~~(% of site: ___ ,% within 1 mile: ___)~~

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?
yes - center of survey point is on a vehicle-wide path to road & open field

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 3 Understory: 3

Dominant Canopy Species: Shagbark Hickory, Black walnut, Red Oak
Dominant Midstory Species: Sugar Maple, Shagbark Hickory
Dominant Understory Species: M Rose, Beech

Percentage of Trees with Exfoliating Bark 30%
Composition of Live Trees (%) Small (4-8 in): 40 Med. (9-15 in): 20 Large (>15 in): 40
Number of Suitable Roost Tree Snags Observed: 0

PRT (live): 2 Shagbarks - mature w/ large amounts of exfoliating bark

other large live snags outside of plot (n = 11)

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: X Width: X

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

great foraging habitat

several roost trees

clear understory

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

(BTH) 0464-67 Site photos

0468-0469

Site Number: 19

Page ___ of ___

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N.V. Surveyor(s): BTM, NGB Date: 11/8/12
Sample Site Number: 20
Latitude/Longitude (DD, WGS 84): 39.03037 85.57780
UTM: Zone (16) Easting 623098 Northing 4321106

Brief Project Description

Project Area
~~Total Acres: ____~~
~~Forest Acres: ___ (% of site: __ ,% within 1 mile: __)~~
~~Open Acres: ___ (% of site: ___ ,% within 1 mile: __)~~

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

no

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 6 Understory: 6

Dominant Canopy Species: Sassafras, Elm, sweet gum
Dominant Midstory Species: Beech, Shagbark
Dominant Understory Species: Beech

Percentage of Trees with Exfoliating Bark 5 (n=1)
Composition of Live Trees (%) Small (4-8 in): 30 Med. (9-15 in): 35 Large (>15 in): 35
Number of Suitable Roost Tree Snags Observed: 0

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: X Width: X

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): X

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

(BTH) 0470 - 0473

Site Number: 20

Page of

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N.V. Surveyor(s): BTH, NGB Date: 11/8/12
Sample Site Number: 21
Latitude/Longitude (DD, WGS 84): 39.02086 85.58279
UTM: Zone ( ) Easting 622690 Northing 4320060

Brief Project Description

Project Area
Total Acres: ___
Forest Acres: ___ (% of site: __ ,% within 1 mile: __)
Open Acres: ___ (% of site: __ ,% within 1 mile: __)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 5 Midstory: 3 Understory: 6

Dominant Canopy Species: White oak, Shagbark, Tulip
Dominant Midstory Species: beech
Dominant Understory Species: beech

Percentage of Trees with Exfoliating Bark 10
Composition of Live Trees (%) Small (4-8 in): 20 Med. (9-15 in): 60 Large (>15 in): 20
Number of Suitable Roost Tree Snags Observed: 0

2 alternate roost
(Shag & White oak, young, low level of exfoliation)

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: 1 Width: 4

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

0460-0463

Site Number: 21

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N.V.1 Surveyor(s): BTH, NGB Date: 11/8/12
Sample Site Number: 22
Latitude/Longitude (DD, WGS 84): 39.01035 85.58927
UTM: Zone ( ) Easting 622134 Northing 4318863

Brief Project Description

Project Area
~~Total Acres: ___~~
~~Forest Acres: ___ (% of site: ___ ,% within 1 mile: ___)~~
~~Open Acres: ___ (% of site: ___ ,% within 1 mile: ___)~~

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 2 Understory: 3

Dominant Canopy Species: Red maple
Dominant Midstory Species: Red maple
Dominant Understory Species: Red maple

Percentage of Trees with Exfoliating Bark 0
Composition of Live Trees (%) Small (4-8 in): 80 Med. (9-15 in): 15 Large (>15 in): 5
Number of Suitable Roost Tree Snags Observed: 1

large, live shagbark hickory (~4's) & white oaks for 1' RTs in vicinity

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: X Width: X

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

(BTH) 0456-0459

Site Number: 22

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N. V. Surveyor(s): BTH, NGB Date: 11/8/12
Sample Site Number: 23 39.01289 85.60101
Latitude/Longitude (DD, WGS 84): 39.01289 ~~85.6500~~
UTM: Zone ( ) Easting 0602112 Northing 4319139
602112?

Brief Project Description

Project Area
~~Total Acres: ____~~
~~Forest Acres: ____ (% of site: ___, % within 1 mile: ___)~~
~~Open Acres: ____ (% of site: ___, % within 1 mile: ___)~~

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?
no

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 2 Understory: 4

Dominant Canopy Species: Shag bark, Tulip, Sassafras
Dominant Midstory Species: Beech, Sassafras
Dominant Understory Species: Beech, Sassafras, m rose

Percentage of Trees with Exfoliating Bark 10% (n=2)
Composition of Live Trees (%) Small (4-8 in): 40 Med. (9-15 in): 10 Large (>15 in): 50
Number of Suitable Roost Tree Snags Observed: 1 (PRT)

2 live PRT (Shag bark)
(multiple PRT roosts in vicinity of plot)

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: 3' Width: 6'

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

0445-0448 site

0449-0450 (PRTs)

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N.V. Surveyor(s): BTH, NCB Date: 11/8/15
Sample Site Number: 24
Latitude/Longitude (DD, WGS 84): 39.01078 -085.60140
UTM: Zone (10) Easting 621091 Northing 4318903

Brief Project Description

Project Area
~~Total Acres: ___ (% of site: ___ ,% within 1 mile: ___)~~
~~Forest Acres: ___ (% of site: ___ ,% within 1 mile: ___)~~
~~Open Acres: ___ (% of site: ___ ,% within 1 mile: ___)~~

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?
no

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 6 Understory: 4

Dominant Canopy Species: Black Cherry, Sassafras, Sugar maple
Dominant Midstory Species: Sugar maple
Dominant Understory Species: M flora rose, Sugar maple

Percentage of Trees with Exfoliating Bark 0
Composition of Live Trees (%) Small (4-8 in): 75 Med. (9-15 in): 25 Large (>15 in): 0
Number of Suitable Roost Tree Snags Observed: 0

2 Alternate roost trees (small dead snag) not suitable for large colonies

Water Resources at Sample Site (3m away)

Stream Type: Ephemeral Intermittent Perennial Depth: 2' Width: 5'

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

0441-0444

Site Number: 24

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N.V Surveyor(s): BTH, NGB Date: 11/8/12
Sample Site Number: 25
Latitude/Longitude (DD, WGS 84): 39.01284 85.60503
UTM: Zone (16) Easting 620773 Northing 4319129

Brief Project Description

Project Area
Total Acres: ___
Forest Acres: ___ (% of site: ___, % within 1 mile: ___)
Open Acres: ___ (% of site: ___, % within 1 mile: ___)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 5 Understory: 4

Dominant Canopy Species: Black Cherry, Sugar maple
Dominant Midstory Species: Sugar maple
Dominant Understory Species: Sugar maple

Percentage of Trees with Exfoliating Bark 0%
Composition of Live Trees (%) Small (4-8 in): 40 Med. (9-15 in): 40 Large (>15 in): 20
Number of Suitable Roost Tree Snags Observed: 0

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: X Width: X

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

(BTH) 0451-0454

Site Number: 25

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N.V Surveyor(s): BTH NGB Date: 11/8/12
Sample Site Number: 26
Latitude/Longitude (DD, WGS 84): 39.01772 085.61284
UTM: Zone (16) Easting 620089 Northing 4319658

Brief Project Description

site located adjacent to Vernon Fork & Muskrat Ck

Project Area
~~Total Acres: ___~~
~~Forest Acres: ___ (% of site: ___ ,% within 1 mile: ___)~~
~~Open Acres: ___ (% of site: ___ ,% within 1 mile: ___)~~

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 6 Understory: 6

Dominant Canopy Species: Sycamore, E red cedar
Dominant Midstory Species: E. red cedar, american elm
Dominant Understory Species: E. red cedar, honey suckle, euonymus (BTH:0439-440)

Percentage of Trees with Exfoliating Bark 0
Composition of Live Trees (%) Small (4-8 in): 80 Med. (9-15 in): 20 Large (>15 in): 0
Number of Suitable Roost Tree Snags Observed: 0

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: 10' (min) Width: 70'

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

adjacent to site - suitability over river would be moderate

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

0435-0438

Site Number: 26

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N.V Surveyor(s): BTH, NGB Date: 11/8/12
Sample Site Number: 27
Latitude/Longitude (DD, WGS 84): 39.01902 -85.61505
UTM: Zone ( ) Easting 619898 Northing 4319799

Brief Project Description

~~Project Area~~
~~Total Acres: ___ (% of site: ___, % within 1 mile: ___)~~
~~Forest Acres: ___ (% of site: ___, % within 1 mile: ___)~~
~~Open Acres: ___ (% of site: ___, % within 1 mile: ___)~~

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

no

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 6 Understory: 6

Dominant Canopy Species: E. red cedar, sassafras,
Dominant Midstory Species: E red cedar
Dominant Understory Species: honey suckle, m. flora rose

Percentage of Trees with Exfoliating Bark 0
Composition of Live Trees (%) Small (4-8 in): 70 Med. (9-15 in): 25 Large (>15 in): 5
Number of Suitable Roost Tree Snags Observed: 0

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: X Width: X

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

n/a

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE (LOW)

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

BTH: 0430 - 0432

0434

Site Number: 27

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N.V Surveyor(s): BTH, NGB Date: 11/8/12
Sample Site Number: 28
Latitude/Longitude (DD, WGS 84): 39.01914 -085.61757
UTM: Zone (16) Easting 619677 Northing 4319810

Brief Project Description

Project Area
~~Total Acres: ___ (% of site: ___, % within 1 mile: ___)~~
Forest Acres: ___ ~~(% of site: ___, % within 1 mile: ___)~~
Open Acres: ___

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?
none

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 Midstory: 6 Understory: 4

Dominant Canopy Species: Hackberry, Sassafras
Dominant Midstory Species: Hackberry, box elder
Dominant Understory Species: Amur honeysuckle, hackberry

Percentage of Trees with Exfoliating Bark 0
Composition of Live Trees (%) Small (4-8 in): 60 Med. (9-15 in): 35 Large (>15 in): 5
Number of Suitable Roost Tree Snags Observed: 0

1 young shagbark

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: 1 Width: 4

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

BTM: 0426-0429

Site Number: 28

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 NV Surveyor(s): TB, NB Date: 11/6/12
Sample Site Number: 29
Latitude/Longitude (DD, WGS 84): 39.02488 -85.61744
UTM: Zone ( ) Easting 619679 Northing 4320497

Brief Project Description

Project Area
~~Total Acres: ___ (% of site: ___, % within 1 mile: ___)~~
Forest Acres: ___ (% of site: ___, % within 1 mile: ___)
Open Acres: ___ (% of site: ___, % within 1 mile: ___)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 / 5 Midstory: 6 / 6 Understory: 6 / 6

Dominant Canopy Species: V. Pine, Tulip poplar → Virginia Pine
Dominant Midstory Species:
Dominant Understory Species: Am. beech

Percentage of Trees with Exfoliating Bark -0
Size Composition of Live Trees (%) Small (4-8 in): 40 Med. (9-15 in): 60 Large (>15 in): ___

Number of Suitable Roost Tree Snags Observed
1 ALT

Site Number:

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: — Width: —

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Cluttered, young forest

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Site Number: 29

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N.V Surveyor(s): RE, BH Date: 11/6/12
Sample Site Number: 30
Latitude/Longitude (DD, WGS 84): 39.02792, -85.61954
UTM: Zone (16) Easting 619492 Northing 4320782

Brief Project Description

Project Area
~~Total Acres: ___ (% of site: ___, % within 1 mile: ___)~~
Forest Acres: ___ (% of site: ___, % within 1 mile: ___)
Open Acres: ___ (% of site: ___, % within 1 mile: ___)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 5 Midstory: 2 Understory: 2

Dominant Canopy Species: QURU ACRU QUPA → Red oak, Red Maple, Pin Oak
Dominant Midstory Species: ULRU ACRU SAAL → Red Maple, Sassafras, Red Elm
Dominant Understory Species: ~~[illegible]~~ FAGR, LIST, ACRU → beech, Red Maple, Sweet Gum

Percentage of Trees with Exfoliating Bark 5%
Size Composition of Live Trees (%) Small (4-8 in): 35 Med. (9-15 in): 20 Large (>15 in): 45

Number of Suitable Roost Tree Snags Observed

PRT = Ø ART = 3

Site Number: 30

Water Resources at Sample Site N/A

Stream Type: Ephemeral Intermittent Perennial Depth: ____ Width: ____

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments: wind damaged trees present.

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

BTH: 0393 - 0396

Canopy : 0399 - 0402

Site Number: 30

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S.50 N Surveyor(s): T. Brown Date: 12-4-12
Sample Site Number: 31
Latitude/Longitude (DD, WGS 84): 39.02060 / -85.57741
UTM: Zone (16 N) Easting 623151 Northing 4320024

Brief Project Description

Project Area
Total Acres: _____
Forest Acres: ___ (% of site: __ ,% within 1 mile: __)
Open Acres: ___ (% of site: __ ,% within 1 mile: __)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: ___

Landscape within 3 mile radius
Flight corridors to other forested areas present?

yes

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Residential / Ag

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%

Closure / Density
Canopy: 5 / 6 Midstory: — / — Understory: 3 / 3

Dominant Canopy Species: Acer rubrum, Prunus serotina, Quercus palustris
Dominant Midstory Species: —
Dominant Understory Species: Ulmus rubra, Prunus serotina

Percentage of Trees with Exfoliating Bark 0
Composition of Live Trees (%) Small (4-8 in): 25 Med. (9-15 in): 75 Large (>15 in): ____
Number of Suitable Roost Tree Snags Observed: 1 PRT

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: ____ Width: ____

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

4 Photos to 3228 S.-E

Site Number: 31

Page 2 of 2

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: US. 50 N Surveyor(s): T. Brown Date: 12-4-12
Sample Site Number: 32
Latitude/Longitude (DD, WGS 84): 39.02471 / -85.57764
UTM: Zone (16 N) Easting 623124 Northing 4320481

Brief Project Description

Project Area
Total Acres: ___
Forest Acres: ___ (% of site: ___ ,% within 1 mile: ___)
Open Acres: ___ (% of site: ___ ,% within 1 mile: ___)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?

Yes

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)

Ag, & residential

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%

Closure Density

Canopy: 6 / 6 Midstory: 2 / 2 Understory: 4 / 2

Dominant Canopy Species: Quercus alba, Carya ovata,
Dominant Midstory Species: Acer saccharum
Dominant Understory Species: Acer saccharum, Asimina, Fagus

Percentage of Trees with Exfoliating Bark 20
Composition of Live Trees (%) Small (4-8 in): 45 Med. (9-15 in): 10 Large (>15 in): 45
Number of Suitable Roost Tree Snags Observed: 1 PRT

Site Number: __ Page __ of __

Water Resources at Sample Site

Stream Type: Ephemeral X Intermittent Perennial Depth: 1 Width: 2

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Room for flight, but few roosts.

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Up to photo 3224 S clockwise to E

Site Number: __

Page __ of __

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N Surveyor(s): T. Brown Date: 12-4-12
Sample Site Number: 33
Latitude/Longitude (DD, WGS 84): 39.03508 / - 85.63168
UTM: Zone (16) N Easting 618429 Northing 4321560

Brief Project Description

Project Area
Total Acres: _____
Forest Acres: ___ (% of site: __ ,% within 1 mile: __)
Open Acres: ___ (% of site: __ ,% within 1 mile: __)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?
Not really, open fields

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)
Residential / Ag

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Closure Density
Canopy: 6 (6) Midstory: 2 (2) Understory: 1 (1)
Dominant Canopy Species: Liriodendron tulipifera, Acer rubrum, Carya ovata
Dominant Midstory Species: Liriodendron,
Dominant Understory Species: Liriodendron

Percentage of Trees with Exfoliating Bark 5
Composition of Live Trees (%) Small (4-8 in): 20 Med. (9-15 in): 75 Large (>15 in): 5
Number of Suitable Roost Tree Snags Observed: 1

Site Number: __ Page __ of __

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: ____ Width: ____

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

3229 up to 3232 S clockwise to E

Site Number: __ Page __ of __

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the sama

Project Name: U.S. 50 N Surveyor(s): T. Brown Date: 12-4-12
Sample Site Number: 34
Latitude/Longitude (DD, WGS 84): 39.03713 / -85.63178
UTM: Zone (16 N) Easting 618417 Northing 4321786

Brief Project Description

Project Area
Total Acres: _____
Forest Acres: ___ (% of site: __ ,% within 1 mile: __)
Open Acres: ___ (% of site: __ ,% within 1 mile: __)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?
Not really, open fields

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)
Ag

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Closure Density Canopy: 6 (6) Midstory: 4 (4) Understory: 5 (5)
Dominant Canopy Species: Carya ovata, Robinia
Dominant Midstory Species: Acer rubrum, Carpinus, Ulmus americana,
Dominant Understory Species: Lindera benzoin, Viburnum sp. (prunifolium ?), Fagus

Percentage of Trees with Exfoliating Bark 50
Composition of Live Trees (%) Small (4-8 in): 20 Med. (9-15 in): 75 Large (>15 in): 5
Number of Suitable Roost Tree Snags Observed: 0

Site Number: __ Page __ of __

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: 2 Width: 3

~50 m away

Other water sources (#and size): Pools Pond Lake Wetlands Permanent Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Photos 3233-36 S clockwise to E

Site Number: __ Page __ of __

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Include a map depicting locations of sample sites if assessing habitat at multiple sites in a project area
A single description can be used for multiple sample sites if habitat is the same

Project Name: U.S. 50 N Surveyor(s): T. Brown Date: 12-4-12
Sample Site Number: 35
Latitude/Longitude (DD, WGS 84): 39.03727 / -85.62831
UTM: Zone (16 N) Easting 618716 Northing 4321808

Brief Project Description

Project Area
Total Acres: ___
Forest Acres: ___ (% of site: ___ ,% within 1 mile: ___)
Open Acres: ___ (% of site: ___ ,% within 1 mile: ___)

Tree Removal (ac)
Completely cleared: ___ Partially cleared (with remnant trees): ___ No clearing: X

Landscape within 3 mile radius
Flight corridors to other forested areas present?
Isolated by fields.

Describe Adjacent Properties (e.g. forested, grassland, com. or res. development, water body)
Ag

Proximity to Public Land
What is the distance (mi.) from the project area to public lands (i.e., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Forest Resources at Sample Site

Closure/Density 1 = 1-10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-60%, 5 = 60-80%, 6 = 80-100%
Canopy: 6 (6) Midstory: 5 (5) Understory: 3 (3)
Dominant Canopy Species: Platanus, Quercus rubra, Quercus palustris
Dominant Midstory Species: Carpinus, Carya ovata, Fraxinus pennsylvanicus
Dominant Understory Species: Fagus, Lindera

Percentage of Trees with Exfoliating Bark 20
Composition of Live Trees (%) Small (4-8 in): 30 Med. (9-15 in): 50 Large (>15 in): 20
Number of Suitable Roost Tree Snags Observed: 2PRT 1ART

Site Number: __ Page __ of __

Water Resources at Sample Site

Stream Type: Ephemeral Intermittent Perennial Depth: 2 Width: 4

@ point

Other water sources (#and size): Pools Pond Lake Wetlands Permanent/ Seasonal

Approximate size (ac.): ___

IS THE HABITAT SUITABLE FOR INDIANA BATS?

IF SUITABLE HIGH MODERATE LOW

Additional Comments:

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Photos 3237- 3240 S clockwise → E

Site Number: __ Page __ of __

APPENDIX C REPRESENTATIVE PHOTOGRAPHS

Appendix C - Representative Photos

Representative High Quality Foraging Habitat

Representative Medium Quality Foraging Habitat

Representative Low Quality Foraging Habitat

Representative High Quality Roosting Habitat

Representative Medium Quality Roosting Habitat

Representative Low Quality Roosting Habitat

Representative High Density Understory

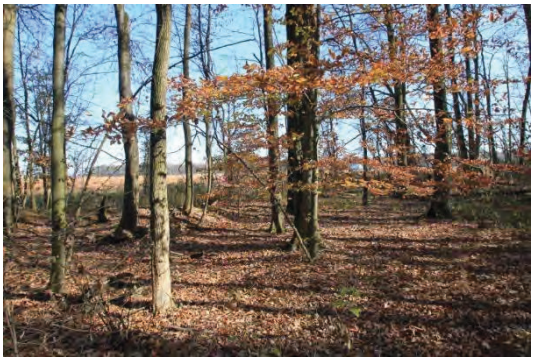
Representative Moderate Density Understory

Representative Low Density Understory

Representative Dead Roost Tree: red elm (*Ulmus rubra*)

Representative Live/Damaged Roost Tree: red maple

Representative Live Roost Tree: Shagbark Hickory (*Carya ovata*)



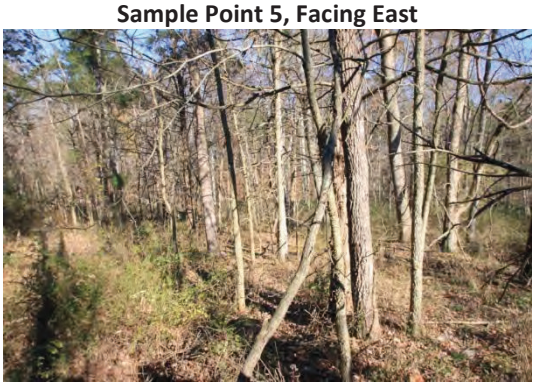
Sample Point 1, Facing East

Sample Point 2, Facing East

Sample Point 3, Facing East

Sample Point 4, Facing East

Sample Point 5, Facing East



Sample Point 6, Facing East

Sample Point 7, Facing East

Sample Point 8, Facing East

Sample Point 9, Facing East

Sample Point 10, Facing East

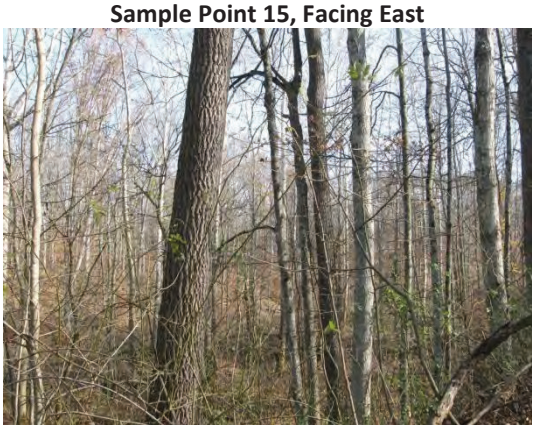
Sample Point 11, Facing East

Sample Point 12, Facing East

Sample Point 13, Facing East

Sample Point 14, Facing East

Sample Point 15, Facing East

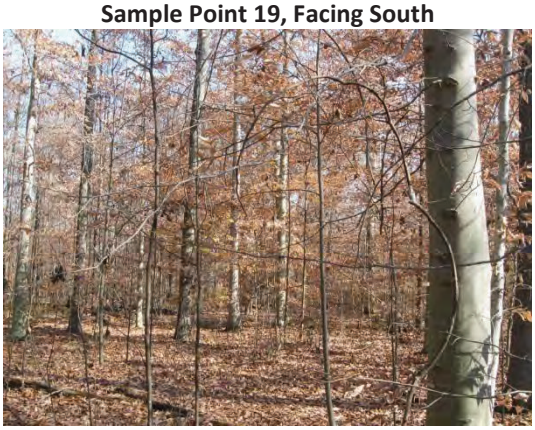


Sample Point 16, Facing East

Sample Point 17, Facing East

Sample Point 18, Facing East

Sample Point 19, Facing South

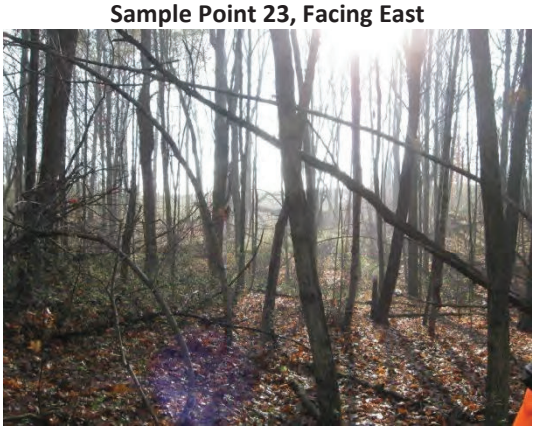


Sample Point 20, Facing East

Sample Point 21, Facing East

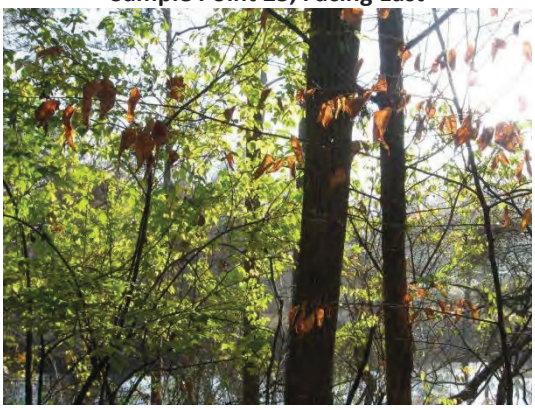
Sample Point 22, Facing East

Sample Point 23, Facing East



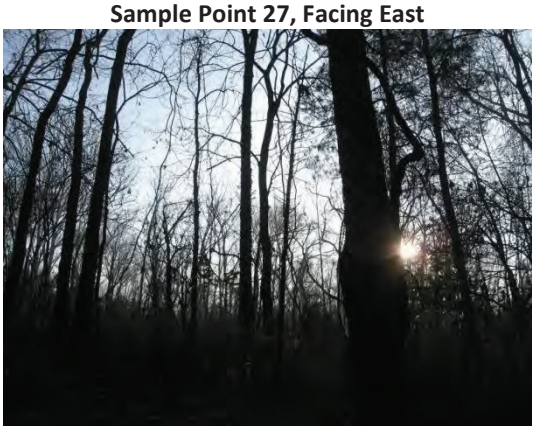
Sample Point 24, Facing East

Sample Point 25, Facing East



Sample Point 26, Facing East

Sample Point 27, Facing East



Sample Point 28, Facing East

Sample Point 29, Facing East

Sample Point 30, Facing East

Sample Point 31, Facing East

Sample Point 32, Facing East

Sample Point 33, Facing East

Sample Point 34, Facing East

Sample Point 35, Facing East

APPENDIX D CORRESPONDENCE; PROXIMAL INDIANA BAT STUDIES

Indiana Department of Natural Resources

Mitchell E. Daniels, Jr., Governor
Robert E. Carter, Jr., Director

Division of Nature Preserves
402 W. Washington St., Rm W267
Indianapolis, IN 46204-2739

November 14, 2012

Benjamin T. Hale
Eco-Tech Consultants
11321 Decimal Drive
Louisville, KY 40299

Dear Benjamin Hale:

I am responding to your request for information on the endangered, threatened, or rare (ETR) bat species documented from a project area, US 50 Bypass East, Jennings County, Indiana. The Indiana Natural Heritage Data Center has been checked and there are no ETR bat species documented within 0.5 mile of the project area.

You may want to consult with the U.S. Fish and Wildlife Service. The Service may have additional information on bat species in this area that is not included in the Indiana Natural Heritage Data Center database. Their Bloomington, Indiana office contact information is.

U.S. Fish and Wildlife Service
620 South Walker St.
Bloomington, Indiana 47403-2121
812)334-4261

At some point, you may need to contact the Department of Natural Resources' Environmental Review Coordinator so that other divisions within the department have the opportunity to review your proposal. For more information, please contact:

Department of Natural Resources
attn: Christie Stanifer
Environmental Coordinator
Division of Fish and Wildlife
402 W. Washington Street, Room W273
Indianapolis, IN 46204
(317)232-8163

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Please note that the Indiana Natural Heritage Data Center relies on the observations of many individuals for our data. In most cases, the information is not the result of comprehensive field surveys conducted at particular sites. Therefore, our statement that there are no documented significant natural features at a site should not be interpreted to mean that the site does not support special plants or animals.

Due to the dynamic nature and sensitivity of the data, this information should not be used for any project other than that for which it was originally intended. It may be necessary for you to request updated material from us in order to base your planning decisions on the most current information.

Thank you for contacting the Indiana Natural Heritage Data Center. You may reach me at (317)232-8059 you have any questions or need additional information.

Sincerely,

Ronald P. Hellmich

Ronald P. Hellmich
Indiana Natural Heritage Data Center

An Equal Opportunity Employer

From: Hellmich, Ron [mailto:rhellmich@dnr.IN.gov]
Sent: Wednesday, November 14, 2012 11:17 AM
To: Ben Hale
Subject: RE: data request

Ben,

Within a 2.5 mile search area still does not pick up *Myotis sodalis*. There is a *Myotis grisescens* record from 1971 at Crosley Fish and Wildlife Area about 3 miles south of the area. The nearest Myotis sodalis is about 5 to 5.5 miles to the northeast along the Vernon Fork of Muscatatuck River. These were found in late 90's surveys for a proposed reservoir in that area. Also there are several records from the Big Oaks National Wildlife Refuge about 5 miles east of the project area. I've attached a GIS shapefile of these records.

Thanks,

Ronald Hellmich
Indiana Natural Heritage Data Center
IDNR Nature Preserves
317-232-8059

From: Hellmich, Ron [mailto:rhellmich@dnr.IN.gov]
Sent: Wednesday, November 14, 2012 9:28 AM
To: Ben Hale
Subject: RE: data request

Ben,

Attached is the response letter for your request. Our database doesn't have any bat information for the project area, though a number of other ETR species are present within 0.5 mile of the area. The US Fish and Wildlife Service may have additional data not included in our database.

Thanks,

Ronald Hellmich
Indiana Natural Heritage Data Center
IDNR Nature Preserves
317-232-8059

Correspondence pertaining to proximal Indiana bat studies

To: Travis Brown
Cc: McGriff, Rob
Subject: RE: Selmeier State Forest Acoustic Study

Travis,

Four (4) acoustic detectors (Anabat SD2) were deployed on May 11, 2012 at random locations on the state forest property. Detectors were located >200 meters from one another and >100 meters from property boundaries. Each detector began recording ≥30 minutes prior to sunset and concluded ≥30 minutes after sunrise over a period of 5 nights (May 11-15). Bats were identified to species if ≥5 individual pulses in one file could be identified to that species. We used "EchoClass" software distributed by the USFWS for the analysis (http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html). Since no pulses (calls) were identified to Indiana bat (Myotis sodalis), it was our conclusion this species was not present at Selmier State Forest **during the survey period**. It is important to note that our survey was done just prior to the date USFWS recognizes as the earliest date appropriate (May 15) for Indiana bat presence/absence surveys. No other acoustic surveys have been done at Selmier.

Let me know if you need more info.
Scott

****
Scott Haulton,
Certified Wildlife Biologist
Forestry Wildlife Specialist
Indiana DNR, Division of Forestry
402 W. Washington St., Rm. W296
Indianapolis, IN 46204
317-234-5725 (voice)
317-233-3863 (fax)
http://www.in.gov/dnr/forestry/
Hardwood Ecosystem Experiment: http://www.heeforeststudy.org/
****
"Without data, all you are is just another person with an opinion."

APPENDIX E DATA SUMMARY

Site	Closure/Density			Exfoliating	% Live Trees			PRT	Snags	Clearing	Water Resources
	Canopy	Midstory	Understory	Bark (%)	Small (4-8")	Med (9-15")	Large (>15")				(type - meters from site)*
HIGH SUITABILITY											
2	80-100	1-10	60-80	20	5	75	20	1	0	none	ephemeral stream - 2160 m
3	80-100	1-10	10-20	15	25	60	15	1	2	none	ephemeral stream - 1327 m
7	80-100	40-60	60-80	20	10	0	90	0	1	none	ephemeral stream - 370 m
11	60-80	60-80	80-100	10	10	70	20	0	2	none	perennial stream
12	40-60	1-10	10-20	15	5	15	80	0	0	partially	ephemeral stream
14	60-80	60-80	80-100	10	40	40	20	1	0	none	pond - 165 m
18	80-100	40-60	40-60	30	10	80	10	6	1	partially	perennial stream - 1020 m
19	80-100	20-40	20-40	30	40	20	40	2	0	none	intermittent stream - 415 m
23	80-100	10-20	40-60	10	40	10	50	2	1	none	ephemeral stream
34	80-100	40-60	60-80	50	20	75	5	0	0	none	intermittent stream - 25 m
35	80-100	60-80	20-40	20	30	50	20	2	3	none	intermittent stream - 1 m
MODERATE SUITABILITY											
1	80-100	80-100	60-80	10	35	55	10	1	0	none	ephemeral stream - 1010 m
4	80-100	60-80	60-80	30	40	50	10	4	4	none	1533 m
5	80-100	60-80	80-100	25	20	60	20	7	7	none	1480 m
8	80-100	60-80	80-100	0	50	20	30	0	0	none	ephemeral stream
10	80-100	1-10	40-60	10	60	30	10	0	5	partially	ephemeral stream
13	80-100	60-80	40-60	0	60	20	20	0	0	none	perennial stream
16	60-80	80-100	60-80	0	10	60	30	0	0	none	river - 100 m
17	60-80	40-60	80-100	5	10	20	70	1	0	partially	ephemeral stream
21	60-80	20-40	80-100	10	20	60	20	0	0	none	ephemeral stream
22	80-100	10-20	20-40	0	80	15	5	0	1	none	pond - 260 m
30	60-80	10-20	10-20	5	35	20	45	0	0	none	pond - 975 pond
31	60-80	1-10	20-40	0	25	75	0	1	1	none	intermittent stream - 150 m
32	80-100	10-20	40-60	20	45	10	45	1	1	none	intermittent stream - 150 m
33	80-100	10-20	1-10	5	20	75	5	1	1	none	intermittent stream - 198 m
LOW SUITABILITY											
6	80-100	80-100	60-80	0	50	50	0	0	0	none	ephemeral stream
9	80-100	30-40	80-100	0	25	50	25	0	0	partially	ephemeral stream
15	10-20	10-20	60-80	0	70	20	10	0	0	mostly	intermittent stream - 190 m
20	80-100	80-100	80-100	5	30	35	35	0	0	none	intermittent stream - 1540 m
24	80-100	80-100	40-60	0	75	25	0	0	0	none	intermittent stream

*Water resources without a distance label indicate the location is within the sample plot

Site	Closure/Density			Exfoliating	% Live Trees			PRT	Snags	Clearing	Water Resources
	Canopy	Midstory	Understory	Bark (%)	Small (4-8")	Med (9-15")	Large (>15")				(type - meters from site)*
25	80-100	60-80	40-60	0	40	40	20	0	0	none	perennial stream - 1325 m
26	80-100	80-100	80-100	0	80	20	0	0	0	none	perennial stream
27	80-100	80-100	80-100	0	70	25	5	0	0	none	perennial stream - 770 m
28	80-100	80-100	40-60	0	60	35	5	0	0	none	ephemeral stream
29	80-100	80-100	80-100	0	40	60	0	0	0	none	pond - 840 m

*Water resources without a distance label indicate the location is within the sample plot