APPENDIX GG1

Tier 2 Biological Assessment

Appendices A to H

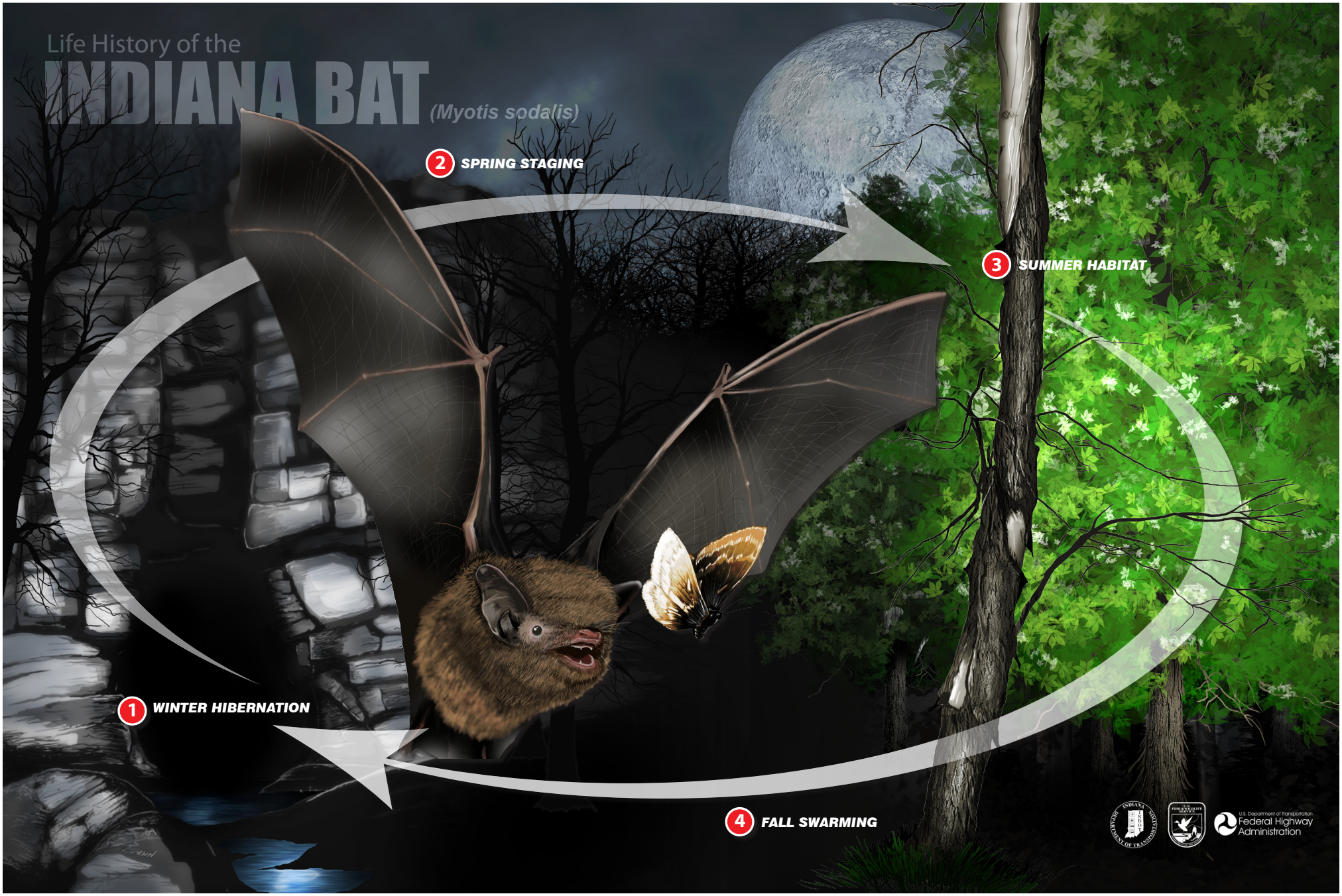
Tier 2 Environmental Impact Statement

I-69 Section 6

Martinsville to Indianapolis

APPENDIX A

Life History of the Indiana Bat

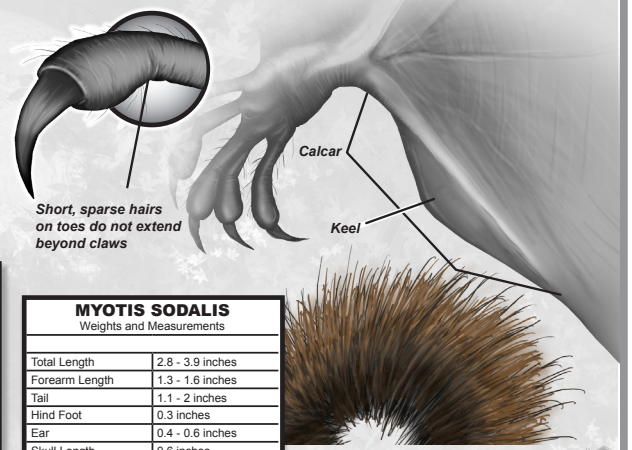

Life History of the
INDIANA BAT
(Myotis sodalis)
2 SPRING STAGING
3 SUMMER HABITAT
1 WINTER HIBERNATION
4 FALL SWARMING
U.S. Department of Transportation
Federal Highway Administration

Life History of the

INDIANA BAT *(Myotis sodalis)*

COMMON NAME

The Indiana bat was first described as a distinct species by Miller and Allen in 1928 from a female specimen collected by J. O. Sibert on March 7, 1904 from Wyandotte Cave in Crawford County, Indiana. The scientific name of the Indiana bat is Myotis sodalis. Myotis means "mouse ear" and refers to the genus. Sodalis is the trivial species name and is a Latin word for "companion." The species is called the Indiana bat because the first specimen described to science came from the state of Indiana.



1 WINTER HIBERNATION

(December to Mid-March)

Caves used by Indiana bats are well ventilated (usually have a chimney effect), and store large volumes of cool air with constant temperatures between 38 to 43 degrees F. The Indiana bat is very sensitive to temperature changes and do not use caves that flood. They prefer caves that have domes, caverns, and diversity in form. Individuals cluster together in these caves in different sized groupings, some as large as 36,000 Indiana bats or as small as 20 to 40 Indiana bats. The bats go into deep hibernation in winter, but have the ability to arouse very quickly which may be an adaptive mechanism for survival from a predator. During the hibernation period, the bats arouse about once every two (2) weeks and use up much of their stored energy in the process. The function of the arousal is not known for sure, but it may be to drink, to exercise, or to get rid of some waste products. The arousal is not to feed though. Disturbances in the winter can be deleterious. Awaking these bats can use up their fat reserves. For this reason, gates at the entrance or fences around these caves have been used as conservation measures. Their winter is huddled together at temperatures of their environment. Individuals on the perimeter of the group are more susceptible to freezing that those in the middle of the mass. Caves are most important in the survival of this species. Some caves are homes to more than 50,000 Indiana bats. Indiana has two (2) caves that are critical habitat for the Indiana bat. Mines are also used as hibernacula.

2 SPRING STAGING

(Mid-March to Mid May)

Both males and females emerge from caves in spring. They are very hungry and thin from some three (3) to four (4) months of deep hibernation. Indiana bats take a week or so to feed and congregate around these caves before migrating to their summer homes. Males usually stay near the hibernacula (within 50 miles or so). However, this species has been found to migrate 40 or 50 miles a day with total distances of several hundred miles. Females usually migrate further than males. The females (as in other bats) show delayed fertilization, that is, they mate with males in the fall, and store such sperm alive in pouches connected to the uterus. Upon an egg moving down the uterus, the sperm move from these pockets and fertilize an egg. This fertilized egg (embryo) then implants itself into the uterus. When females leave the cave, they are pregnant and on a mission to start a new generation in their summer home.

3 SUMMER HABITAT

(Mid-May to Mid-August)

Females and males arrive at their summer habitat (home) in May. Summer roosting sites include primarily dead trees with concavities with exfoliating bark or living trees with shaggy bark (e.g., shagbark hickory). Larger trees are usually preferred over smaller trees where there is an ample amount of solar radiation, and protection from the wind and rain. The nursery colonies often use several roost trees. Roost trees may be primary roost trees (>30 bats) or alternate roost trees (< 30 bats). Primary roost trees are large trees with sloughing bark in the sun. Bats have a strong fidelity for this complex of roost trees and use such areas for food (flyways), water, and shelter. The bats secure themselves under the bark or in crevices or concavities during the day. While at night, they are active feeding on insects and use the underside of bridges on occasion as night roosts. The majority of summer maternity colonies are in big dead and live trees near major streams in both bottomland and upland areas. A maternity colony typically consists of 25 to 325 adult females (average is 80), but usually less than 100 adult females are in such maternity colonies. Babies are born between late June and early July. This process is called parturition and the adult females are lactating (producing milk) at that time. The mother's do not carry the young unless they need to move them, and under such conditions, they will carry them on their abdomen. The young become volant (able to fly) between early July and early August at which time the adult females become non-reproductive. Most young are volant by mid-July.

4 FALL SWARMING

(Mid-August to November)

With the onset of fall and cooler temperatures, males return to the caves. They are at the entrances to the caves when the females and young arrive. Hormones run high and males mate with females. Swarming is a milling of the bats around and out of the cave entrance. It may have several functions, but one seems to bring the sexes together for mating. Members of both sexes feed and gain weight through the fall, thus putting on fat (energy) to help them make it through hibernation. It is not known if juvenile females mate their first autumn, and limited mating may occur in the spring. Limited mating may occur in the cave in winter as well. The males follow the females into hibernation. When temperatures are 50 degrees F or less, the bats start to stay inside the cave.

STATUS

The Indiana bat is presently listed as a Federally endangered species (as of March 11, 1967) which means that it is in danger of becoming extinct. Population declines and vulnerability to human disturbances in winter have prompted its listing with the U.S. Fish and Wildlife Service. During hibernation, bats cluster in groups of up to 484 bats per square foot and some winter hibernacula may support from 20,000 to 50,000 bats. The U.S. Fish and Wildlife Service developed a recovery plan for the Indiana bat in 1976, followed by a revised plan in 1983. A new revision is currently underway.

MYOTIS SODALIS
Weights and Measurements

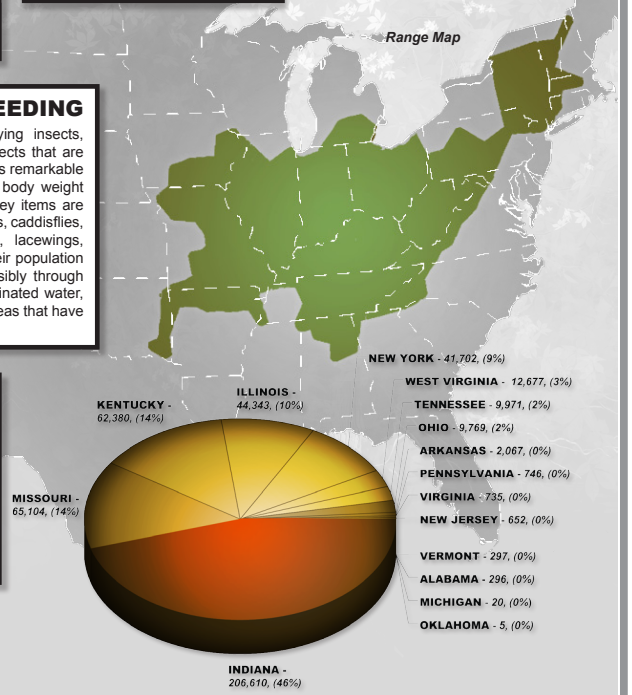
Total Length	2.8 - 3.9 inches
Forearm Length	1.3 - 1.6 inches
Tail	1.1 - 2 inches
Hind Foot	0.3 inches
Ear	0.4 - 0.6 inches
Skull Length	0.6 inches
Skull Width	0.4 inches
Weight	0.1 - 0.2 ounces

FEEDING

Indiana bats eat aquatic and terrestrial flying insects, and in this, benefit people by consuming insects that are considered pests. Their role in insect control is remarkable when you consider they eat about half their body weight in insects each night. Examples of some prey items are moths, beetles, midges, flies, wasps, flying ants, caddisflies, brown leafhoppers, treehoppers, stoneflies, lacewings, and weevils. Some scientists believe that their population is declining today due to pesticide use, possibly through eating contaminated insects, drinking contaminated water, or absorbing the chemicals while feeding in areas that have been recently treated with pesticides.

PREDATION

Feral cats are potential predators within their hibernacula. They are also killed by natural predators such as snakes, owls, hawks, opossums, minks, and raccoons. They can also die from natural disasters such flooding of a cave, collapse in caves and mines, freezing in winter, climate and weather changes, and summer habitat deforestation.



For additional information, please refer to the United States Fish and Wildlife Service's Region 3 website:
http://www.fws.gov/midwest/endangered/mammals/index.html

Acknowledgements - The design, text, and artwork for this product were developed by Bernardin, Lochmueller and Associates, Inc. located in Evansville, Indiana in cooperation with U.S. Fish and Wildlife - Bloomington, Indiana Field Office.

Appendix B

Life History of the Northern Long-Eared Bat


Life History of the
NORTHERN LONG-EARED BAT (Myotis septentrionalis)
2 SPRING STAGING
3 SUMMER HABITAT
1 WINTER HIBERNATION
4 FALL SWARMING
U.S. Department of Transportation
Federal Highway Administration

Life History of the

NORTHERN LONG-EARED BAT *(Myotis septentrionalis)*

1 WINTER HIBERNATION

(October to Mid-March)

Caves and mines are used by the northern long-eared bat in winter. Hibernacula used are typically large, with large passages and entrances, relatively constant and cooler temperatures, and with high humidity and no air currents. The sites favored by them are often in very high humidity areas to such a large degree that droplets of water are often observed on their fur. They are typically found roosting in small crevices or cracks in cave or mine walls and can often be overlooked in surveys. To a lesser extent, they have been found overwintering in habitats that resemble caves or mines, such as abandoned railroad tunnels, storm sewer (Goehring 1954, p. 435), hydro-electric dam (Kurta and Teramino 1994, pp. 410-411), aqueduct (French 2012, unpublished data) or other "unsuspected retreats" where caves and mines are not present. Northern long-eared bats have shown a high degree of philopatry (using the same site multiple years) for a hibernaculum. Other species in Indiana that commonly occupy the same hibernacula with the northern long-eared bat are the little brown bat, big brown bat, tri-colored bat, and Indiana bat. Northern long-eared bats often move between hibernacula throughout the winter, which may further decrease population estimates. Similarly, this species has been found to fly in and out of some of the mines and caves in southern Indiana throughout the winter (Whitaker and Mumford 2009, p. 210).

2 SPRING STAGING

(Mid-March to Mid-May)

Both males and females emerge from caves and mines in spring. Northern long-eared bats exhibit significant weight loss during hibernation. One Indiana study showed a 41-43 % loss (Whitaker and Hamilton 1998, p. 101). During staging, northern long-eared bats are flying in and out of caves to feed and congregate around these caves before migrating to their summer homes. The northern long-eared bat is not considered a long-distance migratory species. Short migratory movements between summer roost and winter hibernacula are typically between 35 to 55 miles (Nagorsen and Brigham 1993, p. 88; Griffith 1945, p. 53). However, movements may range from 5 to 168 miles (Griffith 1945, p. 22). When females leave the cave, they are pregnant and on a mission to start a new generation in their summer home. Gestation is approximately 60 days (Kurta 1994, p. 71). Males are reproductively inactive until late July, with testes descending in most males during August and September (Caire et al. 1979, p. 407; Amelon and Burhans 2006, p. 69).

3 SUMMER HABITAT

(Mid-May to Mid-August)

During the summer, northern long-eared bats typically roost singly or in colonies underneath bark or in cavities or crevices of both live trees and snags. Males and non-reproductive females' summer roost sites may also include cooler locations, including caves and mines (Barbour and Davis 1969, p.77). They also have been found roosting in man-made structures, such as buildings, barns, a park pavilion, sheds, cabins, under eaves of buildings, behind window shutters, and in bat houses (Mumford and Cope 1964, p. 72; Barbour and Davis 1969, p. 77; Cope and Humphrey 1972, p. 9; Amelon and Burhans 2006, p. 72; Whitaker and Mumford 2009, p. 209; Timpone et al. 2010, p. 119; Joe Kath 2013, pers. comm.). This species appears to be somewhat opportunistic in roost selection. Canopy cover at northern long-eared bat roosts has ranged from 56% (Timpone et al. 2010, p. 118) to greater than 84% (Lacki and Schwierjohann 2001, p. 487). Females tend to roost in more open areas than males, likely due to the increased solar radiation, which aids in pup development (Perry and Thill 2007, p. 224). Roosts are also largely selected below the canopy, which could be due to the species' ability to exploit roosts in cluttered environments; their gleaning behavior suggests an ability to easily maneuver around obstacles (Foster and Kurta 1999, p. 669; Menzel et al. 2002, p. 112). One study found that northern long-eared bats roost more often on upper and middle slopes than lower slopes, which suggests a preference for higher elevations due to increased solar heating (Lacki and Schwierjohann 2001, p. 486). Northern long-eared bats switch roosts often (Sasse and Perkins 1996, p. 95), typically every 2-3 days (Foster and Kurta 1999, p. 665; Owen et al. 2002, p.2; Carter and Feldhamer 2005, p. 261; Timpone et al. 210, p. 119). Reasons for switching may be temperature, precipitation, predation, parasitism, and ephemeral roost sites (Carter and Feldhamer 2005, p. 264). The northern long-eared bat is comparable to the Indiana bat in terms of summer roost selection, but appear to be more opportunistic (Carter and Feldhamer 2005, pp. 265-266; Timpone et al. 2010, pp. 120-121). Although northern long-eared bats are more opportunistic than Indiana bats, there may be a small amount of roost selection overlap between these two species (Foster and Kurta 1999, p. 670; Timpone et al. 2010, pp. 120-121). Maternity colonies, consisting of females and young, are generally small, numbering from about 30 (Whitaker and Mumford 2009, p. 212) to 60 individuals (Caceres and Barclay 2000, p. 3). Adult females give birth to a single pup. Birth likely occurs in late May or early June (Caire et al 1979, p. 406; Easteria 1968, p. 770; Whitaker and Mumford 2009, p. 213), but may occur as late as July (Whitaker and Mumford 2009, p.213). Juvenile volancy (flight) occurs by 21 days after birth (Krochmal and Sparks 2007, p. 651; Kunz 1971, p. 480). Adult longevity is estimated to be up to 18.5 years (Hall 1957, p. 407) with the greatest recorded age of 19 years (Kurta 1995, p.71).

4 FALL SWARMING

(Mid-August to November)

With the onset of fall and cooler temperatures, males return to the caves. They are at the entrances when females and young arrive. Elevated hormone levels trigger males to mate with females. Hibernating females store sperm until spring, exhibiting delayed fertilization (amphigonia retardata). Swarming is a milling of the bats around and out of the cave entrance. This behavior may have several functions, but one seems to bring the sexes together for mating. Members of both sexes feed and gain weight through the fall, thus putting on fat (energy) to help them survive through hibernation. It is not known if juvenile females mate their first autumn. Limited mating may occur in the cave in winter and may even occur in the spring. When temperatures are 50 degrees F or less, the bats start to stay inside the cave.

The majority of this information came from 50 CFR Part 17, Volume 78, No. 191. To all the scientists that contributed to its development, we extend our appreciation and gratitude.

For additional information, please refer to the United States Fish and Wildlife Service's Region 3 website (http://www.fws.gov/midwest/endangered/mammals/index.html) and the Northern Long-Eared Bat Interim Conference and Planning Guidance, USFWS Regions 2, 3, 4, 5 & 6, January 6, 2014.

Acknowledgements: The design and artwork for this product were developed by Lochmueller Group, Inc. in Evansville, Indiana in cooperation with the U.S. Fish and Wildlife Service – Bloomington Field Office.

STATUS

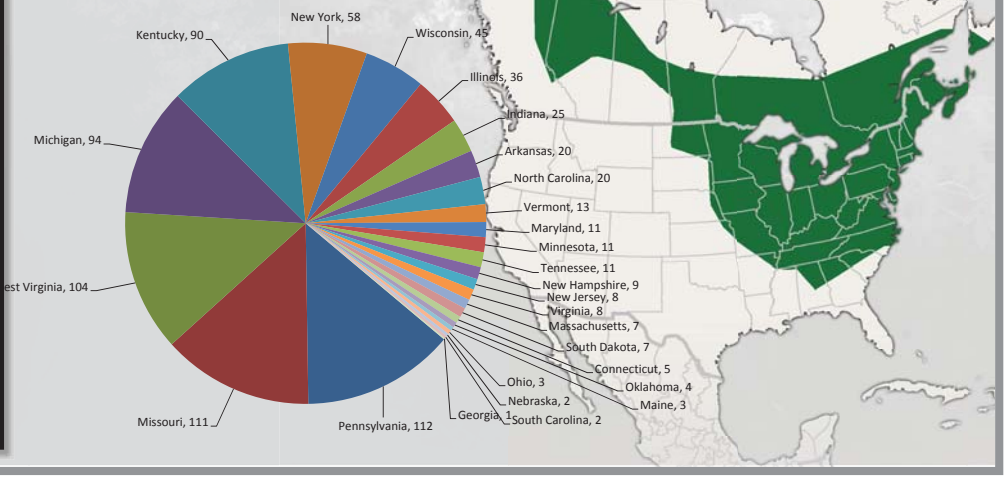
On October 2, 2013 in 50 CFR Part 17, Volume 78 and No. 191, the U.S. Fish and Wildlife Service (USFWS) proposed the northern long-eared bat (Myotis septentrionalis) for listing as endangered under the Endangered Species Act (ESA) throughout its range. The USFWS also determined that critical habitat for the northern long-eared bat is not determinable at this time. This proposed rule, if finalized, would extend the Act's protections to the northern long-eared bat. It is anticipated that USFWS will make a decision on the northern long-eared bat listing sometime in mid-October 2014.

SUMMARY OF FACTORS AFFECTING SPECIES

Under Section 4(a)(1) of Act (16 U.S.C. 1533) and its implementing regulations at 50 CFR part 424, USFWS has the authority to list a species based on any of the following 5 factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence. They found that no other threat is as severe and immediate to the northern long-eared bat's persistence as the disease, white-nose syndrome (WNS). Therefore, WNS is currently the predominant threat to this species.

FEEDING

The northern long-eared bat has a diverse diet including moths, flies, leafhoppers, caddisflies, spiders and beetles with diet composition differing geographically and seasonally (Brack and Whitaker 2001, p. 208). The most common insects found in the diets of northern long-eared bats are moths and beetles (Feldhamer et al. 2009, p. 45; Brack and Whitaker 2001, p. 207) with spiders also being a common prey item (Feldhamer et al. 2009, p. 45). Foraging techniques include hawking (catching insects in flight) and gleaning (picking insects off stationary features such as leaves or branches) in conjunction with passive acoustic cues (Nagorsen and Brigham 1993, p. 88; Ratcliffe and Dawson 2003, p. 851). Presence in their feces are spiders, other non-flying insects, and green plant material suggest considerable gleaning behavior. The northern long-eared bat has a very high frequency call. Gleaning allows this species to gain a foraging advantage for preying upon moths because moths are less able to detect high frequency echolocation calls (Faure et al. 1993, p. 185). Emerging at dusk, most hunting occurs above the understory, 3 to 10 feet about the ground, but under the canopy (Nagorsen and Brigham 1993, p. 88) on forested hillsides and ridges, rather than along riparian areas (Brack and Whitaker 2001, p. 207; LaVal et al. 1977, p. 594). This coincides with data indicating that mature forests are important habitat for foraging in this species (Caceres and Pybus 1998, p. 2).



COMMON NAME

The northern long-eared bat (Myotis septentrionalis) was first described as a distinct species by van Zyll de Jong in 1979 based on geographic separation and difference in morphology. Before that time, the northern long-eared bat was considered a subspecies of Keen's long-eared Myotis (Myotis keenii). No subspecies have been described for Myotis septentrionalis. This species has been recognized by different common names, such as Keen's bat, northern myotis bat, and northern bat. For the purposes of this documentation, we refer to this species as the northern long-eared bat.

SPECIES DESCRIPTION

The northern long-eared is a medium-sized bat as distinguished by its long ears which average 17 mm. When laid forward, they extend beyond the nose but less than 5 mm beyond the muzzle (Caceres and Barclay 2000, p. 1). The tragus is long, pointed and symmetrical. Its length is greater than half the ear. Body color is darker brown on back, and a lighter brown on ventral side. It is most often confused with little brown bat; however, it does not have the sheen to fur, and has longer ears and tragus.

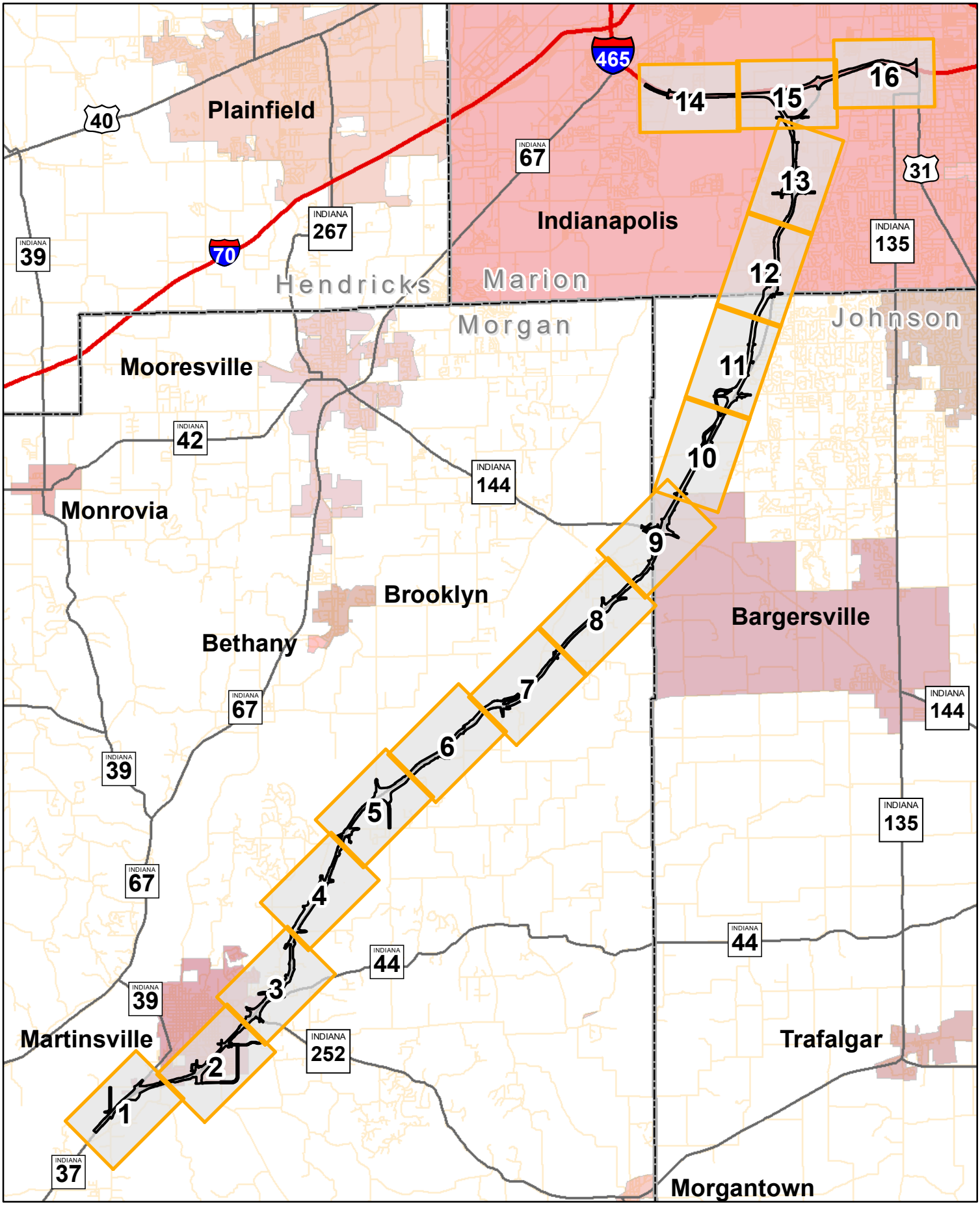
Myotis septentrionalis

Weights and Measurements

Total Length	77mm - 92mm
Forearm Length	34mm - 39mm
Tail	26mm-42mm
Hind Foot	5mm - 11mm
Ear	14mm - 19mm
Tragus	9mm - 11mm
Weight	5g - 9g

Appendix C

Refined Preferred Alternative Atlas



N
W E
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Legend

Map Page Number
RPA Right-of-Way
Interstate Highways
State and US Highways
Local Roads

BIOLOGICAL ASSESSMENT

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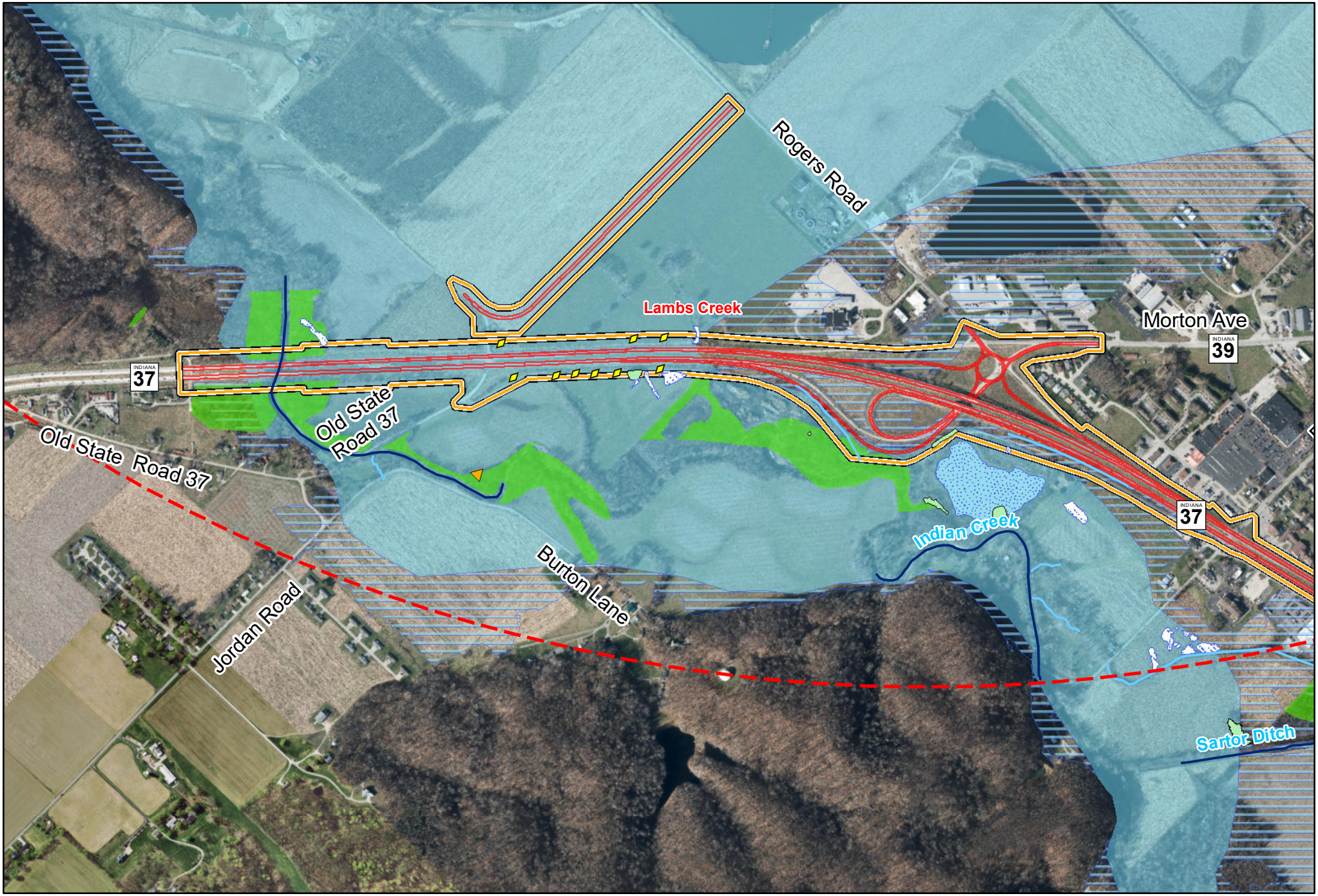
Miles



Legend

- Roost Tree
- Bat Net Sites
- Billboard Relocation
- Maternity Colony - Northern Long-Eared Bat
- Maternity Colony - Indiana Bat
- Ephemeral Stream
- Intermittent Stream
- Perennial Stream

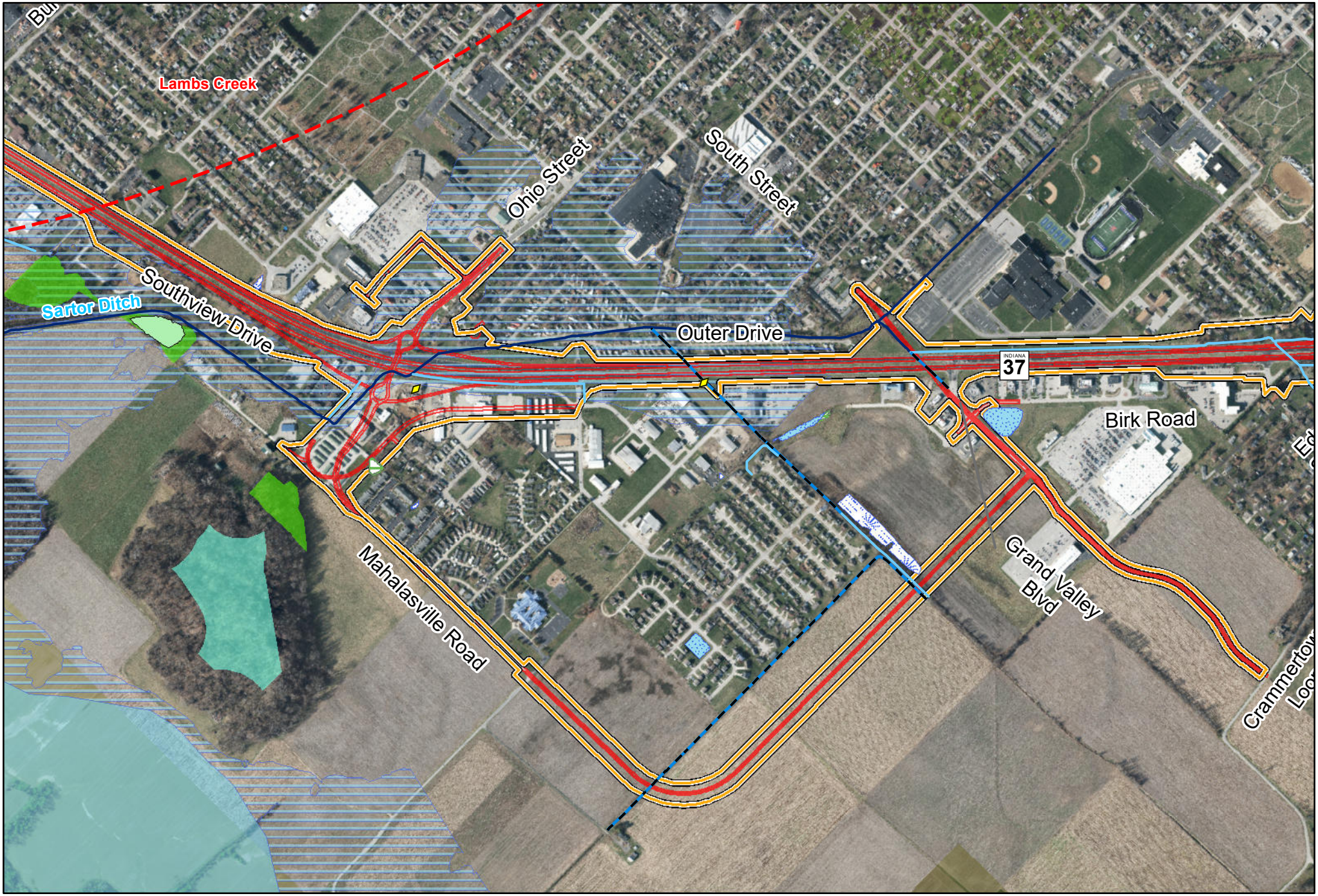
BIOLOGICAL ASSESSMENT

- Open Waters (Field Identified)
- Emergent Wetlands (Field Identified)
- Forested Wetlands (Field Identified)
- Scrub-Shrub Wetlands (Field Identified)
- Core Forest
- Forest Land
- 100-Year Floodplain
- RPA Right of Way
- Floodway
- RPA Linework

1 inch = 1,000 feet

0 500 1,000

Feet



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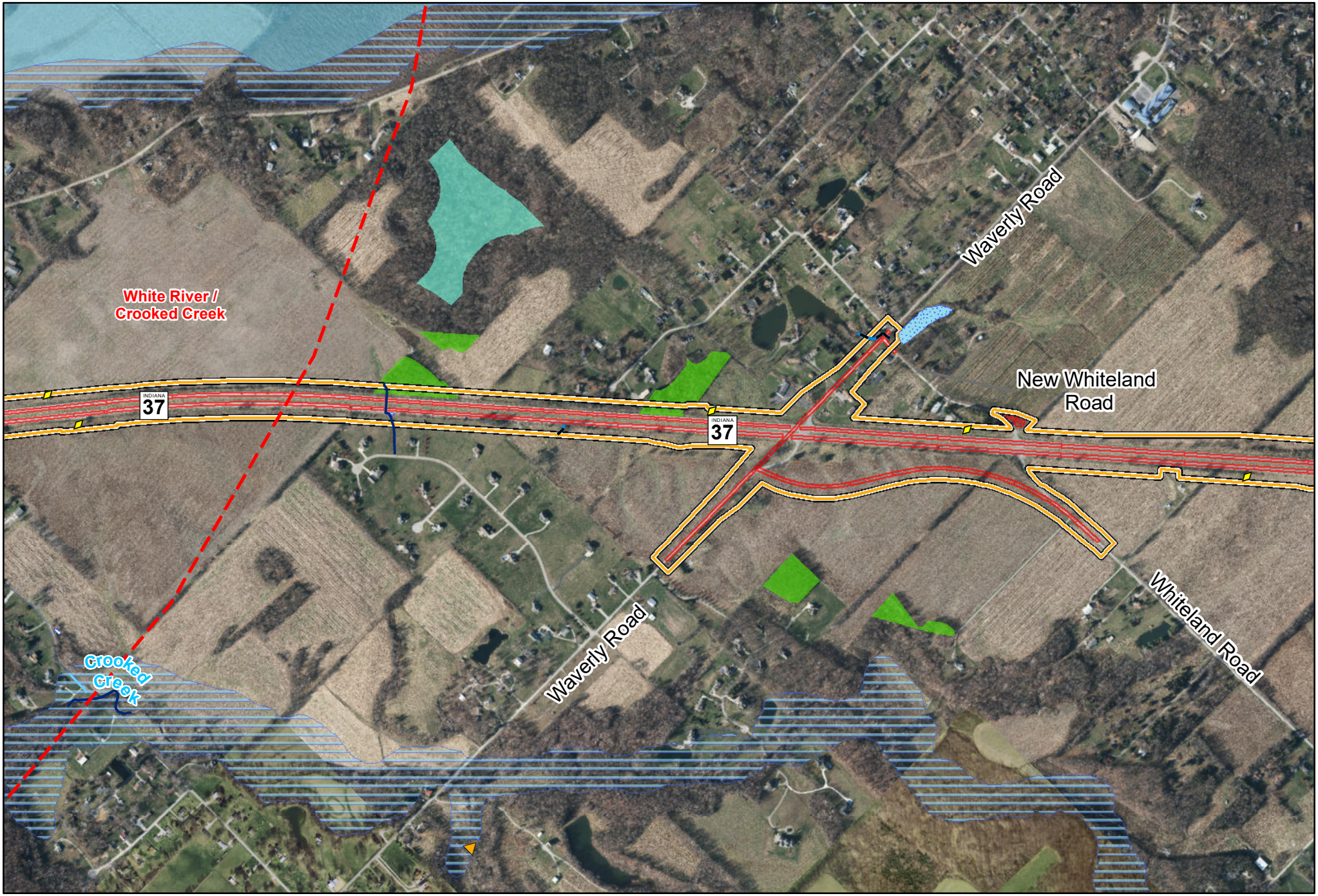

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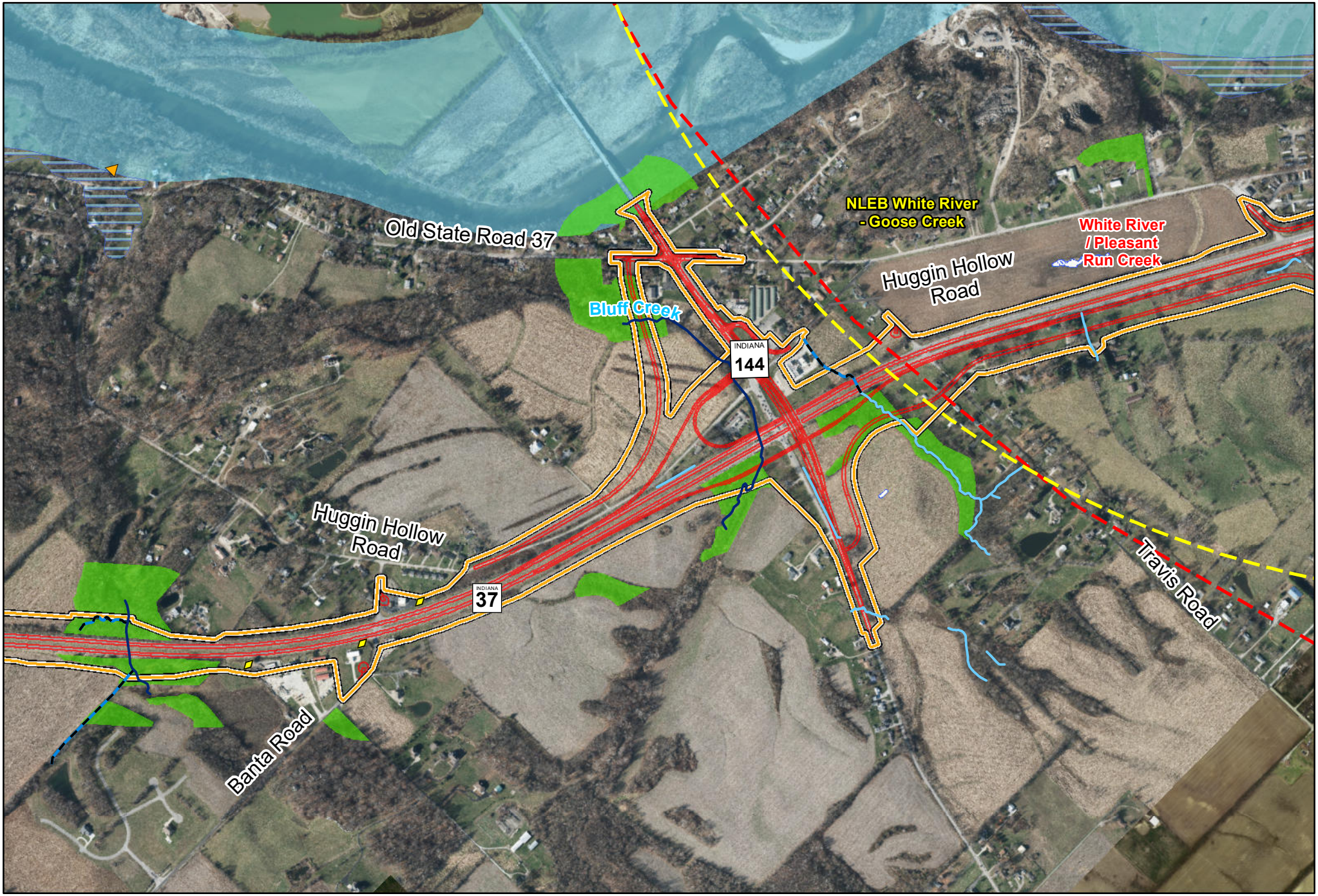

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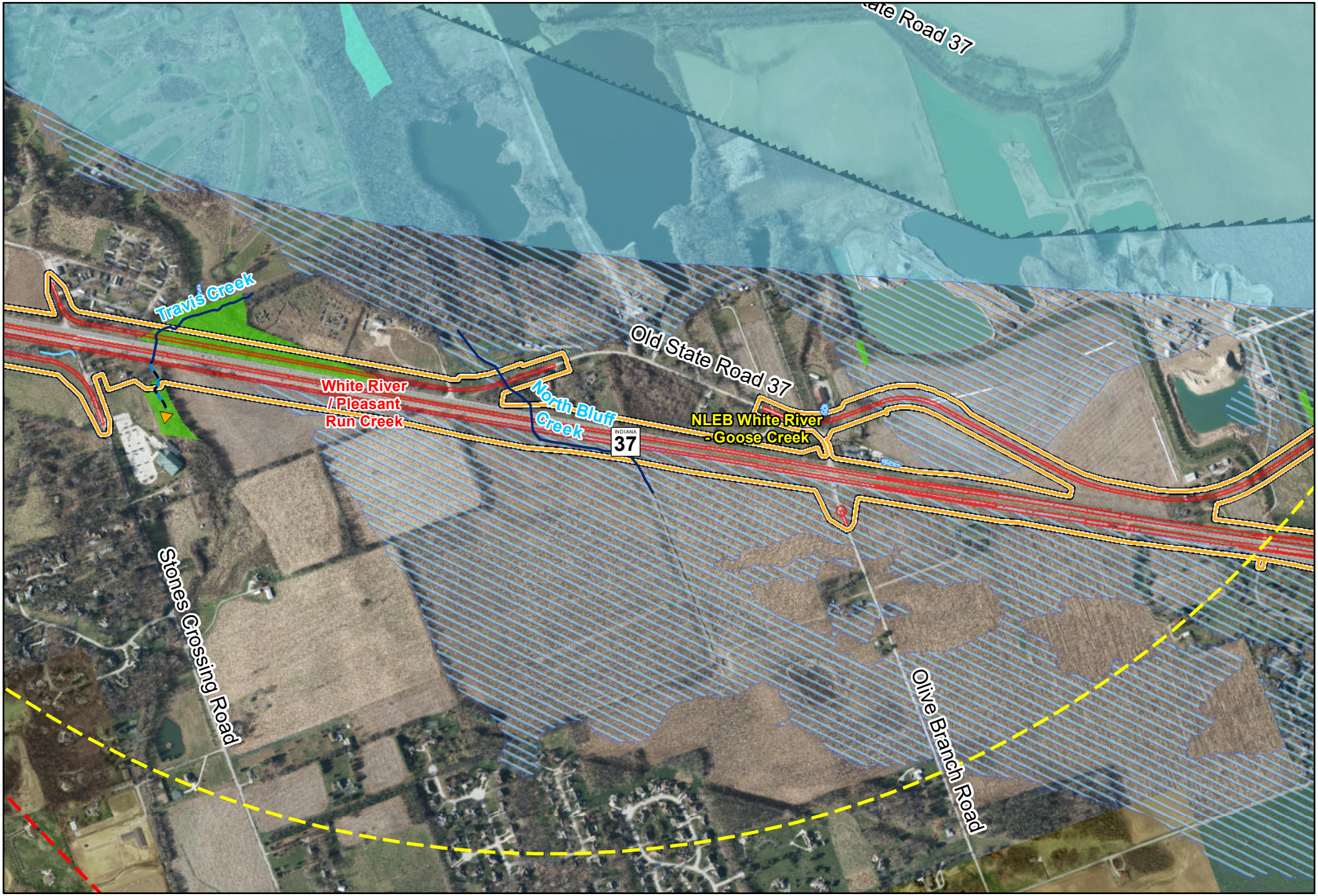

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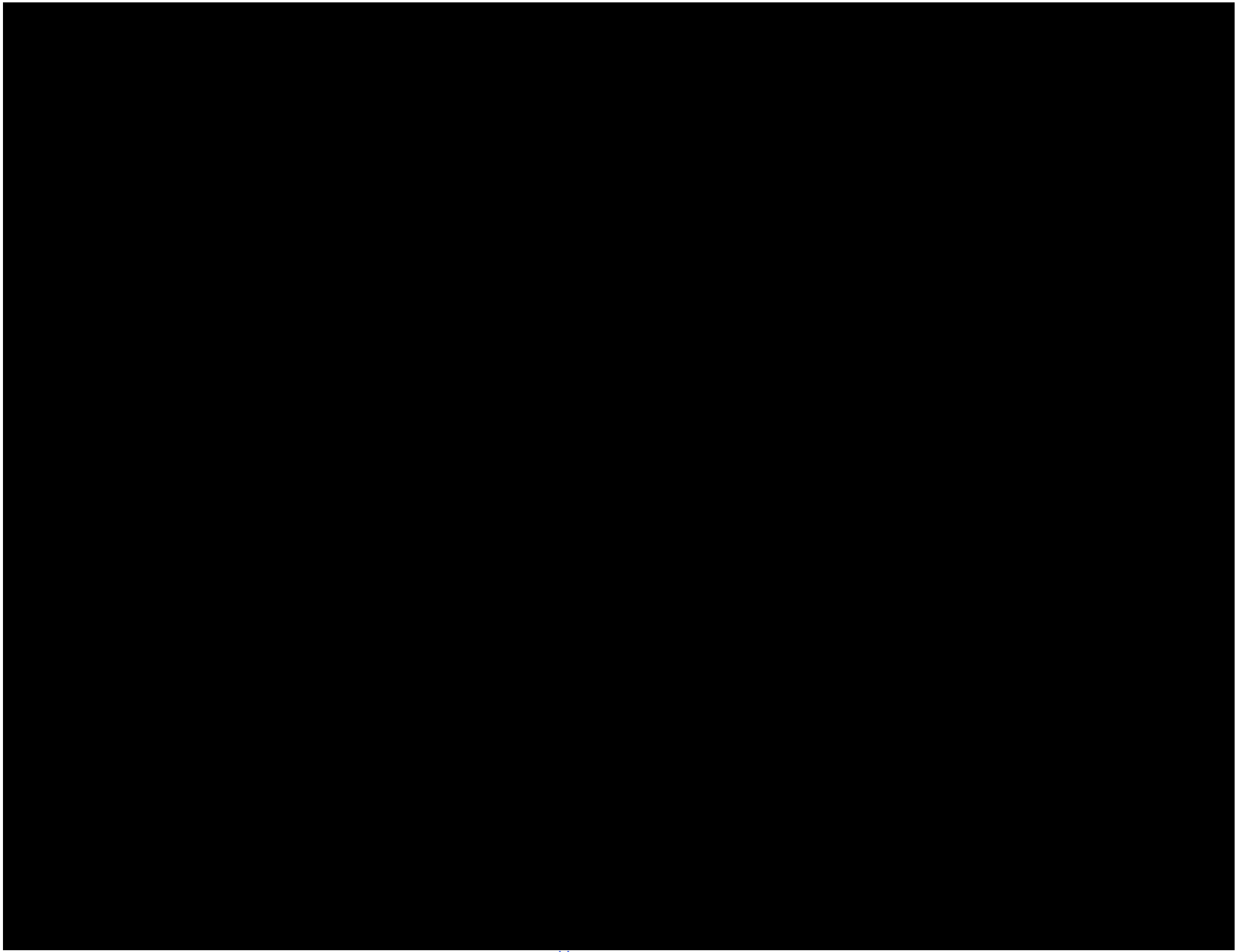

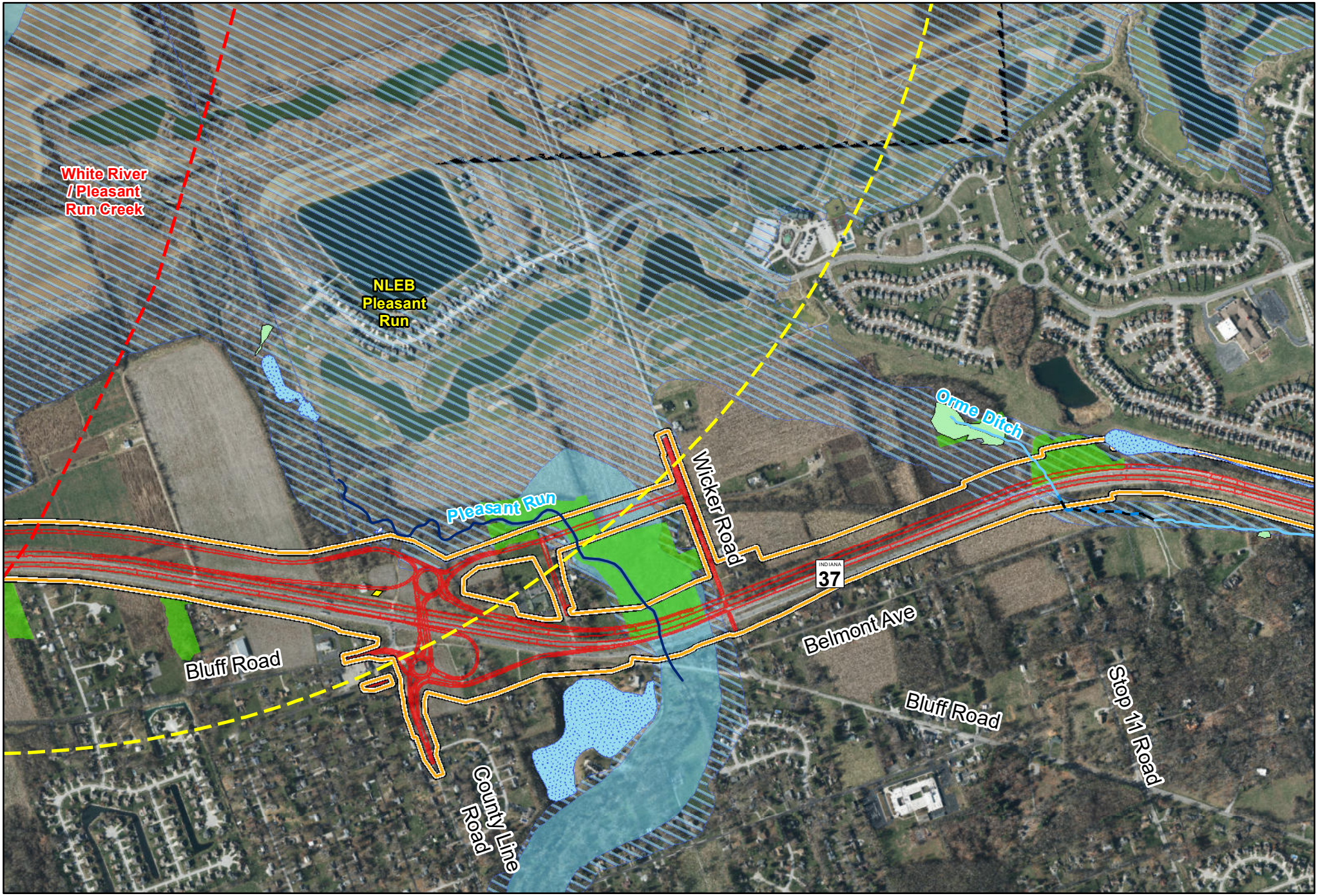

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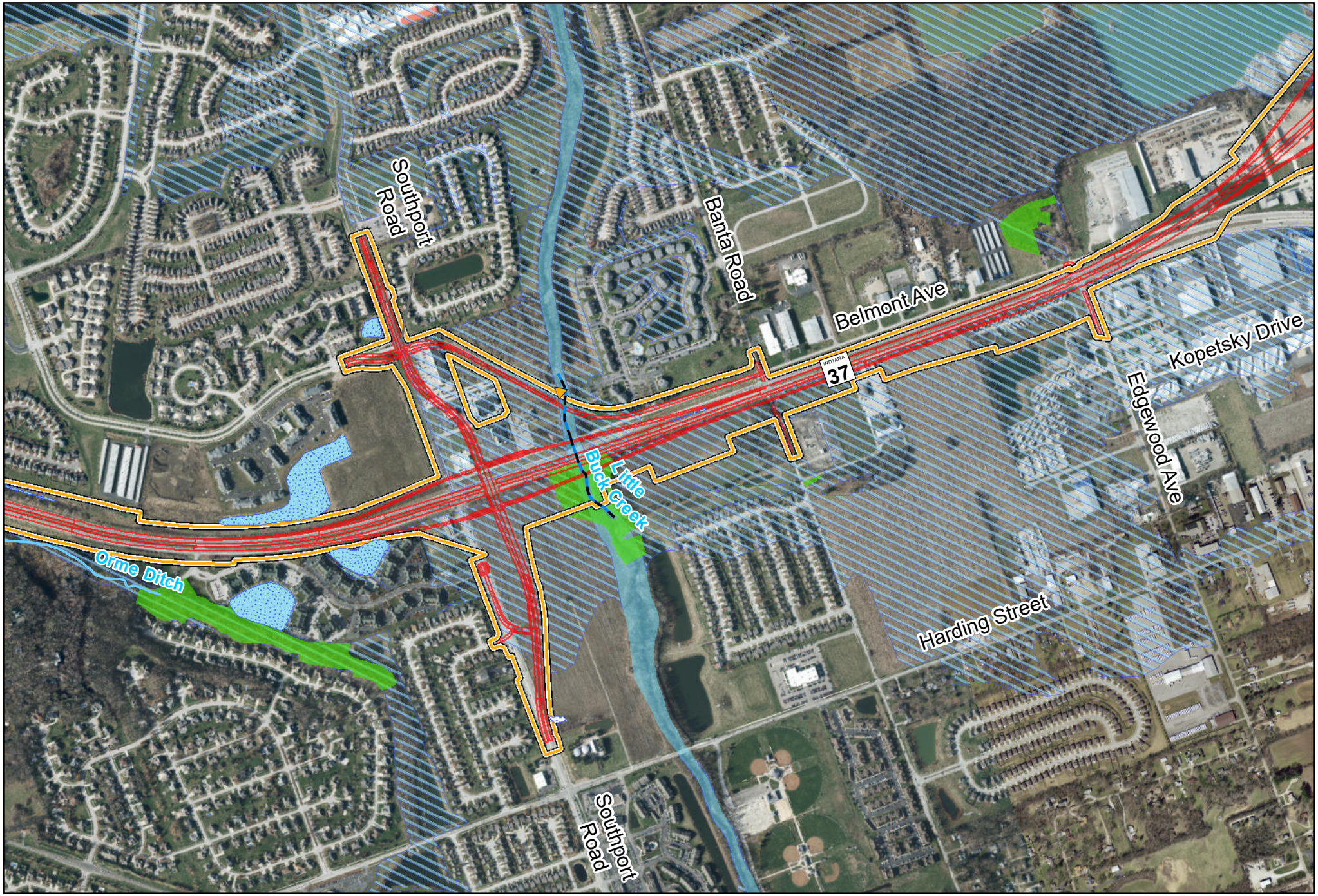
- Scrub-Shrub Wetlands (Field Identified)
- Core Forest
- Forest Land
- 100-Year Floodplain
- RPA Right of Way
- Floodway
- RPA Linework

1 inch = 1,000 feet

0 500 1,000 Feet



Legend

- Roost Tree
- Bat Net Sites
- Billboard Relocation
- Maternity Colony - Northern Long-Eared Bat

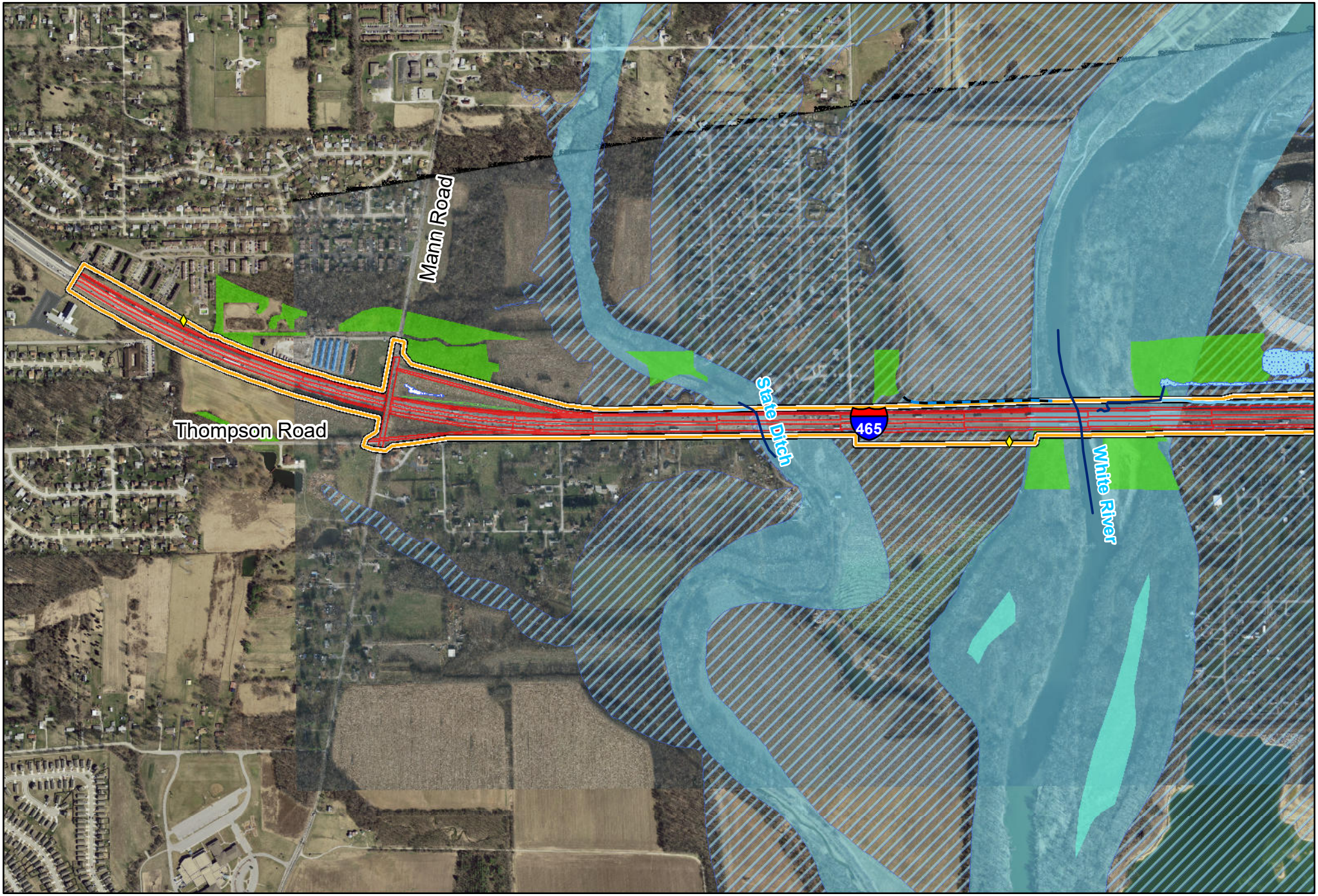
BIOLOGICAL ASSESSMENT

- Maternity Colony - Indiana Bat
- Ephemeral Stream
- Intermittent Stream
- Perennial Stream
- Open Waters (Field Identified)
- Emergent Wetlands (Field Identified)
- Forested Wetlands (Field Identified)
- Scrub-Shrub Wetlands (Field Identified)
- Core Forest
- Forest Land
- 100-Year Floodplain
- RPA Right of Way
- Floodway
- RPA Linework

1 inch = 1,000 feet

0 500 1,000

Feet



Legend

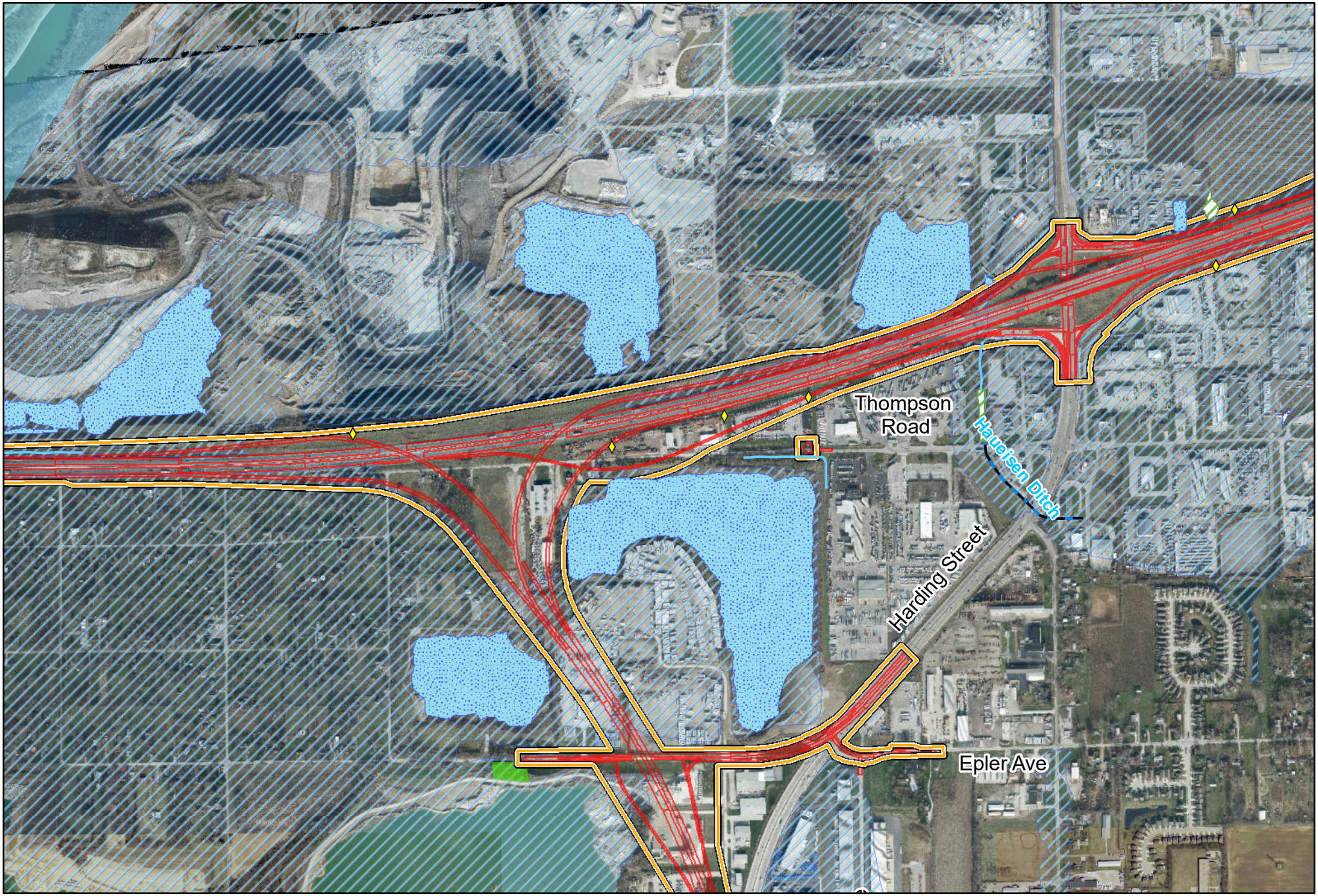
- Roost Tree
- Bat Net Sites
- Billboard Relocation
- Maternity Colony - Northern Long-Eared Bat
- Maternity Colony - Indiana Bat
- Ephemeral Stream
- Intermittent Stream
- Perennial Stream

BIOLOGICAL ASSESSMENT

- Open Waters (Field Identified)
- Emergent Wetlands (Field Identified)
- Forested Wetlands (Field Identified)
- Scrub-Shrub Wetlands (Field Identified)
- Core Forest
- Forest Land
- 100-Year Floodplain
- RPA Right of Way
- Floodway
- RPA Linework

1 inch = 1,000 feet

0 500 1,000 Feet



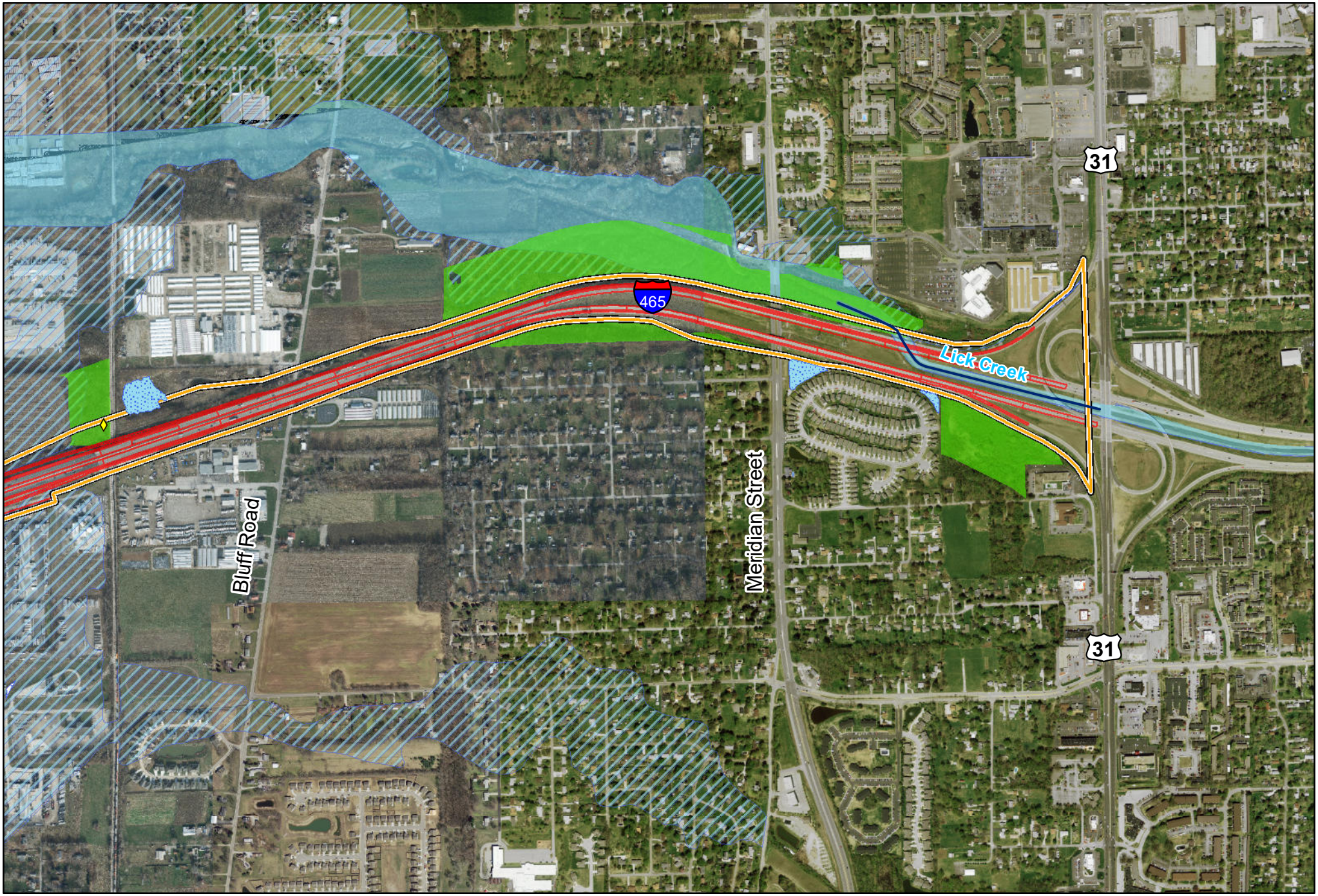
Legend

- Roost Tree
- Bat Net Sites
- Billboard Relocation
- Maternity Colony - Northern Long-Eared Bat
- Maternity Colony - Indiana Bat
- Ephemeral Stream
- Intermittent Stream
- Perennial Stream
- Open Waters (Field Identified)
- Emergent Wetlands (Field Identified)
- Forested Wetlands (Field Identified)
- Scrub-Shrub Wetlands (Field Identified)
- Core Forest
- Forest Land
- 100-Year Floodplain
- RPA Right of Way
- Floodway
- RPA Linework

BIOLOGICAL ASSESSMENT

1 inch = 1,000 feet

0 500 1,000 Feet



Legend

- Roost Tree
- Bat Net Sites
- Billboard Relocation
- Maternity Colony - Northern Long-Eared Bat
- Maternity Colony - Indiana Bat
- Ephemeral Stream
- Intermittent Stream
- Perennial Stream

BIOLOGICAL ASSESSMENT

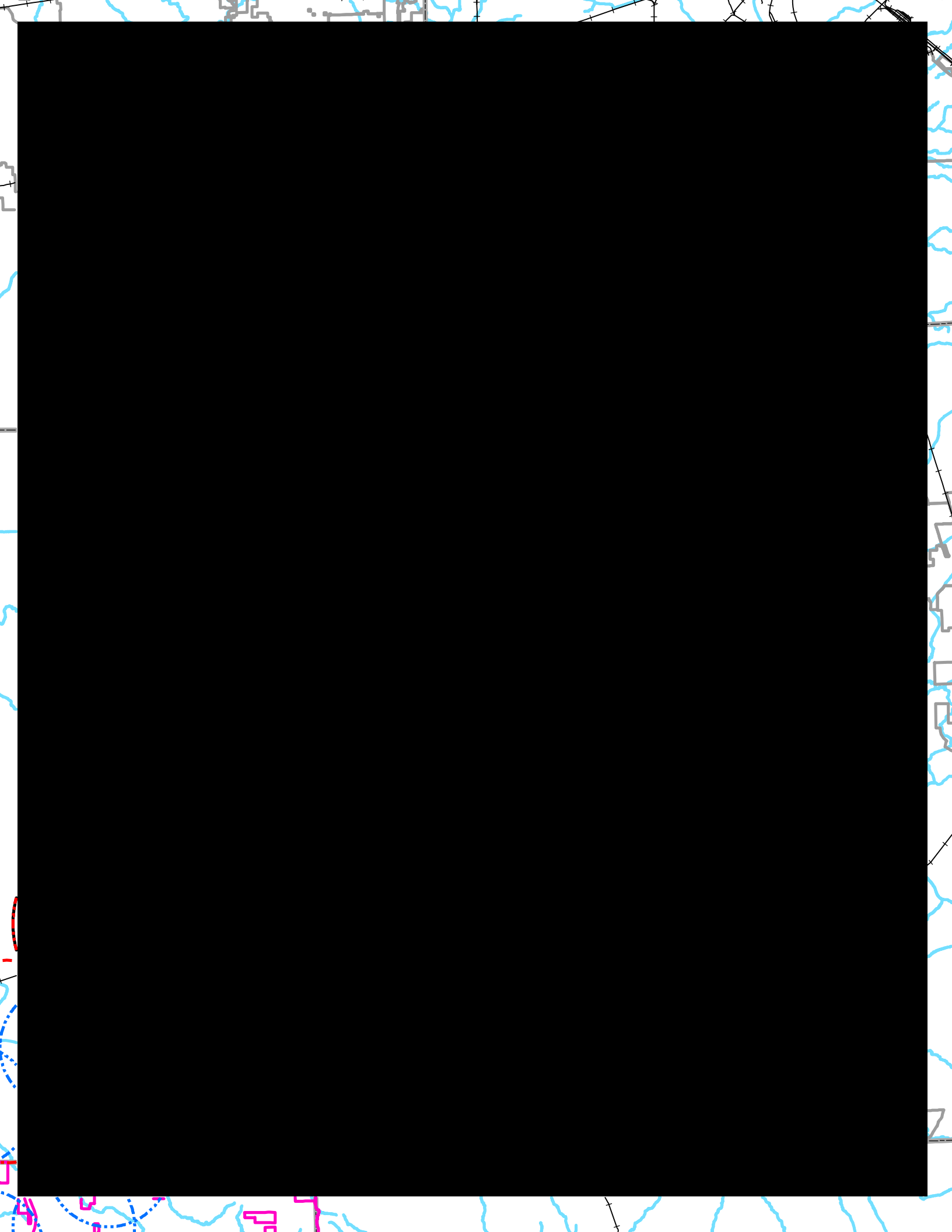
- Open Waters (Field Identified)
- Emergent Wetlands (Field Identified)
- Forested Wetlands (Field Identified)
- Scrub-Shrub Wetlands (Field Identified)
- Core Forest
- Forest Land
- 100-Year Floodplain
- RPA Right of Way
- Floodway
- RPA Linework

1 inch = 1,000 feet

0 500 1,000 Feet

Appendix D

Forest Transect Data Forms



I-69 Section 6 Forest Plot Worksheet

Transect ID: 1	Investigators: RKY, RC	Date: 4/26/2016	Time: 8:54 am
County: Morgan	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 343 feet Approx. Area = 0.47 acre	**Approx. Length = 343 feet Approx. Area = 0.47 acre**

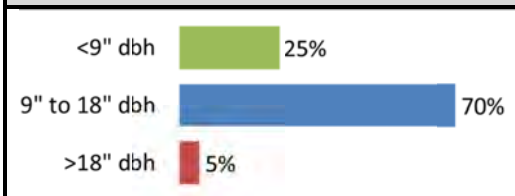
Stage of Decay of Potential Roosts

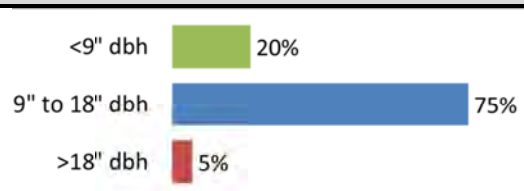
Transect Inside Alignment		Transect Outside Alignment	
Stage 1		Stage 1	
Stage 2		Stage 2	1x30”
Stage 3		Stage 3	1x15” 1x35”
Stage 4	1x14” 1x16” 1x19”	Stage 4	1x9”
Stage 5		Stage 5	
Stage 6	1x9”	Stage 6	

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
cottonwood	1x19”	cottonwood	1x35”
silver maple	1x14” 1x16”	silver maple	1x30” 1x15”
boxelder	1x9”	boxelder	1x9”
sycamore			
black willow			
American elm			
green ash			

General Size Class Cover Estimation





Sub-Canopy Density

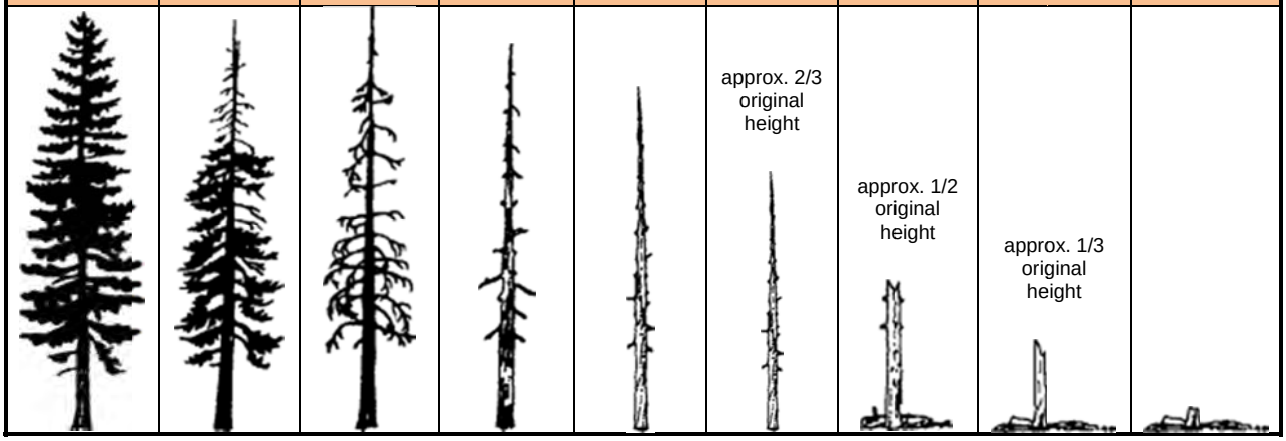
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
Japanese honeysuckle, creeping Charlie, garlic mustard	Japanese honeysuckle, creeping Charlie, garlic mustard, multiflora rose

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 1 inside alignment facing southwest from north end

Plot **1** inside alignment facing northeast from south end

Plot 1 outside alignment facing southwest from north end

Plot **1** outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 2	Investigators: RKY, RC	Date: 4/26/2016	Time: 10:21 am
County: Morgan	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 462 feet Approx. Area = 0.64 acre	**Approx. Length = 349 feet Approx. Area = 0.48 acre**

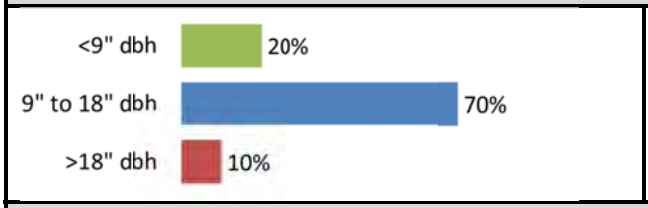
Stage of Decay of Potential Roosts

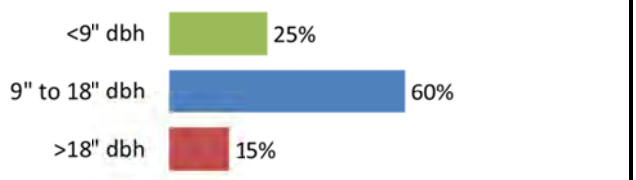
Transect Inside Alignment		Transect Outside Alignment	
Stage 1		Stage 1	
Stage 2	1x19" 1x24" 1x25"	Stage 2	1x19" 1x26"
Stage 3	1x9" 1x30"	Stage 3	1x14"
Stage 4		Stage 4	1x14" 1x24"
Stage 5		Stage 5	
Stage 6		Stage 6	

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
black cherry	1x30"	unknown	1x26"
unknown	1x25"	red maple	1x24"
white oak	1x24"	mulberry	1x19"
green ash	1x19"	black cherry	1x14"
Virginia pine	1x9"	green ash	1x14"
hackberry		boxelder	
sugar maple		black walnut	
boxelder			

General Size Class Cover Estimation





Sub-Canopy Density

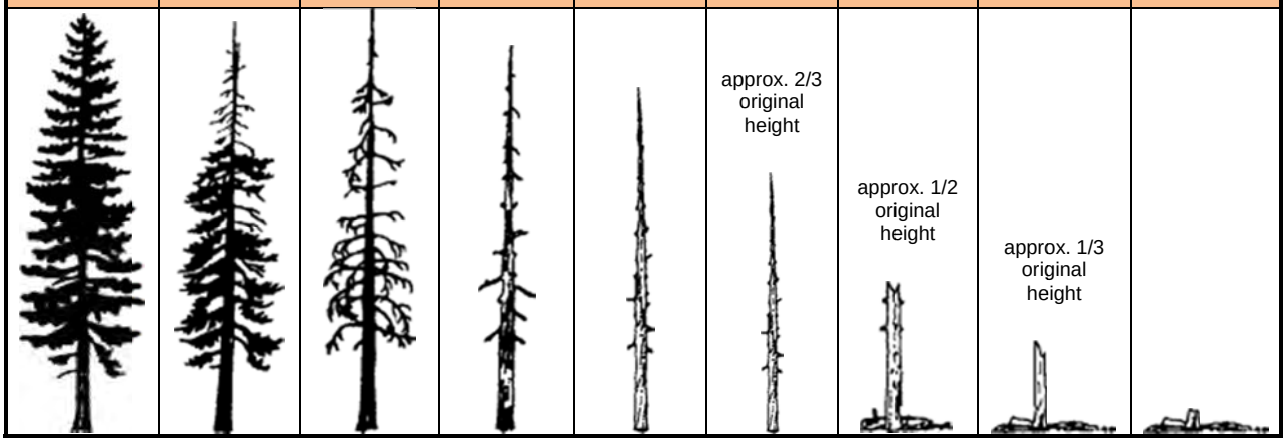
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	**Dense**	Open	**Moderate**	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
garlic mustard, Japanese honeysuckle, purple winter creeper, multiflora rose, Amur honeysuckle	garlic mustard, Japanese honeysuckle, purple winter creeper, multiflora rose, Amur honeysuckle

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 2 inside alignment facing southwest from north end

No Photo Available

Plot 2 outside alignment facing northeast from south end

Plot 2 outside alignment facing southwest from north end

No Photo Available

Plot 2 outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 3	Investigators: RKY, RC	Date: 4/26/2016	Time: 11:10 am
County: Morgan	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 389 feet Approx. Area = 0.54 acre	**Approx. Length = 389 feet Approx. Area = 0.54 acre**

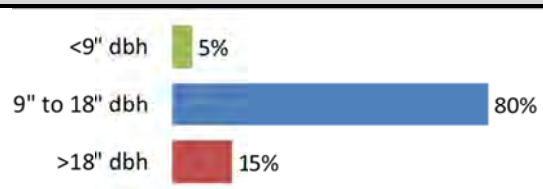
Stage of Decay of Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
Stage 1		Stage 1	1x29”
Stage 2	1x7”	Stage 2	
Stage 3	1x16” 1x10”	Stage 3	1x6” 1x8” 2x9” 1x12”
Stage 4	1x6”	Stage 4	
Stage 5	1x7”	Stage 5	1x6”
Stage 6	1x7”	Stage 6	

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
tulip poplar	1x16” 1x10” 3x7” 1x6”	American beech	1x29”
black cherry		unknown	1x12”
sugar maple		tulip poplar	2x9” 1x8” 2x6”
black walnut		black walnut	
flowering dogwood		hackberry	
		sugar maple	
		Virginia pine	

General Size Class Cover Estimation



Sub-Canopy Density

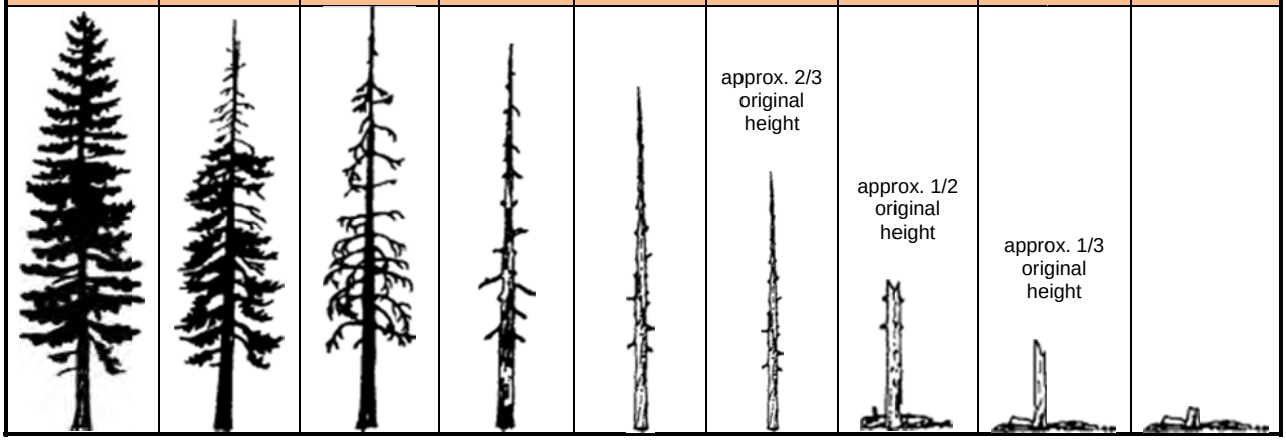
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
multiflora rose	multiflora rose

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



No Photo Available

No Photo Available

Plot 3 inside alignment facing southwest from north end

Plot 3 inside alignment facing northeast from south end

Plot 3 outside alignment facing southwest from north end

Plot 3 outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 4	Investigators: RKY, RC	Date: 4/26/2016	Time: 1:12 pm
County: Morgan	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: T12N R1E Sec 35	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 578 feet Approx. Area = 0.80 acre	**Approx. Length = 578 feet Approx. Area = 0.80 acre**

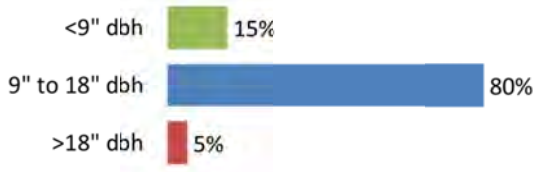
Stage of Decay of Potential Roosts

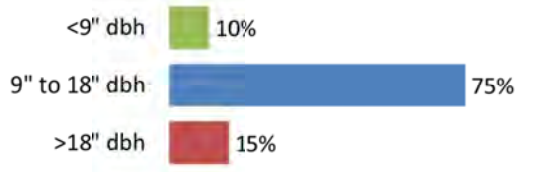
Transect Inside Alignment		Transect Outside Alignment	
Stage 1		Stage 1	1x16" 1x24"
Stage 2	1x12" 1x18"	Stage 2	
Stage 3	1x6" 1x14"	Stage 3	1x15"
Stage 4	1x6" 1x12" 1x13"	Stage 4	2x11" 1x12" 1x18"
Stage 5	1x6"	Stage 5	1x8"
Stage 6		Stage 6	

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
black cherry	1x18"	sugar maple	1x24"
tulip poplar	1x6" 1x13" 1x14"	tulip poplar	1x18"
black walnut	1x12"	shagbark hickory	1x16"
honey locust	1x12"	unknown	1x8" 1x11" 1x12"
unknown	1x6"	black walnut	1x11" 1x15"
sugar maple	1x6"	American beech	
white pine		red oak	
green ash		hackberry	
red oak		white ash	
sassafras		sassafras	
slippery elm			
hackberry			
sycamore			

General Size Class Cover Estimation





Sub-Canopy Density

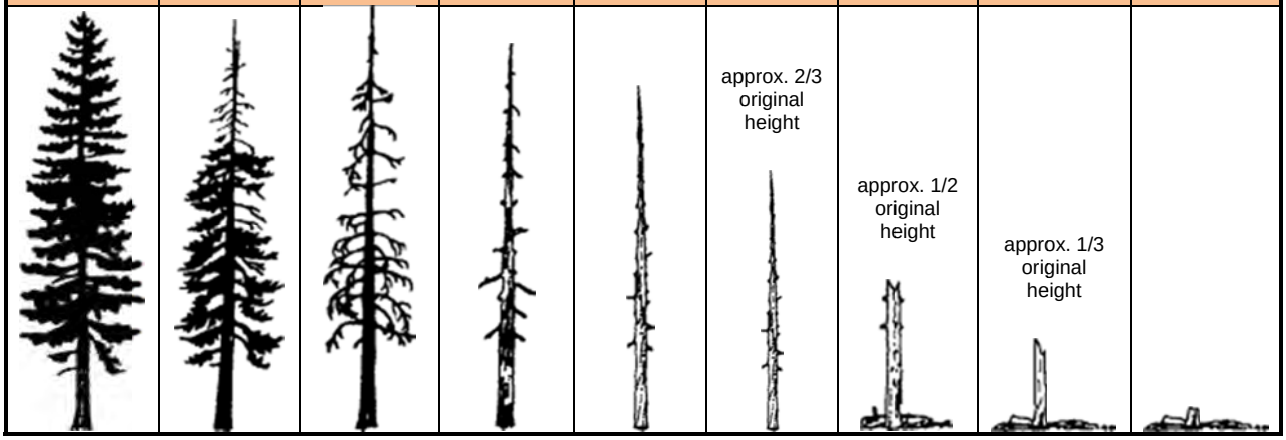
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
multiflora rose, garlic mustard, Japanese honeysuckle	multiflora rose, garlic mustard

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 4 inside alignment facing southwest from north end

Plot 4 inside alignment facing northeast from south end

Plot 4 outside alignment facing southwest from north end

Plot 4 outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 5	Investigators: RKY, RC	Date: 4/26/2016	Time: 2:26 pm
County: Morgan	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 269 feet Approx. Area = 0.37 acre	**Approx. Length = 269 feet Approx. Area = 0.37 acre**

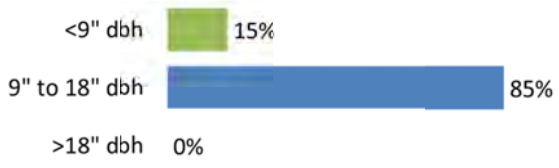
Stage of Decay of Potential Roosts

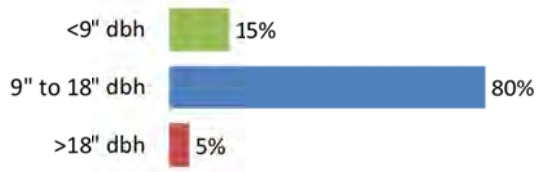
Transect Inside Alignment		Transect Outside Alignment	
Stage 1		Stage 1	
Stage 2	1x6”	Stage 2	1x15”
Stage 3		Stage 3	2x17”
Stage 4		Stage 4	
Stage 5		Stage 5	
Stage 6		Stage 6	

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
sugar maple	1x6”	sugar maple	1x15” 2x17”
black cherry		black locust	
American beech		tulip poplar	
slippery elm		slippery elm	
sssafras		sassafras	
tulip poplar		black cherry	
black locust			

General Size Class Cover Estimation





Sub-Canopy Density

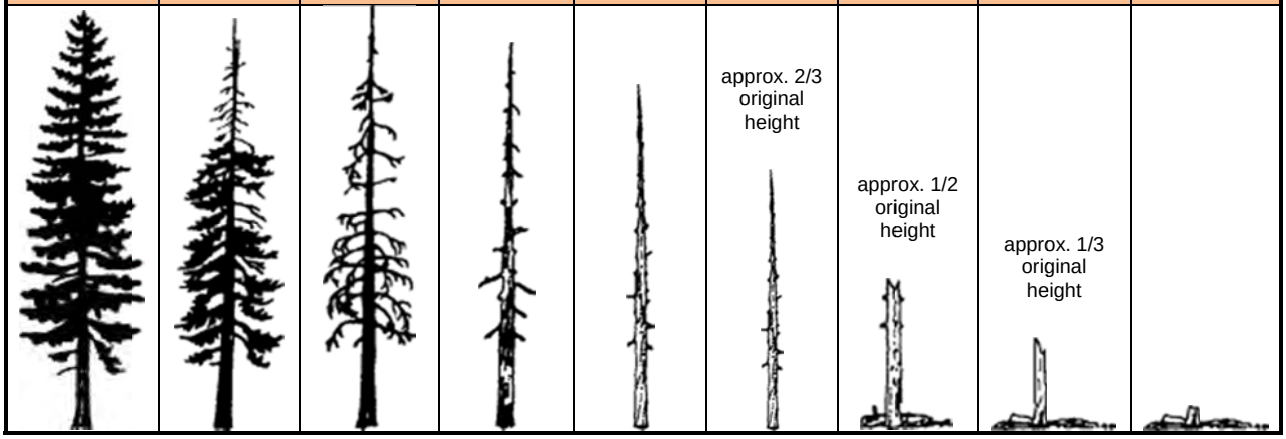
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
multiflora rose	

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 5 inside alignment facing southwest from north end

Plot 5 inside alignment facing northeast from south end

Plot 5 outside alignment facing southwest from north end

Plot 5 outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 6	Investigators: RKY, RC	Date: 4/26/2016	Time: 3:11 pm
County: Morgan	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 386 feet Approx. Area = 0.53 acre	**Approx. Length = 386 feet Approx. Area = 0.53 acre**

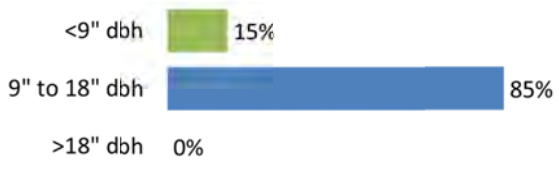
Stage of Decay of Potential Roosts

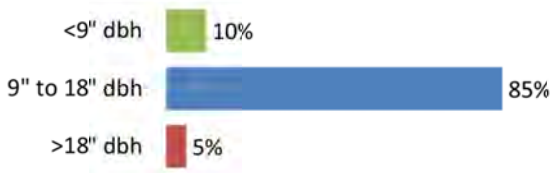
Transect Inside Alignment	Transect Outside Alignment
Stage 1	Stage 1
Stage 2	Stage 2
Stage 3 1x12”	Stage 3
Stage 4 1x13” 1x14”	Stage 4
Stage 5	Stage 5 1x7”
Stage 6	Stage 6

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
white pine	1x12” 1x14”	black locust	1x7”
black cherry	1x13”	black cherry	
white pine		boxelder	
sycamore		white pine	
black locust		green ash	
boxelder		slippery elm	
honey locust		tulip poplar	
slippery elm			
hackberry			
red maple			

General Size Class Cover Estimation





Sub-Canopy Density

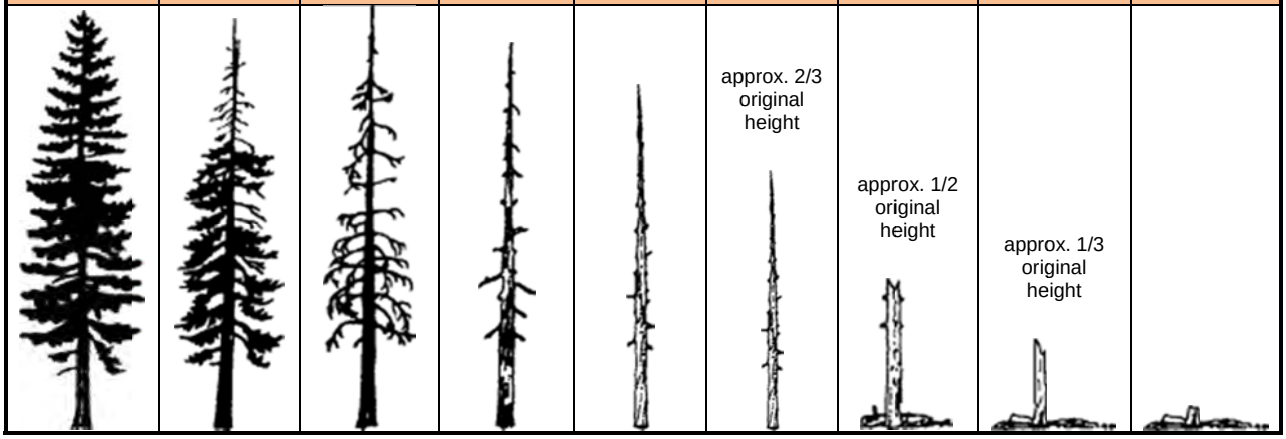
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
garlic mustard, Russian olive, Japanese honeysuckle, Amur honeysuckle, creeping charlie	garlic mustard, Russian olive, Japanese honeysuckle, Amur honeysuckle, creeping charlie

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 6 inside alignment facing southwest from north end

Plot 6 inside alignment facing northeast from south end

Plot 6 outside alignment facing southwest from north end

Plot 6 outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 7	Investigators: RKY, RC	Date: 4/26/2016	Time: 4:18 pm
County: Morgan	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 285 feet Approx. Area = 0.39 acre	**Approx. Length = 285 feet Approx. Area = 0.39 acre**

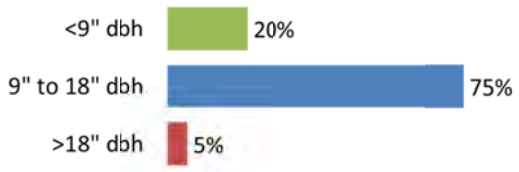
Stage of Decay of Potential Roosts

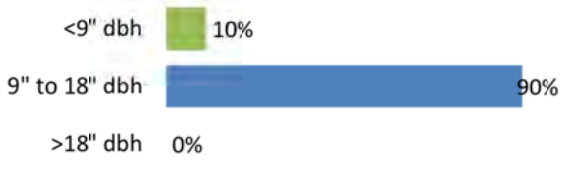
Stage 1	Stage 1
Stage 2	Stage 2 1x12" 1x13"
Stage 3	Stage 3
Stage 4	Stage 4
Stage 5	Stage 5
Stage 6	Stage 6

Canopy and Sub-Canopy Trees with Potential Roosts

Ohio buckeye	black locust 1x12" 1x13"
black cherry	black cherry
tulip poplar	flowering dogwood
green ash	tulip poplar
boxelder	sugar maple
slippery elm	hackberry
sycamore	Ohio buckeye
sugar maple	
black locust	

General Size Class Cover Estimation





Sub-Canopy Density

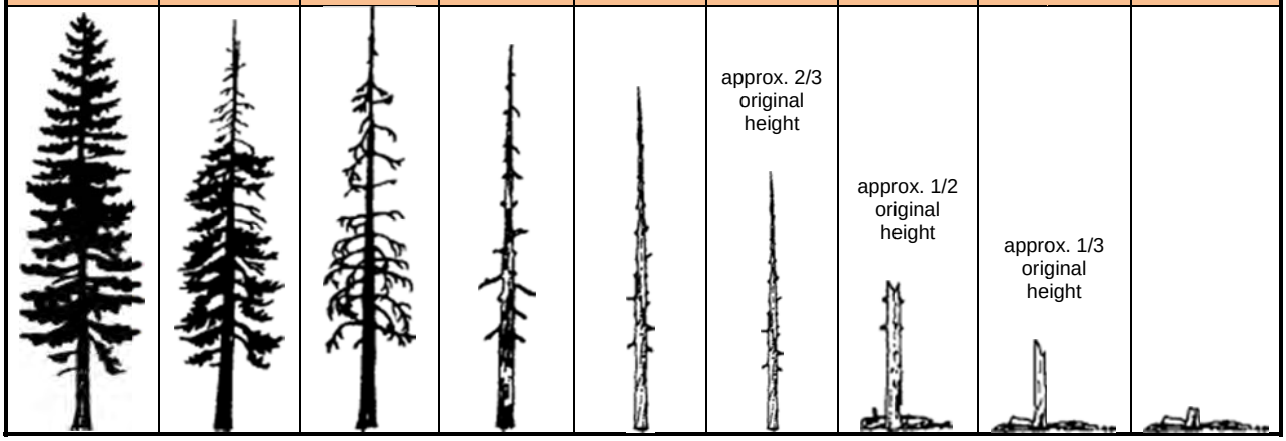
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

multiflora rose, Amur honeysuckle	multiflora rose, Amur honeysuckle

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 7 inside alignment facing southwest from north end

Plot 7 inside alignment facing northeast from south end

Plot 7 outside alignment facing southwest from north end

Plot 7 outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 8	Investigators: RKY, RC	Date: 4/27/2016	Time: 7:41 am
County: Morgan	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 453 feet Approx. Area = 0.62 acre	**Approx. Length = 453 feet Approx. Area = 0.62 acre**

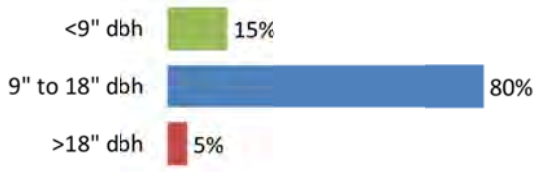
Stage of Decay of Potential Roosts

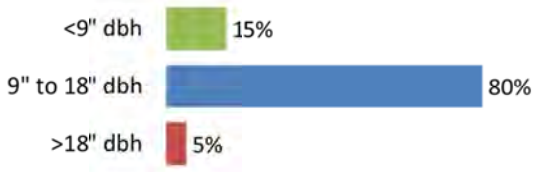
Transect Inside Alignment		Transect Outside Alignment	
Stage 1	1x22" 1x26"	Stage 1	1x17"
Stage 2		Stage 2	
Stage 3	1x9"	Stage 3	
Stage 4	1x10"	Stage 4	
Stage 5		Stage 5	1x11"
Stage 6		Stage 6	

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
red maple	1x26"	shagbark hickory	1x17"
shagbark hickory	1x22"	unknown	1x11"
sycamore	1x10"	blue beech	
tulip poplar	1x9"	black walnut	
black cherry		sycamore	
pignut hickory		sassafras	
sugar maple		American beech	
American beech		tulip poplar	
		flowering dogwood	

General Size Class Cover Estimation





Sub-Canopy Density

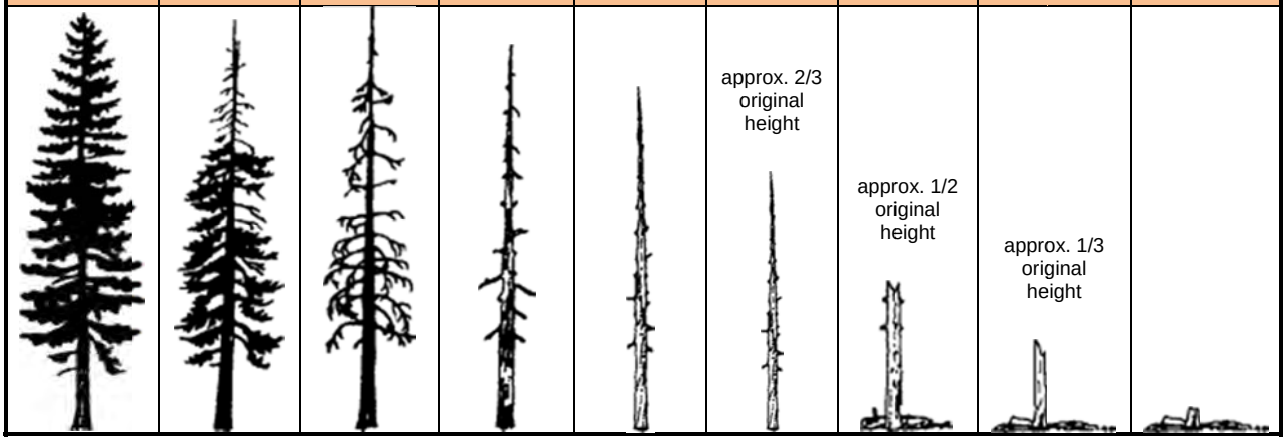
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
multiflora rose, Amur honeysuckle	multiflora rose, Amur honeysuckle, Russian olive

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 8 inside alignment facing southwest from north end

Plot 8 inside alignment facing northeast from south end

Plot 8 outside alignment facing southwest from north end

Plot 8 outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 9	Investigators: RKY, RC	Date: 4/27/2016	Time: 8:39 am
County: Morgan	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 1786 feet Approx. Area = 2.46 acre	**Approx. Length = 1786 feet Approx. Area = 2.46 acre**

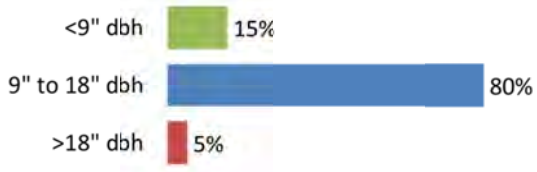
Stage of Decay of Potential Roosts

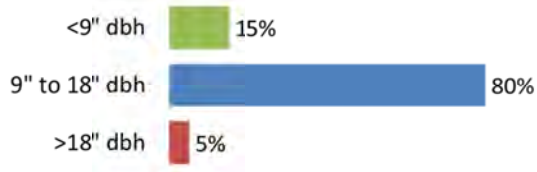
	Transect Inside Alignment	Transect Outside Alignment
Stage 1	2x20” 1x28” 1x30”	
Stage 2	1x15” 1x17” 1x24” 1x26” 1x34”	
Stage 3	1x7” 2x8” 1x10” 1x11” 1x12” 1x13” 1x14”	
Stage 4	1x7” 1x17”	
Stage 5		
Stage 6		

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
sugar maple	2x20” 1x26” 1x28” 1x34”	unknown	1x10” 1x27”
white oak	1x30”	sugar maple	1x21”
black cherry	1x24”	pignut hickory	1x11” 1x16” 1x20”
pignut hickory	1x15” 1x17”	black cherry	1x20”
tulip poplar	1x7” 1x8” 1x13” 1x17”	shagbark hickory	1x17” 1x18”
black locust	1x7” 1x11” 1x12” 1x14”	black locust	1x17”
unknown	1x8” 1x10”	tulip poplar	1x9” 1x10”
American beech		American beech	1x10”
chinkapin oak		red maple	
green ash		green ash	
American elm		white oak	
honey locust		American elm	
red oak	pin oak	hackberry	boxelder

General Size Class Cover Estimation





Sub-Canopy Density

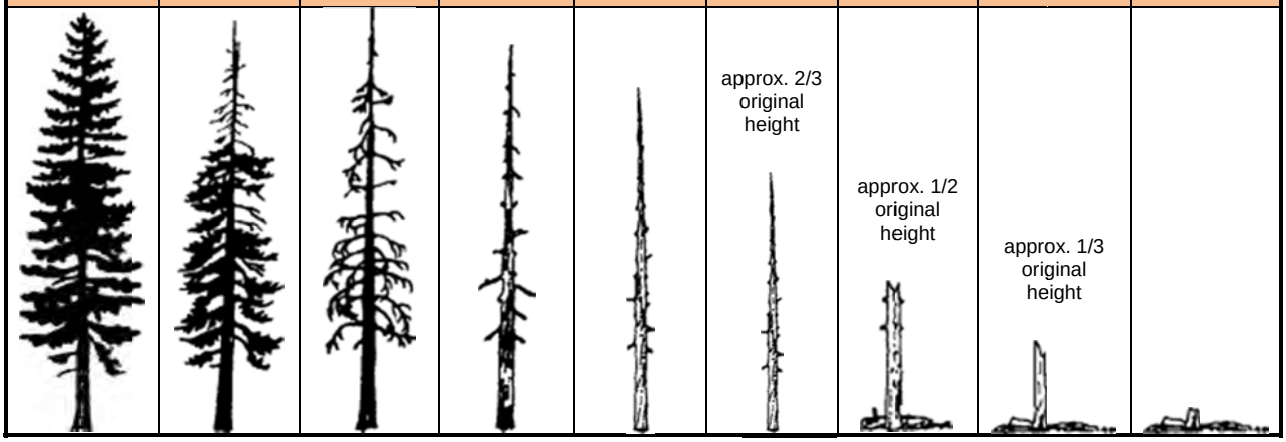
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
Amur honeysuckle, Russian olive, multiflora rose, garlic mustard, Japanese honeysuckle	multiflora rose, Russian olive, Amur honeysuckle, Japanese honeysuckle, garlic mustard, winged burning bush

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 9 inside alignment facing southwest from north end

Plot 9 inside alignment facing northeast from south end

Plot 9 outside alignment facing southwest from north end

Plot 9 outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 10	Investigators: RKY, RC	Date: 4/27/2016	Time: 12:25 pm
County: Morgan	Quadrangle: [redacted]	Location: [redacted] Cre[redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 940 feet Approx. Area = 1.29 acre	**Approx. Length = 940 feet Approx. Area = 1.29 acre**

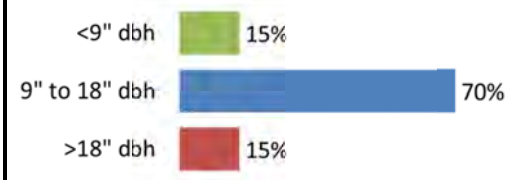
Stage of Decay of Potential Roosts

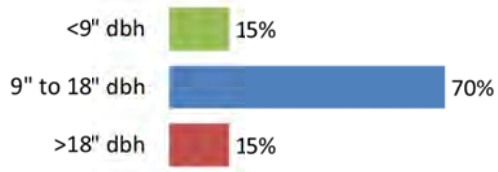
Transect Inside Alignment		Transect Outside Alignment	
Stage 1	1x46”	Stage 1	1x13” 1x17” 1x24”
Stage 2	1x27”	Stage 2	
Stage 3	1x11” 1x13”	Stage 3	1x19” 1x40”
Stage 4	2x8” 1x9” 1x11” 1x13”	Stage 4	1x9”
Stage 5	1x9” 1x10”	Stage 5	
Stage 6		Stage 6	

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
tulip poplar	1x8” 1x9” 1x11” 1x46”	black locust	1x13” 1x19” 1x40”
pignut hickory	1x27”	shagbark hickory	1x17” 1x24”
black locust	1x8” 1x10” 1x13”	honey locust	1x9”
honey locust	1x13”	black walnut	
black cherry	1x9” 1x11”	black cherry	
unknown	1x6”	white oak	
sycamore		sugar maple	
American beech		American beech	
red oak			
chestnut oak			
sugar maple			
American elm			

General Size Class Cover Estimation





Sub-Canopy Density

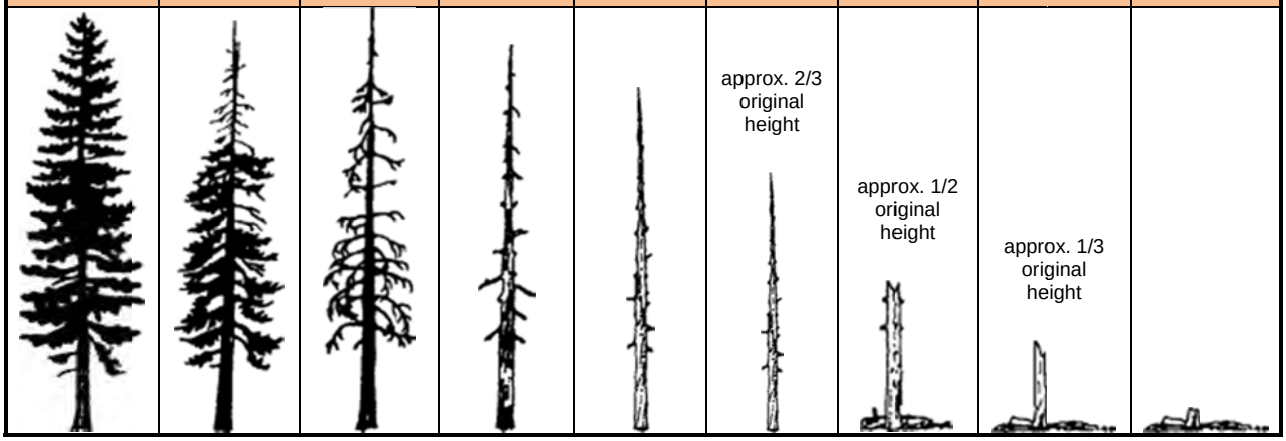
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
Russian olive, Amur honeysuckle, multiflora rose	Russian olive, multiflora rose, Amur honeysuckle, garlic mustard

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 10 inside alignment facing southwest from north end

Plot 10 inside alignment facing northeast from south end

Plot 10 outside alignment facing southwest from north end

Plot 10 outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 11	Investigators: RKY, RC	Date: 4/27/2016	Time: 2:11 pm
County: Morgan	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 370 feet Approx. Area = 0.51 acre	**Approx. Length = 370 feet Approx. Area = 0.51 acre**

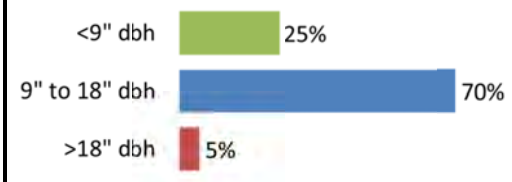
Stage of Decay of Potential Roosts

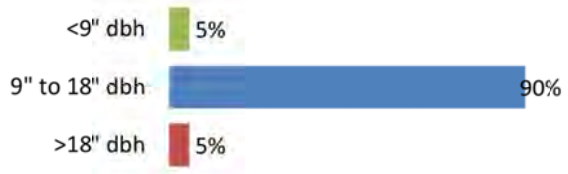
Transect Inside Alignment		Transect Outside Alignment	
Stage 1		Stage 1	
Stage 2	1x17”	Stage 2	
Stage 3	1x9” 1x13”	Stage 3	1x16”
Stage 4		Stage 4	
Stage 5		Stage 5	
Stage 6		Stage 6	

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
cottonwood	1x17”	honey locust	1x16”
unknown	1x9” 1x13”	boxelder	
sugar maple		pignut hickory	
white oak		hawthorn	
hackberry		green ash	
boxelder		American elm	
American elm			
honey locust			
persimmon			
swamp chestnut oak			
green ash			
sycamore			

General Size Class Cover Estimation





Sub-Canopy Density

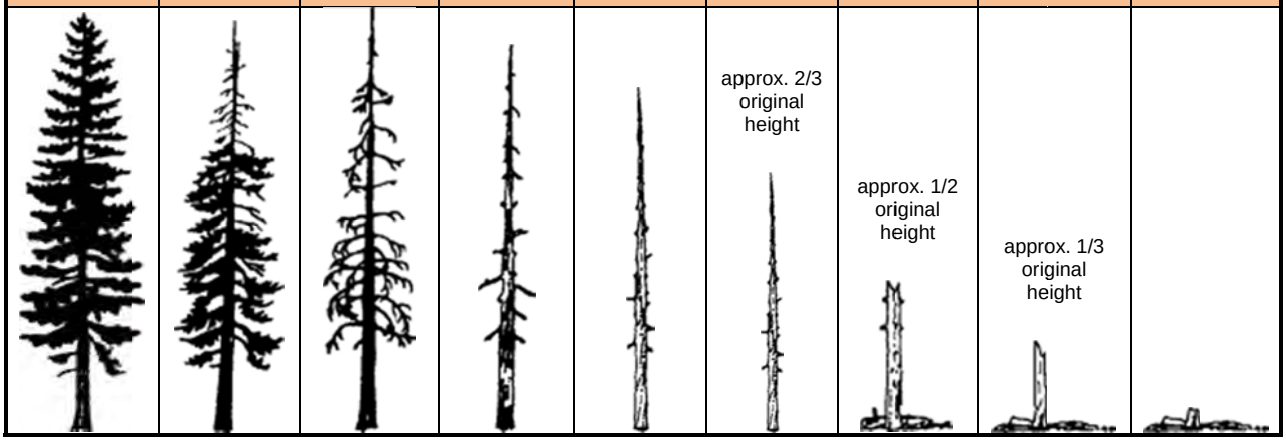
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
Amur honeysuckle, creeping jenny	Amur honeysuckle

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 11 inside alignment facing southwest from north end

Plot 11 inside alignment facing northeast from south end

Plot 11 outside alignment facing southwest from north end

Plot 11 outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 12	Investigators: RKY, RC	Date: 4/27/2016	Time: 3:27 pm
County: Morgan	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 1270 feet Approx. Area = 1.75 acre	**Approx. Length = 1270 feet Approx. Area = 1.75 acre**

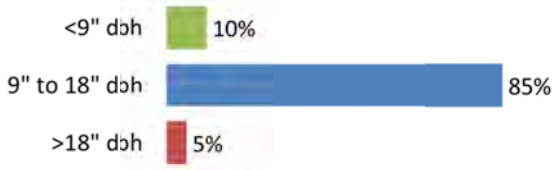
Stage of Decay of Potential Roosts

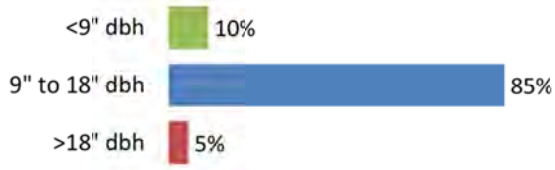
Transect Inside Alignment		Transect Outside Alignment	
Stage 1	1x11" 1x16" 1x17"	Stage 1	
Stage 2		Stage 2	1x9" 1x14"
Stage 3		Stage 3	1x8" 1x12" 1x15" 1x24"
Stage 4	1x9"	Stage 4	
Stage 5	2x14"	Stage 5	1x26" 1x35"
Stage 6		Stage 6	

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
honey locust	1x17"	unknown	1x24" 1x26" 1x35"
shagbark hickory	1x16"	tulip poplar	1x14" 1x15"
sassafras	2x14"	boxelder	1x12"
sugar maple	1x11"	shagbark hickory	1x9"
tulip poplar	1x9"	American elm	1x8"
black cherry		black cherry	
red cedar		boxelder	
pignut hickory		green ash	
white oak		slippery elm	
American beech	sycamore	red oak	
American elm	red oak	sugar maple	
black locust	boxelder		
green ash	chinkapin oak		

General Size Class Cover Estimation





Sub-Canopy Density

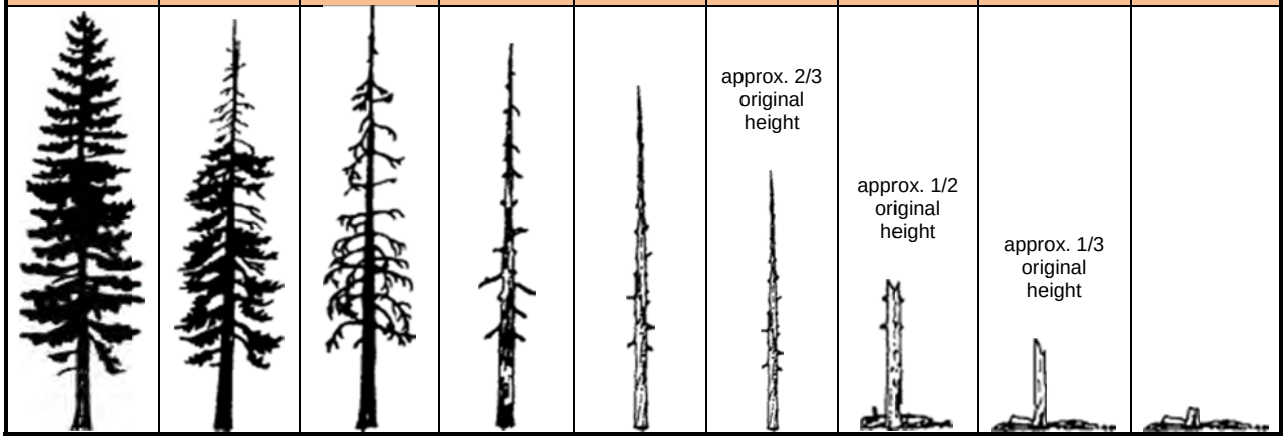
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
multiflora rose, garlic mustard, Japanese honeysuckle	garlic mustard, multiflora rose, Amur honeysuckle

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 12 inside alignment facing southwest from north end

Plot 12 inside alignment facing northeast from south end

Plot 12 outside alignment facing southwest from north end

Plot 12 outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 13	Investigators: RKY, RC	Date: 4/27/2016	Time: 8:13 am
County: Morgan	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 1766 feet Approx. Area = 2.43 acre	**Approx. Length = 1766 feet Approx. Area = 2.43 acre**

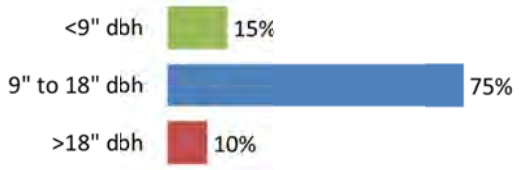
Stage of Decay of Potential Roosts

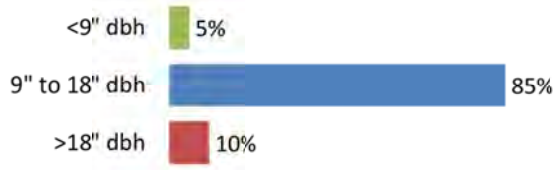
	Transect Inside Alignment	Transect Outside Alignment
Stage 1	1x10” 1x11” 1x12” 1x13” 2x15”	2x9” 3x12” 1x13” 1x14” 1x15” 1x17” 2x18” 1x20” 1x22” 1x24” 1x40”
Stage 2		1x7” 1s14” 1x22”
Stage 3	1x10” 1x36”	1x9” 1x12”
Stage 4	1x6” 1x12” 1x14” 1x15”	1x12”
Stage 5	1x7”	1x11”
Stage 6		

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
tulip poplar	1x12” 1x36”	red oak	1x40”
shagbark hickory	1x10” 1x11” 1x12” 1x13” 2x15”	pignut hickory	1x24”
unknown	1x6” 1x7” 1x14” 1x15”	sugar maple	1x11” 1s22”
sugar maple	1x10”	shagbark hickory	2x9” 3x10” 3x12” 1x13” 1x14” 3x15” 1x17” 2x18” 1x20” 1x22”
black cherty		black locust	1x9” 1x12” 1x14”
Ohio buckeye		tulip poplar	1x12”
pignut hickory	black walnut	black cherry	1x7”
blue beech	black locust	American beech	
hackberry	green ash	honey locust	
American beech	American hornbeam		
red oak	honey locust		

General Size Class Cover Estimation





Sub-Canopy Density

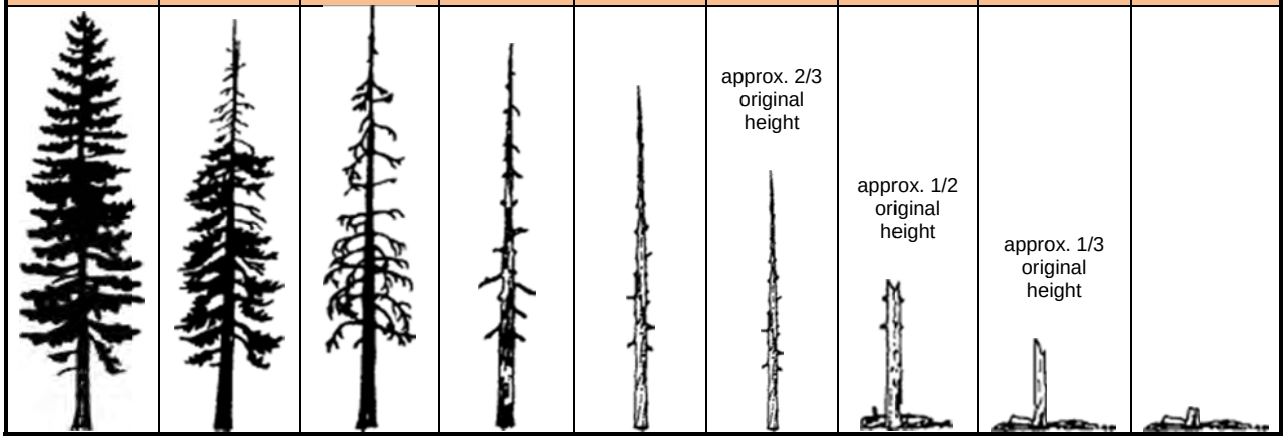
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
purple winter creeper	purple winter creeper, Japanese honeysuckle, garlic mustard

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 13 inside alignment facing west from north end

Plot 13 inside alignment facing northeast from south end

Plot 13 outside alignment facing southwest from north end

Plot 13 outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 14	Investigators: RKY, RC	Date: 4/27/2016	Time: 5:26 pm
County: Morgan	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 1141 feet Approx. Area = 1.57acre	**Approx. Length = 1141 feet Approx. Area = 1.57 acre**

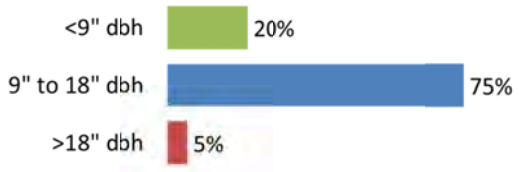
Stage of Decay of Potential Roosts

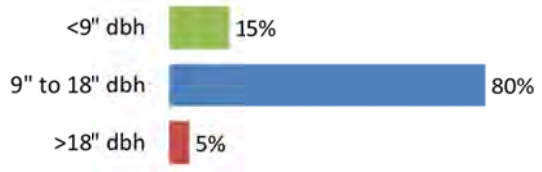
Transect Inside Alignment		Transect Outside Alignment	
Stage 1	1x20”	Stage 1	1x17” 1x19” 1x21” 1x23”
Stage 2	1x28”	Stage 2	1x6” 1x8” 1x11” 1x16” 1x26” 1x32”
Stage 3	1x6” 1x8” 1x11” 1x13” 1x14” 1x17”	Stage 3	1x6” 2x8” 1x9” 2x14” 1x20”
Stage 4	1x10” 1x11”	Stage 4	1x8” 1x12”
Stage 5		Stage 5	
Stage 6		Stage 6	

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
black walnut	1x28”	black walnut	1x32”
black locust	2x11” 1x13” 1x14” 1x17” 1x20”	black locust	1x8” 1x9” 1x11” 1x14” 1x16” 1x17” 1x19” 1x20” 1x21” 1x23” 1x26”
unknown	1x6” 1x10”	sugar maple	1x6” 1x8” 1x14”
tulip poplar	1x8”	hackberry	1x6” 1x8” 1x12”
honey locust		Ohio buckeye	
American elm		black cherry	
box elder		swamp chestnut oak	
hawthorn	hackberry	pignut hickory	
green ash	sugar maple		
Ohio buckeye	black cherry		
slippery elm	pignut hickory		

General Size Class Cover Estimation





Sub-Canopy Density

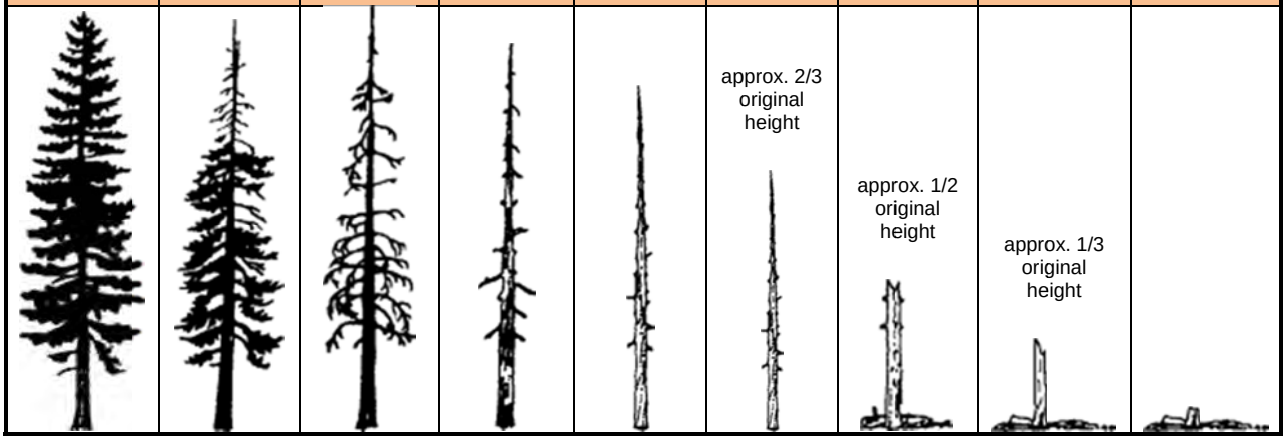
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
Russian olive, purple winter creeper, creeping Charlie, multiflora rose	Amur honeysuckle, purple winter creeper, garlic mustard, Japanese honeysuckle

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 14 inside alignment facing west from north end

Plot 14 inside alignment facing northeast from south end

Plot 14 outside alignment facing southwest from north end

Plot 14 outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 15	Investigators: RKY, KL	Date: 4/28/2016	Time: 9:30 am
County: Morgan	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 1632 feet Approx. Area = 2.25 acre	**Approx. Length = 1632 feet Approx. Area = 2.25 acre**

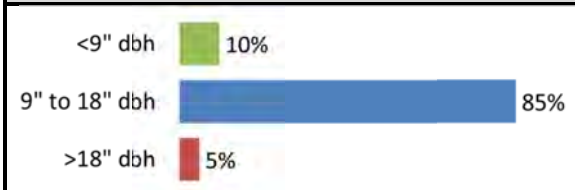
Stage of Decay of Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
Stage 1		Stage 1	
Stage 2		Stage 2	1x36”
Stage 3	1x10” 1x12” 1x13”	Stage 3	1x6”
Stage 4	1x10”	Stage 4	
Stage 5	1x10” 2x15”	Stage 5	
Stage 6		Stage 6	

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
shagbark hickory	1x15”	silver maple	1x36”
unknown	2x10” 1x15”	black cherry	1x6”
silver maple	1x13”	honey locust	
black cherry	1x10” 1x12”	hackberry	
white pine		sycamore	
black locust		tulip poplar	
boxelder		sassafras	
hackberry		green ash	
sycamore		American elm	
honey locust		hawthron	

General Size Class Cover Estimation



Sub-Canopy Density

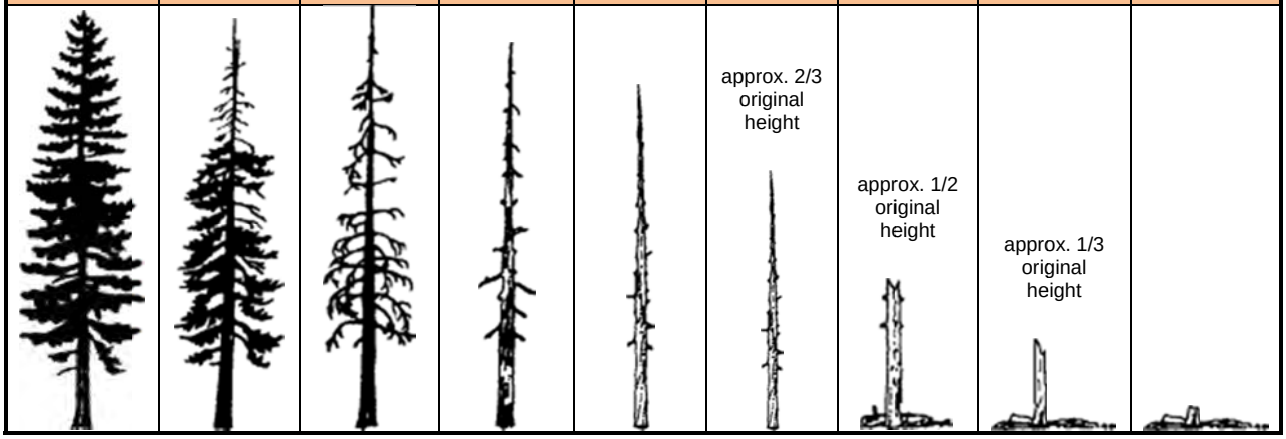
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
Amur honeysuckle, purple winter creeper, garlic mustard, Russian olive, multiflora rose	garlic mustard, Amur honeysuckle, multiflora rose, Russian olive, purple winter creeper

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 15 inside alignment facing southwest from north end

Plot 15 inside alignment facing northeast from south end

No Photo Available

Plot 15 outside alignment facing southwest from north end

Plot 15 outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 16	Investigators: RKY, KL	Date: 4/28/2016	Time: 12:29 pm
County: Morgan	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 421 feet Approx. Area = 0.58 acre	**Approx. Length = 421 feet Approx. Area = 0.58 acre**

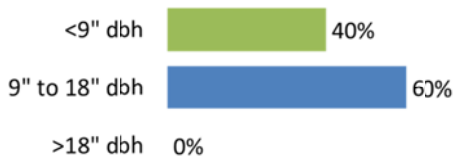
Stage of Decay of Potential Roosts

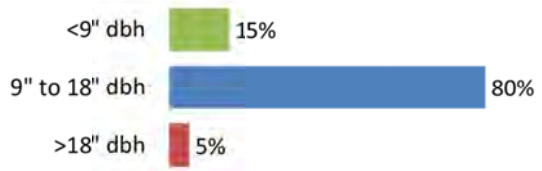
Transect Inside Alignment		Transect Outside Alignment	
Stage 1		Stage 1	
Stage 2		Stage 2	2x16” 1x20” 1x24”
Stage 3		Stage 3	3x12” 1x30”
Stage 4	1x10” 2x11” 2x12” 2x13”	Stage 4	1x10” 1x12” 1x13” 1x16”
Stage 5		Stage 5	
Stage 6		Stage 6	

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
sugar maple	1x11” 1x13”	sugar maple	1x16” 1x30”
tulip poplar	1x11” 1x12” 1x13”	black cherry	1x16” 1x24”
American elm	1x12”	red oak	1x20”
black cherry	1x10”	tulip poplar	1x10” 4x12” 1x13”
green ash		American beech	
boxelder			
sycamore			

General Size Class Cover Estimation





Sub-Canopy Density

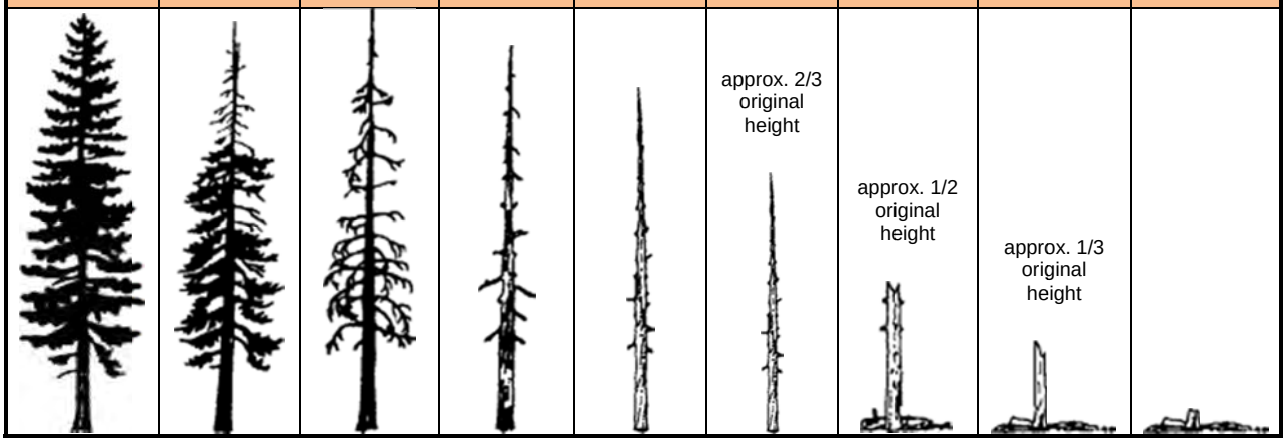
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
multiflora rose, garlic mustard, Japanese honeysuckle, Amur honeysuckle	Japanese honeysuckle, Amur honeysuckle, garlic mustard

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 16 inside alignment facing southwest from north end

Plot 16 inside alignment facing northeast from south end

Plot 16 outside alignment facing southwest from north end

Plot 16 outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 17	Investigators: RKY, KL	Date: 4/28/2016	Time: 1:42 pm
County: Johnson	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 877 feet Approx. Area = 1.21 acre	**Approx. Length = 877 feet Approx. Area = 1.21 acre**

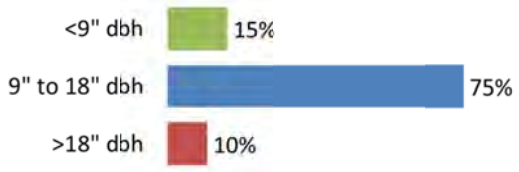
Stage of Decay of Potential Roosts

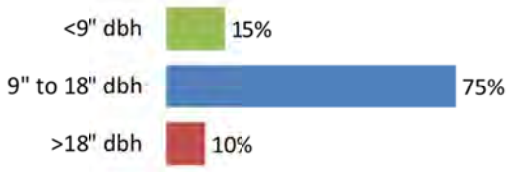
Transect Inside Alignment		Transect Outside Alignment	
Stage 1		Stage 1	
Stage 2	1x20”	Stage 2	1x11”
Stage 3	1x12”	Stage 3	1x8”1x10”
Stage 4	1x8” 1x13”	Stage 4	1x6” 1x7” 1x10”
Stage 5		Stage 5	1x9” 1x10” 1x30”
Stage 6		Stage 6	

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
silver maple	1x13” 1x20”	sugar maple	1x30”
honey locust	1x12”	honey locust	1x6” 1x11”
shellbark hickory	1x8”	silver maple	1x8” 1x10” 1s10”
black cherry		unknown	1x7” 1x9” 1x10”
black walnut		boxelder	
redbud		sycamore	
boxelder		American elm	
sugar maple		hackberry	
		black walnut	

General Size Class Cover Estimation





Sub-Canopy Density

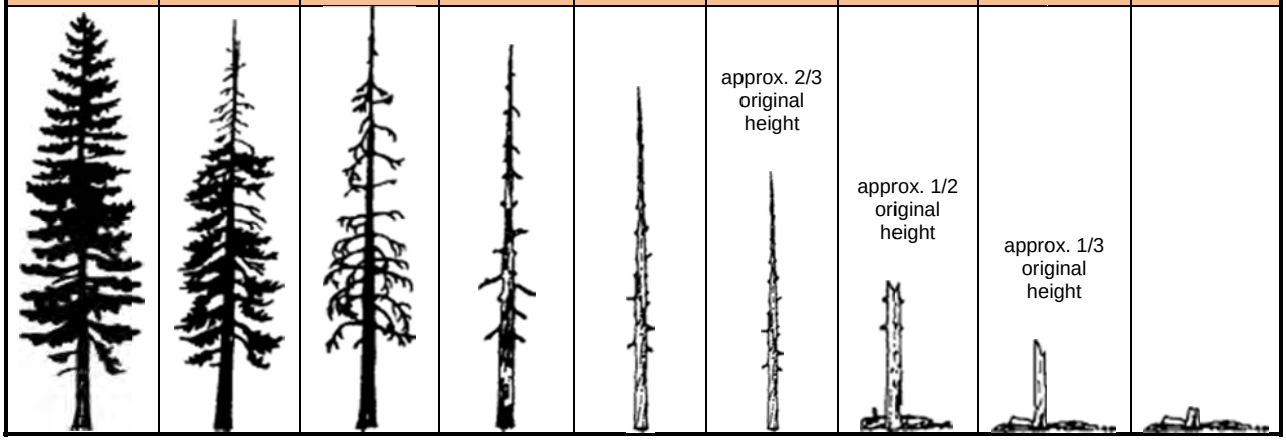
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
garlic mustard, purple winter creeper, Amur honeysuckle	Amur honeysuckle, purple winter creeper

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 17 inside alignment facing southwest from north end

No Photo Available

Plot 17 inside alignment facing northeast from south end

Plot 17 outside alignment facing southwest from north end

Plot 17 outside alignment facing northeast from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 18	Investigators: RKY, KL	Date: 4/28/2016	Time: 2:31 pm
County: Marion	Quadrangle: [redacted]	Location: [redacted]	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 290 feet Approx. Area = 0.40 acre	**Approx. Length = 290 feet Approx. Area = 0.40 acre**

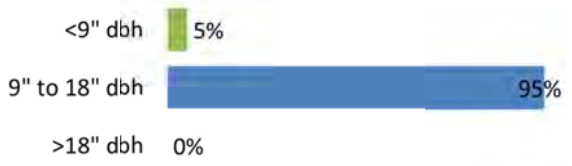
Stage of Decay of Potential Roosts

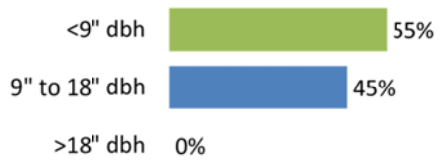
Transect Inside Alignment		Transect Outside Alignment
Stage 1		Stage 1
Stage 2	1x13”	Stage 2
Stage 3		Stage 3
Stage 4		Stage 4
Stage 5		Stage 5
Stage 6		Stage 6

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment
unknown	1x13”	hackberry
boxelder		boxelder
silver maple		elm
mulberry		mulberry
cottonwood		

General Size Class Cover Estimation





Sub-Canopy Density

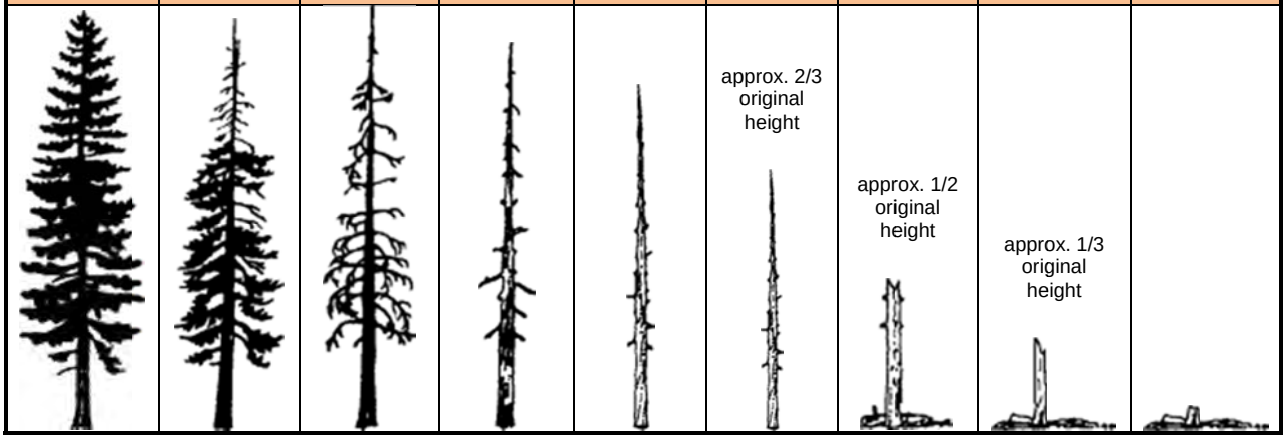
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
multiflora rose, garlic mustard, Amur honeysuckle	garlic mustard, Amur honeysuckle

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 18 inside alignment facing south from north end

Plot 18 inside alignment facing north from south end

Plot 18 outside alignment facing south from north end

Plot 18 outside alignment facing north from south end

I-69 Section 6 Forest Plot Worksheet

Transect ID: 19	Investigators: RKY, KL	Date: 4/28/2016	Time: 3:21 pm
County: Marion	Quadrangle: [redacted]	Location: [redacted]ion	
UTM (meters): [redacted]		PLSS: [redacted]	

Transect Inside Alignment	Transect Outside Alignment
Approx. Length = 436 feet Approx. Area = 0.60 acre	**Approx. Length = 436 feet Approx. Area = 0.60 acre**

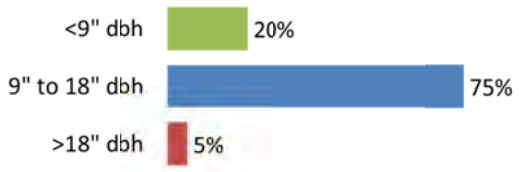
Stage of Decay of Potential Roosts

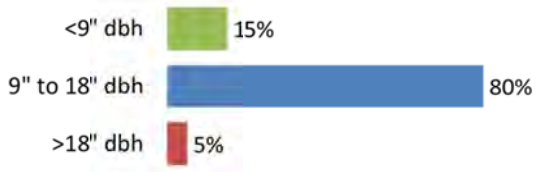
Transect Inside Alignment		Transect Outside Alignment	
Stage 1	1x15”,	Stage 1	
Stage 2	1x9” 1x34”	Stage 2	1x34”
Stage 3		Stage 3	
Stage 4		Stage 4	1x7”
Stage 5		Stage 5	
Stage 6		Stage 6	

Canopy and Sub-Canopy Trees with Potential Roosts

Transect Inside Alignment		Transect Outside Alignment	
black walnut	1x34”	cottonwood	1x34”
shellbark hickory	1x15”	unknown	1x7”
boxelder	1x9”	honey locust	
honey locust		black walnut	
black cherry		green ash	
sycamore		hackberry	
hackberry		black cherry	
American elm		hawthorn	
		boxelder	

General Size Class Cover Estimation





Sub-Canopy Density

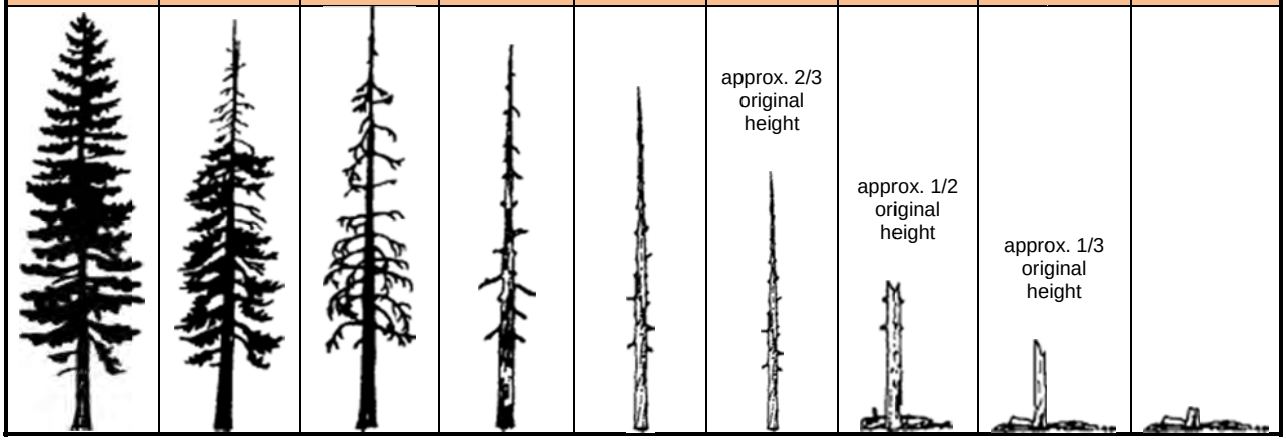
Transect Inside Alignment			Transect Outside Alignment		
Open	Moderate	Dense	Open	Moderate	Dense

Invasive Species

Transect Inside Alignment	Transect Outside Alignment
garlic mustard, Amur honeysuckle	garlic mustard, Amur honeysuckle

Decay Class

LIVE		DEAD					DEAD FALLEN	
1	2	3	4	5	6	7	8	9



Plot 19 inside alignment facing south from north end

Plot 19 inside alignment facing north from south end

Plot 19 outside alignment facing south from north end

Plot 19 outside alignment facing north from south end

Appendix E

Bald Eagle Proximity Map

Appendix F

Overall Impact Summary

Summary of Impacts for I-69													
Project Section	**Revised Direct Habitat Loss Estimated in the Tier 1 RPBO Amendment(acres)**			**Direct Habitat Loss Estimated in the Tier 2 BA (acres)[1]**					**Total Habitat Available in the Summer Action Area after Construction (acres)[2]**				
	Total Forest[3]	**Scrub Shrub (SS)[4]**	**Emergent (EM)[4]**	**Total Forest**	**UP**	**PFO**	**SS**	**EM**	**Total Forest**	**UP**	**PFO**	**SS**	**EM**
1	28	0	1.2	28.91	28.9	0.01	0	0.85	14,691	12,906	1,785	480	292
2	212	0.5	6.4	186.43	175.7	10.73	0.03	4.82	25,881	18,589	7,291	1095	870
3	67	1.3	2.4	59.95	57.9	2.05	0.56	2.46	15,566	12,242	3,324	131	526
4	1,050	0.2	5.1	882.09	880.1	1.99	0.19	4.46	74,195	73,427	768	16	80
5	350	1.1	3.5	193.99	192.56	1.43	0.28	2.65	47,681	45,835	1,845	99	471
6	314	0	6	209.90	208.2	1.70	0.39	1.90	34,211	31,678	2,533	40	648
Total	**2,021**	**3.1**	**24.6**	**1561.27**	**1543.36**	**17.91**	**1.45**	**17.14**	**212,225**	**194,677**	**17,546**	**1,861**	**2,887**
Total Habitat Loss	**2048.7**			**1579.86**					**216,971**				

[1] Sections 1-4 have been updated with as-built information. Section 5 has been updated with best available data. The impacts in Sections 1-5 show the acreage of upland forest that was removed within the construction limits plus wetland forest and utility impacted forest. The impacts in Section 6 show the acreage of upland forest within the right-of-way plus wetland, utility and billboard forest impact estimates for the refined preferred alternative.

[2] These acreages include the Tier 2 data. The Tier 2 data includes EEAC data within the corridor and right-of-way and NWI (wetlands) or 2001 USGS/2006 NLCD (forest) data for the remaining area. In Section 4/Section 5, 2003 tree cover data was used where available. Section 6 includes updated 2011 NLCD and current NWI data for the Action Area outside of the field survey area.

[3] As presented in the Biological Opinion, Tier 2 Total Forest Loss includes wetland forest. The totals shown for Sections 1-5 are as presented in Amendment 2 to the Tier 1 RPBO. The total shown for Section 6 is as presented in Amendment 3 to the Tier 1 RPBO (Sections 1-5 were not included in Amendment 3).

[4] The totals shown are as estimated to develop the 30 acre non-forested wetland threshold presented in Amendment 2 to the Tier 1 RPBO (wetland thresholds were not included in Amendment 3). While the summation of all estimated non-forested wetland impacts (PSS and PEM) totals 27.7 acres, the impact (take) threshold provided was identified as 30 acres of cumulative non-forested wetland impact.

Appendix G

Indirect Development Land Use Analysis

		NLCD 2011							CORRIDOR MODEL TAZ LAYER						
TAZ ID	COUNTY	DEVELOPED (ac)	UNUSABLE (ac)	AG/OTHER in FLOODPLAIN (ac)	FOREST in FLOODPLAIN (ac)	AVAILABLE AG/OTHER (ac)	AVAILABLE FOREST (ac)	TOTAL LANDCOVER (ac)	NOBUILD GROWTH (ac)	C4 BUILD GROWTH (ac)	C4 INDUCED GROWTH (ac)	C4 INDUCED HOUSEHOLDS	C4 INDUCED HOUSEHOLDS (ac)	C4 INDUCED EMPLOYMENT	C4 INDUCED EMPLOYMENT (ac)
268	Hendricks	196	0	12	13	158	40	419	37.6	44.4	6.8	0	0.0	100	6.8
275	Hendricks	89	0	265	59	528	155	1096	104.9	127.7	22.8	100	22.8	0	0.0
282	Hendricks	289	0	115	53	290	17	764	248.8	250	1.2	0	0.0	17	1.2
297	Johnson	220	0	119	1	1622	18	1980	91.2	104.2	13	57	13.0	0	0.0
306	Johnson	177	0	0	12	0	1	190	15.4	22.9	7.5	33	7.5	0	0.0
343	Johnson	60	0	0	0	445	133	638	28.7	30.1	1.4	0	0.0	20	1.4
363	Johnson	357	0	1	5	0	0	363	12.4	15.8	3.4	0	0.0	50	3.4
373	Johnson	215	1	0	0	1752	432	2400	61.9	69.4	7.5	33	7.5	0	0.0
374	Johnson	29	0	0	0	67	90	186	17.6	19	1.4	0	0.0	21	1.4
380	Johnson	20	0	0	0	161	51	232	24.4	25.6	1.2	0	0.0	18	1.2
381	Johnson	12	0	0	0	103	67	182	35.5	39	3.5	0	0.0	51	3.5
384	Johnson	20	0	0	0	256	27	303	25.7	28.4	2.7	0	0.0	40	2.7
444	Johnson	77	0	0	0	47	0	124	25.8	27.5	1.7	0	0.0	25	1.7
445	Johnson	86	10	572	271	182	4	1125	1.6	10.3	8.7	33	7.5	18	1.2
972	Marion	268	0	0	0	842	57	1167	25.4	51	25.6	112	25.6	0	0.0
974	Marion	124	0	71	35	1134	111	1475	24.2	32.2	8	35	8.0	0	0.0
980	Marion	405	0	8	8	308	67	796	4.1	41.8	37.7	165	37.7	0	0.0
1065	Marion	361	0	0	0	240	25	626	0.2	2.1	1.9	0	0.0	28	1.9
1141	Marion	351	7	771	268	16	1	1414	26.9	40.6	13.7	0	0.0	200	13.7
1144	Marion	601	1	210	48	8	0	868	31.5	35.7	4.2	0	0.0	61	4.2
1239	Marion	138	0	48	2	7	0	195	28.4	44.8	16.4	0	0.0	239	16.4
1245	Marion	146	0	4	0	0	0	150	6.9	12.2	5.3	0	0.0	77	5.3
1679	Morgan	98	0	0	0	0	3	101	18.7	21	2.3	0	0.0	34	2.3
1684	Morgan	33	0	0	0	0	0	33	1.9	3.9	2	0	0.0	29	2.0
1696	Morgan	69	0	0	1	0	0	70	1.8	2.3	0.5	0	0.0	8	0.5
1725	Morgan	489	0	377	138	1755	765	3524	10.4	21.8	11.4	50	11.4	0	0.0
1727	Morgan	155	0	13	7	697	440	1312	3.0	5.3	2.3	10	2.3	0	0.0
1730	Morgan	21	0	0	0	0	0	21	1.2	1.7	0.5	0	0.0	7	0.5
1761	Morgan	116	0	7	2	1071	1148	2344	0.0	6.4	6.4	28	6.4	0	0.0
1763	Morgan	83	0	0	25	247	369	724	0.0	18.7	18.7	82	18.7	0	0.0
1764	Morgan	91	2	2	18	655	901	1669	0.0	11	11	48	11.0	0	0.0
1767	Morgan	33	0	7	6	118	35	199	0.0	2.7	2.7	12	2.7	0	0.0
1768	Morgan	55	1	26	18	141	220	461	1.8	5.6	3.8	0	0.0	55	3.8
1774	Morgan	49	0	0	0	96	15	160	0.0	3.4	3.4	0	0.0	50	3.4
1775	Morgan	15	0	0	6	123	74	218	0.0	3.4	3.4	0	0.0	50	3.4
1776	Morgan	29	0	3	43	298	138	511	0.0	2.3	2.3	10	2.3	0	0.0
1777	Morgan	82	0	17	1	226	12	338	0.0	3.8	3.8	0	0.0	55	3.8
1780	Morgan	37	0	21	22	420	191	691	1.1	6.6	5.5	0	0.0	80	5.5
1783	Morgan	34	0	3	4	195	102	338	0.5	3.9	3.4	0	0.0	50	3.4
1794	Morgan	62	0	0	0	422	217	701	30.3	32	1.7	0	0.0	25	1.7
1795	Morgan	31	0	32	0	598	25	686	3.5	6.5	3	4	0.9	30	2.1
1796	Morgan	65	0	0	0	4	0	69	0.8	1.6	0.8	0	0.0	11	0.8
1797	Morgan	19	0	0	0	0	0	19	1.4	3.2	1.8	0	0.0	27	1.8
1798	Morgan	54	0	0	0	6	9	69	0.8	1	0.2	0	0.0	3	0.2
1799	Morgan	115	0	1	0	165	0	281	31.1	45	13.9	38	8.7	76	5.2
1800	Morgan	59	0	0	0	5	0	64	2.2	11.2	9	0	0.0	132	9.0
1817	Morgan	41	0	0	0	0	0	41	4.4	4.9	0.5	0	0.0	8	0.5
1822	Morgan	191	0	44	165	17	11	428	0.0	1.7	1.7	0	0.0	25	1.7
1825	Morgan	235	5	654	220	64	49	1227	0.0	5.7	5.7	25	5.7	0	0.0
1826	Morgan	100	0	0	1	280	181	562	2.9	5.2	2.3	10	2.3	0	0.0
1829	Morgan	101	0	0	2	289	178	570	5.3	9.9	4.6	20	4.6	0	0.0
1832	Morgan	101	0	12	10	472	9	604	0.0	0.1	0.1	0	0.0	2	0.1
1894	Morgan	56	0	0	0	303	66	425	18.5	20.3	1.8	0	0.0	26	1.8
1914	Morgan	17	0	18	22	265	318	640	0.9	5.9	5	22	5.0	0	0.0
1916	Morgan	176	5	49	44	220	371	865	1.4	6	4.6	20	4.6	0	0.0

Appendix H

Section 6 Bat Presence Survey
Mist Netting Report

I-69 PRESENCE/ABSENCE
MIST NETTING SURVEY FOR
INDIANA BAT (*MYOTIS SODALIS*)
AND NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*)
SECTION 6 (MORGAN, JOHNSON AND MARION COUNTIES, IN)
UPPER WHITE RIVER WATERSHED

Prepared For:

Indiana Department of Transportation
Environmental Services
100 North Senate Avenue, Room N642
Indianapolis, Indiana 46204-2249
Phone: 317-232-0240

Prepared By:

LOCHMUELLER GROUP
6200 Vogel Road
Evansville, IN 47715
Phone: 812-479-6200 / Fax: 812-479-6262

January 21, 2016

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Appendices

I-69 PRESENCE/ABSENCE MIST NETTING SURVEY FOR INDIANA BAT (*MYOTIS SODALIS*) AND NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*) SECTION 6 (MORGAN, JOHNSON AND MARION COUNTIES, IN) UPPER WHITE RIVER WATERSHED

Thomas H. Cervone, Ph.D. and Rusty K. Yeager
Lochmueller Group, Inc., 6200 Vogel Road, Evansville, IN 47715

ABSTRACT

The presence/absence survey was conducted to provide documentation for preparation of the I-69 Section 6 Tier 2 Biological Assessment for the Indiana Department of Transportation (INDOT) and Federal Highway Administration (FHWA) Section 7 Consultation with the U.S. Fish and Wildlife Service (USFWS). The Section 6 representative alignment from the Tier 1 phase of the project begins just south of Martinsville and extends to I-465 on the south side of Indianapolis. This survey was conducted between 3 July and 6 August to establish presence and general distribution of the federally endangered Indiana bat (*Myotis sodalis*) and the recently listed federally threatened northern long-eared bat (*Myotis septentionalis*) using mist net capture techniques and to identify maternity roost trees through the use of radio-telemetry tracking. While the primary objective of the survey is to provide annual monitoring of the Indiana bat presence in the vicinity of the I-69 corridor, data was also collected on other species native to Indiana, including the possible presence of the state endangered evening bat (*Nycticeius humeralis*).

This survey includes 19 sites, 15 of which were previously surveyed in 2004 and in part again in 2005. For the 2015 effort, a total of 126 bats representing seven species were captured: 72 big brown bats (*Eptesicus fuscus*), 18 eastern red bats (*Lasiurus borealis*), 24 evening bats, 4 little brown bats (*Myotis lucifigus*), 3 Indiana bats, 3 northern long-eared bats, and 1 tri-colored bat (*Perimyotis subflavus*). One captured bat escaped before identification could be obtained. Overall capture rates for the survey were 1.5 bats per net night.

Radio transmitters were attached to all three of the Indiana bats (all juvenile females), but only one captured at Site 21 was tracked to two different dead cottonwood trees (dbh = 45cm and 35cm) [redacted] of the [redacted] in [redacted] County. Emergence counts from four nights of observation for these two roosts ranged from 7 to 35. Radio telemetry conducted on two of the three northern long-eared bats captured resulted in the identification of a single roost tree [redacted] of the [redacted] ([redacted] County) from a post-lactating female captured at Site 20.

INTRODUCTION

This presence/absence survey was conducted for the Tier 2 Environmental Impact Statement (EIS) studies for Section 6 of I-69. On 5 December 2004, the Federal Highway Administration (FHWA) approved the I-69 Tier 1 Environmental Impact Statement (EIS) identifying Alternative 3C as the preferred alternative. Subsequently the Record of Decision (ROD) was approved on 24 March 2004. As part of the Endangered Species Act Section 7 consultation for the Indiana bat in the Tier 1 phase, a presence/absence survey was conducted in 2004 for all six section of the I-69 project to document the distribution of the species in the vicinity of the Tier 1 corridor and to obtain roost data for the purposes of identifying maternity colonies. As part of Section 7 formal consultation a final Biological Assessment (BA) was submitted to the U.S. Fish and Wildlife Service (USFWS) on 21 July 2003 and the Tier 1 Biological Opinion (BO) was issued on 3 December 2003.

Given that nearly 10 years have passed since the original Indiana bat presence/absence survey was conducted, coordination between USFWS, FHWA and INDOT on 9 April 2014 concluded that a follow-up survey was warranted for Section 6 to update and supplement the 2004 and 2005 capture distribution and roost data. This was coordinated with the USFWS in greater detail at the 2 March 2015 Section 6 proposed mist netting meeting. Since the northern long-eared bat was to be listed as threatened (4(d) rule) on 2 April 2015, the 2015 survey was also to serve as a means to generate supplemental capture distribution data for the species, as well as roost/emergence data lacking from the 2004 and 2005 surveys in an effort to potentially better characterize colonies and locations from which project impacts would be assessed.

PROJECT AREA

The [redacted] end of the Section 6 project area at [redacted] is within the [redacted] section of the [redacted] while the remainder of the project area [redacted] to In[redacted] is within the [redacted] extent of the [redacted] section of the [redacted] The [redacted] has deeply dissected uplands underlain by siltstone, shale and sandstone (Homoya et al. 1985).The [redacted] is an undissected plain with remnants of beech-maple-oak northern flatwoods communities (Homoya et al. 1985). Existing [redacted] of M[redacted] is located within the [redacted] and generally runs parallel east of the river. The principal watersheds (14 digit HUC) for the project area from south to north include [redacted] and [redacted]

INDIANA BAT

Status

The Indiana bat (*Myotis sodalis*) was first described as a distinct species by Miller and Allen (1928) from a female specimen collected by J. O. Sibert on 7 March 1904 from Wyandotte Cave in Crawford County, Indiana. *Myotis* means "mouse ear" while s*odalis* is derived from the Latin word for "companion." The Indiana bat was listed as being in danger of extinction by the USFWS under the Endangered Species

Preservation Act of 1966 on 11 March 1967 (32 FR 4001) and was subsequently listed as endangered under the Endangered Species Act of 1973, as amended. Critical habitat consisting of eleven caves (including Ray's Cave and Wyandotte Cave in Indiana) and two mines was established in 41 FR 41914 on 24 September 1976. A recovery plan was developed for the species in 1983 (USFWS 1983) and a draft revised version was prepared in April 2007 (USFWS 2007).

Morphological Description

The Indiana bat is a small bat similar to the little brown bat in general appearance; however, it has a keel on the calcar, and small hind feet with sparse hairs on toes that do not extend beyond the claws. The fur is brownish gray and hair around the nose is sparse and sometimes gives a pink look to the nose. The sagittal crest is narrower than in the little brown bat (Hall 1981, Barbour and Davis 1969). Total length ranges from 73 to 100 mm (2.87 to 3.94 inches) and weight ranges from 6 to 11 grams (0.21 to 0.39 ounces) (Kurta 1995).

Range

The Indiana bat range includes the eastern United States from Vermont to southern Wisconsin to eastern Oklahoma to northern Florida. USFWS (2007) reports that based on winter 2005 surveys, there are 23 Priority 1 hibernacula in Illinois (n=1), Indiana (n=7), Kentucky (n=5), Missouri (n=6), New York (n=2), Tennessee (n=1) and West Virginia (n=1). However, in 2012 a new Priority 1 site was discovered in Missouri, thus bringing the total to 24. USFWS biennial population estimate data from 1981 through 2015 indicate that the population experienced a low of 496,027 in 2001 with an apparent resurgence to 635,349 in 2007 (http://www.fws.gov/Midwest/Endangered/mammals/inba/index.html as revised 8-25-2015). Possibly due to increased mortality resulting from white-nose syndrome, population estimates declined to 523,636 in 2015. Based on the 2015 Range-wide Population Estimate, Indiana (35%), Missouri (35%), Kentucky (13%), and Illinois (11%) provided hibernacula for 94% of the population in the winter range.

A total of 34 priority hibernacula exist in Indiana (USFWS 2007). Indiana populations seemingly increased slightly from estimates of 160,300 in 1965 to 238,068 in 2007; however, estimates before standardized surveys began in 1980 are unreliable (USFWS 2007). From 2007 populations have experienced a small decline to 226,365 in 2013 (USFWS unpublished data 2014). Redistribution of local winter populations from one cave to a nearby cave over the span of a few years has been reported in some instances (USFWS unpublished data 2006). [redacted] and [redacted] are critical habitat in Indiana.

A total of 269 summer maternity colonies have been documented from 16 states as of 2006, but this is considered to represent only a fraction of those that exist based on winter population estimates and average maternity colony size (USFWS 2007). Maternity colonies appear to be more abundant in the glaciated portions of the upper Midwest than the unglaciated regions of the Midwest or the Mideast portion of the range (USFWS 2007).

Feeding

Indiana bats eat aquatic and terrestrial flying insects, and in this, benefit people by consuming insects that are considered pests. Their role in insect control is remarkable when you consider they eat about half their body weight in insects each night. Examples of preferred prey include moths, beetles, midges,

flies, wasps, stoneflies, flying ants, caddisflies, brown leafhoppers, treehoppers, lacewings, and weevils (Kiser and Elliott 1996, Murray and Kurta 2002, Whitaker 2004).

Some scientists believe that their population is declining today due to pesticide use, possibly through eating contaminated insects, drinking contaminated water, or absorbing the chemicals while feeding in areas that have been recently treated with pesticides (Mohr 1953, Schmidt et al. 2002, USFWS 2007, http://www.fws.gov/midwest/endangered/mammals/inba/inbafctsht.html).

Predation

Feral cats are potential predators within their hibernacula. They are also killed by natural predators such as snakes, owls, hawks, opossums, minks, and raccoons. They can also die from natural disasters such as flooding of caves, collapse in caves and mines, freezing in winter, climate and weather changes, and summer habitat deforestation.

Winter Hibernation

In southern Indiana, winter hibernation in caves and mines generally occurs as late as November or December to as early as mid-March. Hall (1962) and LaVal and LaVal (1980) report hibernation typically from October to April, while Kurta et al. (1997) and Hicks (2004) extend hibernation from September to May in northern areas including New York, Vermont and Michigan (USFWS 2007).

In 2005, 30 percent of the population was considered to hibernate in man-made hibernacula (i.e., mines, tunnels, dams) (USFWS unpublished data 2006). Caves used by Indiana bats are well ventilated (usually have a chimney effect), and store large volumes of cool air with constant temperatures between 3°C to 7.2°C (37.4°F to 45°F) (Tuttle and Kennedy 2002). Brack et al. (2003) observed that in hibernacula in Indiana the highest concentrations of Indiana bats were found at sites with mid-winter temperatures of 6°C to 7°C (42.8°to 44.6°F). The Indiana bat is very sensitive to temperature changes and do not use caves that flood. They prefer caves that have domes, caverns, and diversity in form.

Hibernating bats form large, compact clusters with as many as 5,000 individuals, but averaging 500 to 1,000 bats per cluster (USFWS 2004). Pennsylvania Natural Heritage reported clusters with 250 per square foot (http://www.naturalheritage.state.pa.us/factsheets/11449.pdf), while the New York Department of Environmental Conservation (http://www.dec.ny.gov/animals/6972.htmlreports) reported more than 300/square foot. Several researchers have noted an inverse relationship between ambient roost temperature and the size of hibernating clusters (Clawson et al. 1980, Brack et al. 1984) as reported in USFWS (2007).

Bats go into deep hibernation (torpor) in winter, but have the ability to arouse very quickly which may be an adaptive mechanism for survival. During the hibernation period, bats arouse about once every two weeks or so and stay aroused for a short time period of 1-2 hours (Reeder et al. 2012). Cumulative arousals throughout hibernation cause much of their stored fat energy to be metabolized and lost to the individual. The function of the arousal is not known for sure, but it may be to drink, to exercise, or to get rid of some waste products. Arousal is not to feed though.

Disturbances in the winter can be deleterious. Awaking these bats can use up their fat reserves. For this reason, gates at the entrance or fences around these caves have been used as conservation measures. When huddled together (clustered), individuals on the perimeter of the group are more susceptible to

freezing that those in the middle of the mass. Caves are most important in the survival of this species. During hibernation, bats cluster in large groups and some winter hibernacula may support from 20,000 to 50,000 or more bats.

Spring Staging

Spring staging generally occurs from mid-March to mid-May when males and females emerge from caves. They are hungry and thin after three to four or more months of hibernation. Indiana bats feed and congregate around these caves before migrating to their summer homes. Males usually stay near the hibernacula, but may leave the area entirely (USFWS 2007). Indiana bats have been found to migrate 64 to 80 km (40 or 50 miles) a day with total distances of several hundred kilometers. One female released in southeastern New York moved 56 kilometers (35 miles) in approximately 85 minutes (Sanders et al. 2001), while one female bat released from Canoe Creek Mine in Pennsylvania traveled approximately 96 kilometers (60 miles) in one evening (USFWS 2007) as reported by C. Butchkoski in 2005. Twelve female Indiana bats from maternity colonies in Michigan migrated an average of 476 kilometers (296 miles) to their hibernacula in Indiana and Kentucky, with a maximum migration of 574 kilometers (357 miles) (Winhold and Kurta 2006). Females usually migrate further than males.

The females (as in other bats) show delayed fertilization, that is, they mate with males in the fall, and store sperm alive in pouches connected to the uterus. Upon an egg moving down into the uterus, sperm are discharged from these pockets and fertilize the egg. The fertilized egg (embryo) then implants itself into the uterus. When females leave the cave, they are pregnant and on a mission to start a new generation in their summer home.

Summer Habitat

Indiana bats occupy summer habitat from mid-May to mid-August. Females and males arrive at their summer habitat (home) in May. Summer roosting sites include primarily dead trees with cavities and/or exfoliating bark or living trees with shaggy bark (e.g., shagbark hickory). Larger trees are usually preferred over smaller trees where there is an ample amount of solar radiation, and protection from the wind and rain. Numerous studies indicate that Indiana bats exhibit site fidelity to their traditional summer maternity areas (Humphrey et al. 1977, Gardner et al. 1991a, 1991b, Gardner et al. 1996, Callahan et al. 1997, Whitaker and Sparks 2003, Whitaker et al. 2004).

These nursery colonies often use several roost trees. Roost trees may be primary roost trees (emergence count ≥ 30 bats) or alternate roost trees (emergence count < 30 bats). Ideal primary roost trees are large trees with sloughing bark in the sun where they secure themselves under the bark, in crevices or cavities during the day. While at night, they are active feeding on insects and use the underside of bridges on occasion as night roosts (Kiser et al. 2002). The majority of summer maternity colonies are in large dead or live trees near major streams in both bottomland and upland areas.

A maternity colony can vary greatly in size (USFWS 2007), but typically consists of 25 to 325 adult females (average is 80 adult females per Whitaker and Brack 2002). Although most documented maternity colonies contained 100 or fewer adult females (Harvey 2002), as many as 384 bats have been reported emerging from one maternity roost tree in Indiana (Whitaker and Brack 2002).

Young are born between late June and early July. This process is called parturition and the adult females are lactating (producing milk) at that time. Females do not carry the young unless they need to move

them, and under such conditions, they will carry them on their abdomen. The young become volant (able to fly) between early July and early August at which time the adult females become non-reproductive. Most young are volant by mid-July. Males may form bachelor colonies during the summer.

Fall Swarming

Fall swarming generally occurs mid-August to November. With the onset of fall and cooler temperatures, males return to the caves. They are at the entrances to the caves when the females and young arrive. Hormones run high and males mate with females. Swarming is a milling of the bats around and out of the cave entrance. It may have several functions, but one seems to bring the sexes together for mating. It is not known if juvenile females mate their first autumn. Limited mating may occur in the spring, and in the cave in winter (Hall 1962).

Members of both sexes feed and gain weight through the fall, thus putting on fat (energy) needed to help them through hibernation. LaVal and LaVal (1980) found females to reach maximum weight in early October, while the males reached maximum weight in late October. The males follow the females into hibernation, and both sexes stay in the cave when outside temperatures trend towards freezing.

Cumulative Impacts

Cumulative impacts resulting from human disturbances at winter hibernacula, summer and winter habitat loss, wind farm fatalities and white nose syndrome (WNS) are threats to the species and chief factors for population declines. However, in recent years WNS and wind farms are considered the primary causes of death for Indiana bats (Boyles *et al.* 2011).

WNS is a disease caused by the cold-loving fungus *Pseudogymnoascus destructans (formerly called Geomyces destructans),* that affects bats during winter hibernation. It was first reported in 2006 from New York. Since then, the USFWS estimates that at least 5.7 million to 6.7 million bats have died from WNS (http://www.batcon.org/pdfs/USFWS_WNS_Mortality_2012_NR_FINAL.pdf). The disease originally spread south along the Appalachian Mountains and north into Canada, and then westward into Tennessee, Missouri and Iowa in the south; and Canada in the north. WNS was first reported in Indiana in January 2011.

It takes some time for the fungus to attach to the skin of the bat, but once embedded into the epidermis; it causes open sores (lesions) in the epidermis and dermis in especially bare areas like the nose, forearms and wings. If the bat survives, such lesions heal as scars. The fungus grows around 4°C to 20°C (39.2°F to 68.0°F) (https://en.wikipedia.org/wiki/Pseudogymnoascus_destructans). The upper critical temperature for growth is between 19°C and 19.8°C (66.2°F and 67.6°F) with temperatures above 12°C (53.6°F) displaying atypical morphology in the fungus that may have implications its proliferation (Verant et al. 2012).

Bats usually come into hibernation with extra grams of fat, of which, much of this fat are used in arousals. The remaining grams of fat in the bat are needed to sustain it through the duration of hibernation. Fungal lesions caused by *Pseudogymnoascus destructans* cause the bat to become more active and waste critical energy reserves. When this happens, bats may leave the cave in winter in search of food, and ultimately die in or out of the cave from starvation. This is one theory for the many deaths from WNS.

Wind farms (as becoming more prevalent in the landscape) are also reported to kill many bats. The majority of such losses affect bats that migrate long distances such as the hoary bat, eastern red bat, and silver haired bat. However, an Indiana bat was killed in a wind farm in Benton County, Indiana. Bats that die from WNS and wind farms may lower the Indiana bat population.

Boyles *et al.* (2011) reported that the loss of some 1 million bats equates to about 660 to 1,320 metric tons of insects that would not be consumed each year in WNS-affected areas. Farmers would need to offset such losses with investing more money to control insect infestations. It is reported that from $3.7 billion/year to $53.0 billion/year ($22.9 billion/year average) would be needed to control unwanted agricultural insect pests. This equates to a most likely scenario of $74/acre that the farmer would need to spend on pesticides.

NORTHERN LONG-EARED BAT

Status

The northern long-eared bat (*Myotis septentionalis*) was first recognized as a distinct species instead of a subspecies of Keen's long-eared myotis (*Myotis keenii*) by van Zyll de Jong in 1979 based on geographic separation and morphologyical characteristics (78 FR 61051). On October 2, 2013 the USFWS published a proposed rule (78 FR 61046) to list the northern long-eared bat as endangered. Subsequently, a proposed species-specific rule under Section 4(d) of the Act was published on January 15, 2015 (80 FR 2371) to list the species as threatened. On 2 April 2015 the USFWS published the final rule listing the species as threatened with an Interim 4(d) Rule (80 FR 17974). The listing became effective on 4 May 2015.

Morphological Description

It is a medium sized bat, the most distinguishing character of which is its long ear and long, narrow, pointed tragus (Whitaker *et al.* no date; Kurta 1995). Fur is typically light to dark brown with a yellowish venter. Size and weight are generally consistent with the little brown and Indiana bat, although the northern long-eared bat tends to be slightly smaller on average (Kurta 1995).

Range and Distribution

The species range includes eastern and north-central United States, as well as all Canadian provinces west to the southern Yukon Territory and eastern British Columbia. Specifically, in the United States it includes 39 states from Maine west to Montana, south to eastern Kansas, eastern Oklahoma, Arkansas, and east to northern Florida. In the U.S., it was more commonly observed in the northeastern portion of its range than in the southern and western regions (Caceres and Barclay 2000; Amelon and Burhans 2006). Within this range, more than 780 hibernacula have been identified from 27 states, more than 60% of which are in Pennsylvania, Missouri, West Virginia, Michigan and Kentucky (Whitaker and Hamilton 1998). Twenty-five hibernacula have been documented in Indiana (80 FR 17974).

The U.S. range has been divided into four populations (eastern, midwest, southern and western), although these are not considered isolated populations from each other (78 FR 61052). It is less common in the southern and western portions of the range, but is fairly common within the Midwest population (Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio and Wisconsin). Although Indiana has fewer known hibernacula than most of the other states that comprise the Midwest

population, it has historically been considered the fourth or fifth most abundant species statewide, and most frequently captured at mine entrances. A USFWS comparison of a three year survey conducted in northern Indiana where only 4 percent of the captures were northern long-eared bats versus a three summer survey in south-central Indiana where 38 percent of the captures were northern long-eared bats suggest that habitat abundance or other environmental conditions are more favorable in the southern portion of the state. Range-wide or Indiana population estimates have not currently been generated by the USFWS.

Feeding

The northern long-eared bat has a diverse diet including moths, flies, leafhoppers, caddisflies, spiders and beetles with diet composition differing geographically and seasonally (Brack and Whitaker 2001). The most common insects found in the diets of northern long-eared bats are moths and beetles (Feldhamer *et al.* 2009; Brack and Whitaker 2001) with spiders also being a common prey item (Feldhamer *et al.* 2009). Foraging techniques include hawking (catching insects in flight) and gleaning (picking insects off stationary features such as leaves or branches) in conjunction with passive acoustic cues (Nagorsen and Brigham 1993; Ratcliffe and Dawson 2003). Present in their feces are spiders, other non-flying insects, and green plant material suggest considerable gleaning behavior. The northern long-eared bat has a very high frequency call. Gleaning allows this species to gain a foraging advantage for preying upon moths because moths are less able to detect high frequency echolocation calls (Faure *et al.* 1993). Emerging at dusk, most hunting occurs above the understory, 3 to 10 feet about the ground, but under the canopy (Nagorsen and Brigham 1993) on forested hillsides and ridges, rather than along riparian areas (Brack and Whitaker 2001; LaVal *et al.* 1977). This coincides with data indicating that mature forests are important habitat for foraging in this species (Caceres and Pybus 1998).

Winter Hibernation

Caves and mines are used by the northern long-eared bat in winter. Hibernacula used are typically large, with large passages and entrances, relatively constant and cooler temperatures, and with high humidity and no air currents. The sites favored by them are often in very high humidity areas to such a large degree that droplets of water are often observed on their fur. They are typically found roosting in small crevices or cracks in cave or mine walls and can often be overlooked in surveys. To a lesser extent, they have been found overwintering in habitats that resemble caves or mines, such as abandoned railroad tunnels, storm sewer (Goehring 1954), hydro-electric dam (Kurta and Teramino 1994), aqueduct (French 2012 unpublished data) or other "unsuspected retreats" where caves and mines are not present. Northern long-eared bats have shown a high degree of philopatry (using the same site multiple years) for a hibernaculum. Other species in Indiana that commonly occupy the same hibernacula with the northern long-eared bat are the little brown bat, big brown bat, tri-colored bat, and Indiana bat. Northern long-eared bats often move between hibernacula throughout the winter, which may further decrease population estimates. Similarly, this species has been found to fly in and out of some of the mines and caves in southern Indiana throughout the winter (Whitaker and Mumford 2009).

Spring Staging

Both males and females emerge from caves and mines in spring. Northern long-eared bats exhibit significant weight loss during hibernation. One Indiana study showed a 41-43 % loss (Whitaker and Hamilton 1998). During staging, northern long-eared bats are flying in and out of caves to feed and congregate around these caves before migrating to their summer homes. The northern long-eared bat is not considered a long-distance migratory species. Short migratory movements between summer roost

and winter hibernacula are typically between 35 to 55 miles (Nagorsen and Brigham 1993; Griffin 1945). However, movements may range from 5 to 168 miles (Griffin 1945). When females leave the cave, they are pregnant and on a mission to start a new generation in their summer home. Gestation is approximately 60 days (van Zyll de Jong 1985). Males are reproductively inactive until late July, with testes descending in most males during August and September (Caire *et al.* 1979; Amelon and Burhans 2006).

Summer Habitat

During the summer, northern long-eared bats typically roost singly or in colonies underneath bark or in cavities or crevices of both live trees and snags. Males and non-reproductive females' summer roost sites may also include cooler locations, including caves and mines (Barbour and Davis 1969). They also have been found roosting in man-made structures, such as buildings, barns, a park pavilion, sheds, cabins, under eaves of buildings, behind window shutters, and in bat houses (Mumford and Cope 1964, Barbour and Davis 1969, Cope and Humphrey 1972; Amelon and Burhans 2006; Whitaker and Mumford 2009; Timpone *et al.* 2010; Joe Kath 2013 pers. comm.). This species appears to be somewhat opportunistic in roost selection. Canopy cover at northern long-eared bat roosts has ranged from 56% (Timpone *et al.* 2010) to greater than 84% (Lacki and Schwierjohann 2001). Females tend to roost in more open areas than males, likely due to the increased solar radiation, which aids in pup development (Perry and Thill 2007). Roosts are also largely selected below the canopy, which could be due to the species' ability to exploit roosts in cluttered environments; their gleaning behavior suggests an ability to easily maneuver around obstacles (Foster and Kurta 1999; Menzel *et al.* 2002). One study found that northern long-eared bats roost more often on upper and middle slopes than lower slopes, which suggests a preference for higher elevations due to increased solar heating (Lacki and Schwierjohann 2001). Northern long-eared bats switch roosts often (Sasse and Perkins 1996), typically every 2-3 days (Foster and Kurta 1999; Owen *et al.* 2002; Carter and Feldhamer 2005; Timpone *et al.* 2010). Reasons for switching may be temperature, precipitation, predation, parasitism, and ephemeral roost sites (Carter and Feldhamer 2005).

The northern long-eared bat is comparable to the Indiana bat in terms of summer roost selection, but appear to be more opportunistic (Carter and Feldhamer 2005; Timpone *et al.* 2010). Although northern long-eared bats are more opportunistic than Indiana bats, there may be a small amount of roost selection overlap between these two species (Foster and Kurta 1999; Timpone *et al.* 2010). Maternity colonies, consisting of females and young, are generally small, numbering from about 30 (Whitaker and Mumford 2009) to 60 individuals (Caceres and Barclay 2000). Adult females give birth to a single pup. Birth likely occurs in late May or early June (Caire et al 1979; Easteria 1968, Whitaker and Mumford 2009), but may occur as late as July (Whitaker and Mumford 2009). Juvenile volancy (flight) occurs by 21 days after birth (Krochmal and Sparks 2007; Kunz 1971). Adult longevity is estimated to be up to 18.5 years (Hall *et al.* 1957) with the greatest recorded age of 19 years (Kurta 1995).

Fall Swarming

With the onset of fall and cooler temperatures, males return to the caves. They are at the entrances when females and young arrive. Elevated hormone levels trigger males to mate with females. Hibernating females store sperm until spring, exhibiting delayed fertilization (amphigonia retardata). Swarming is a milling of the bats around and out of the cave entrance. This behavior may have several functions, but one seems to bring the sexes together for mating. Members of both sexes feed and gain weight through the fall, thus putting on fat (energy) to help them survive through hibernation. It is not

known if juvenile females mate their first autumn. Limited mating may occur in the cave in winter and may even occur in the spring. When temperatures are 50 degrees F or less, the bats start to stay inside the cave.

Cumulative Impacts

Under Section 4(a)(1) of Act (16 U.S.C. 1533) and its implementing regulations at 50 CFR part 424, USFWS has the authority to list a species based on any of the following 5 factors: (A) present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence. No other threat is as severe and immediate to the northern long-eared bat's persistence as WNS, although habitat loss continues to be a contributing factor and a potential limiting factor in its potential for recovery.

EVENING BAT

Status

The evening bat (*Nyctesius humeralis*) was described by Rafinesque in 1818. It is considered a species of "least concern" by the IUCN, but is currently listed as endangered by the Indiana DNR under IC 14-22-34.

Morphological Description

A small bat with blackish (juvenile) to bronze-brown (adult) fur often greasy in appearance that is best differentiated from other myotis bats by its shorter, rounded tragi and shorter ears (Mumford and Whitaker 1982). Additionally, the evening bat has a single pair of upper incisors compared to a double set for all other Indiana species except those of the *Lasiurus* genus (Kurta 1995; Menzel *et al.* 2002) and uniform size molariform teeth behind the canines (Whitaker *et al.* undated). Wing and tail membranes are hairless with total length ranges from 86 to 103 mm and weight ranges from 6 to 12 grams (Kurta 1995).

Range and Distribution

Evening bat range is the eastern United States extending north to Nebraska, Iowa, southern Michigan, Pennsylvania, New Jersey, west to Kansas, eastern Texas, south to the Gulf Coast and along the mid-Atlantic Coast (Kurta 1995). In Indiana, it is currently considered to be restricted more to the southern portion of the state. From records of Cope *et al.* (1961), Humphrey and Cope (1970), and Whitaker and Gummer (1993), the known pre-1990s distribution of the species included southeast Indiana (Orange, Washington and Clark counties), west-central (Clay County) and north-central (Montgomery, Tippecanoe, Clinton, Carroll, White and Cass counties). Records from the 1993 suggest that evening bats appear to be closely associated with the lower Wabash and White Rivers (Whitaker and Gummer, 2003), particularly the Prairie Creek area of Vigo County.

Feeding

Evening bat diet generally consists of beetles (particularly chrysomelid beetle or spotted cucumber beetle), moths, flies, leafhoppers and true bugs (Kurta 1995; Feldhamer *et al.* 1995)). A colony of 100 evening bats is estimated to consume 1.25 million insects in a season (Kurta 1995), thus providing a notable contribution to pest insect control.

Summer Habitat

Typically, females form maternity colonies in buildings and tree hollows from late April to early May (Whitaker and Gummer 2003, Whitaker *et al.* undated). Males usually remain in the southern portion of the range and do not migrate much to the north (Kurta 1995), as such females and juveniles are more likely to occur in Indiana that males. Parturition within a colony (two or sometimes three pups) occurs within a period of roughly six days in June (Kurta 1995) although births have been reported in July (Whitaker *et al.* undated). Boyles and Robbins (2006) noted from a yearlong survey in Missouri that maternity colonies were only occupied for a ten day period in mid-June 2003. By July, volant males leave the colony and disperse, while juvenile females remain at the colony roost to forage and continue nursing with their mother (Whitaker *et al.* undated). From capture data available as of 2003, Whitaker and Gummer (2003) concluded that maternity colonies were present in at least five counties (Vigo, Sullivan, Posey, Hendricks and Bartholomew).

Although they occupy man-made buildings, evening bats generally inhabit rural landscapes where they forage at open field, agricultural fields and within woodlands (Whitaker *et al.* undated). However, Whitaker and Gummer (2003) noted that from mist net surveys conducted from 1994 to 1999 in Indiana, evening bats were predominantly captured in bottomland woods which lacked development (i.e., structures) and that within Prairie Creek in Vigo County, evening bats were tracked to hollows in silver maple trees. It is not uncommon for evening bats to move from tree to tree, with some trees harboring large numbers and others just a few individuals. Boyles and Robbins (2006) identified eight different species of trees used as roosts by evening bats; however, 88 percent (30 of the 34 roosts) were oak species. Also, they tended to prefer trees in more advanced stages of decay than live or recently dying trees.

Winter Hibernation

Fall migration southward begins around mid-October in Indiana and has been documented to cover as much as 547 km, or 340 miles (Whitaker *et al.* undated). In the winter, they migrate to areas between Arkansas and South Carolina (Kurta 1995) where they likely hibernate in hollow trees, but apparently don't use caves for hibernacula (Whitaker *et al.* undated). It has also been suggested that evening bats summering in "middle latitudes" may not migrate south (Boyles and Robbins 2006). Whitaker and Gummer (2003) surmised that they do not hibernate in Indiana and likely reside in trees associated with large rivers south of the state. Boyles and Robbins (2006) captured both males and females during the winter in south-central Missouri and tracked them to oak roosts (primarily white oaks and post oaks) in the same areas, but not the same trees as roosting was observed in the summer.

Cumulative Impacts

Threats to the evening bat include natural predators, principally cats, as well as snakes, raccoons, owls and hawks (Kurta 1995). As with other bats in Indiana, habitat loss is also likely a contributing limiting factor to population size. White nose syndrome has not yet been detected in evening bats.

PREVIOUS STUDIES

Tier 1 NEPA Phase Monitoring

There have been two previous I-69 Tier 1 NEPA Phase bat studies conducted within Section 6 in 2004 and 2005.

- Hendricks, William D. et al. (15 December 2004) – Summer habitat for the Indiana bat (*Myotis sodalis*) within the Martinsville Hills from Martinsville to Indianapolis, Indiana.
- Henry et al. (27 February 2006) – Identification of Indiana bat roost trees along the proposed Interstate 69 between Bloomington and Indianapolis, Indiana.

In 2004, 29 sites were mist net surveyed for two nights at each location between 12 July and in accordance with the USFWS Mist Netting Guidelines active at that time. A total of ten Indiana bats from eight survey sites (27% of sites surveyed) and 21 northern long-eared bats from eleven survey sites (38% of sites surveyed) were captured. Indiana bat captures included four reproductive females, one non-reproductive male and five juveniles (male = 3, female = 2). Radio transmitters were attached to four adult female and one juvenile female Indiana bats for the purposes of tracking to individual or multiple summer roost trees. Three of the five bats were tracked to four different roost trees along the [redacted] and within the [redacted] Roost counts from a dead ash snag and a power pole were in excess of 60 individuals/night from multiple counts suggesting these were likely primary roosts for a local colony. Northern long-eared bat captures included two adult reproductive females, one adult non-reproductive female, twelve adult males, and six juveniles (males = 3, females = 3). Because the 2004 survey pre-dates the USFWS listing of this species as threatened, no radio telemetry and roost tree identification was conducted. From 18 bridge inspections, bats were observed roosting at two bridges across [redacted] although no Indiana bats or northern long-eared bats were found. Mist netting was supplemented with AnaBat II detector acoustic data collection at six of the 29 locations, but no automated program analysis or manual hand vetting for species identification was conducted.

In 2005, seven of the 29 sites surveyed in 2004 were revisited from 12 July to 19 July to generate additional data on Indiana bat roost trees within the Section 6 portion of the [redacted] corridor. A total of three Indiana bats (all reproductive females) from three different mist net sites were captured and fitted with radio transmitters. Each bat was tracked to two different roosts within the [redacted] floodplain. Only one of the six roost trees yielded nightly emergence counts greater than 10 bats/night. From five nights of observations, exit counts at this roost ranged from 29 to 52 bats per night, thus it was either an alternative roost or a low count primary roost. A total of six northern long-eared bat captures included an adult reproductive female, an adult male and four juvenile females. Again, no telemetry or roost tree identification was conducted on this species since this survey pre-dated USFWS listing. Acoustic data collection was not a part of the scope for this survey.

MATERNITY COLONIES

Indiana Bat

Capture and roost tree emergence count data from the 2004 and 2005 surveys for the entire I-69 length was utilized by the USFWS to define twelve maternity colonies along the Tier 1 corridor. As a result of continuing monitoring surveys in 2010, a thirteenth colony was defined within Section 4 of the project between [redacted] and [redacted] Three of these 13 Indiana bat 2.5 mile radius maternity colonies are located within Section 6.

- West Fork White River / Clear Creek colony: Determined by the centroid of three 2004 and 2005 roost locations associated with the [redacted] and [redacted] approximately [redacted] of [redacted] There is a small amount of overlap with the adjacent West Fork White River / Crooked Creek colony.
- West Fork White River / Crooked Creek colony: Determined by a pair of 2004 maternity roosts (utility pole and shagbark hickory) immediately west of the [redacted] approximately [redacted] of [redacted] There is a small amount of overlap with the adjacent West Fork White River / Clear Creek colony.
- West Fork White River / Pleasant Run Creek colony: Determined by the centroid of multiple 2004 capture locations associated with the [redacted] to the [redacted] of [redacted] and approximately [redacted] southwest of the [redacted] interchange.

Northern Long-Eared Bat

Since the northern long-eared bat was not listed as threatened (4(d) rule) until 2 April 2015, it was not within the scope of the 2004 and 2005 surveys performed in Section 6 to conduct radio telemetry, roost tree identification and emergence count surveys for the purposes of defining maternity colonies for the species. However, as part of Conferencing coordination with the USFWS during development of the Tier 1 Biological Assessment addendum for the northern long-eared bat the Bloomington Field Office staff utilized capture data from the 29 survey sites in 2004 and 2005 to define four 1.5 mile radius maternity colonies within Section 6. Two of these are located in the [redacted] half of the survey area and two are located in the [redacted] half.

- Clear Creek East Fork: Determined by the centroid from captures of a post-lactating female, and five juveniles at Site 6 in 2004 and a juvenile female at Site 7 in 2005 associated with [redacted] and [redacted] approximately [redacted] northeast of [redacted] There is approximately 20 percent overlay with the adjacent White River colony.
- White River: Determined by the capture of two juvenile females at Site 10 in 2004 immediately adjacent to the [redacted] approximately [redacted] northeast of [redacted] There is approximately 20 percent overlay with the adjacent Clear Creek East Fork colony.
- White River / Goose Creek: Determined by the centroid from captures of a post-lactating female at Site 20 in 2004 and a lactating female at Site 19 in 2005 associated with the [redacted] in the vicinity of the [redacted] confluence approximately [redacted] southwest of the [redacted] interchange. The [redacted] radius boundary of this colony abuts, but does not overlap, the Pleasant Run colony limits to the north.

- Pleasant Run: Determined by the centroid from captures of a juvenile male at Site 25 in 2004 and a non-reproductive female at Site 23 2005 associated with the [redacted] in the vicinity of the [redacted] confluence approximately [redacted] southwest of the [redacted] interchange. The [redacted] radius boundary of this colony abuts, but does not overlap, the Pleasant Run colony limits to the north.

REPRESENATIVE ALIGNMENT HABITAT ASSESSMENT AND MIST NETTING SITE SELECTION

Section 6 of the Tier 1 I-69 corridor begins [redacted] of [redacted] on [redacted] just south of [redacted] in [redacted] County, proceeds north along [redacted] through [redacted] and [redacted] counties and ends at [redacted] on the [redacted] side of [redacted] The total length of the Section 6 corridor is approximately [redacted] As per the 2015 Range-Wide Indiana Bat Summer Survey Guidelines (April 2015) for the applicable Midwest Recovery Unit, the number of net nights required for the 2015 Section 6 Phase 2 presence/absence survey was based on a minimum of 4 net nights per km (0.6 mile) of suitable summer habitat. The cumulative linear distance of suitable summer habitat for Section 6 was determined using the "representative alignment" for Section 6 and the "Tier 2 forest GIS data". The representative alignment for Section 6 has the footprint for the alternative with the largest Tier 2 forest impacts, among those alternatives that were still under consideration as of November 14, 2005. The Tier 2 forest GIS data was created through photo interpretation of the best available aerial photographs and supplemented by field reconnaissance.

An analysis of available summer habitat (i.e., forested tracts) within and immediately adjacent to either side of the representative alignment right-of-way for Section 6 indicated that approximately [redacted] of forested land use along this linear corridor supports potential Indiana bat and northern long-eared bat habitat. The majority of this potential habitat was located between [redacted] and [redacted], and from [redacted] to [redacted] As such, a minimum of 76 net nights of survey effort was required to satisfy the USFWS criteria. To keep the survey scheme similar to Sections 1 through 5, it was decided that a total of 19 sites, each consisting of two nets surveyed for two nights, would be selected for a total of 76 net nights.

The 29 sites in Section 6 surveyed in 2004 (Hendricks, William D. et al., 2004) and 2005 (Henry et al., 2006) as part of the Tier 1 study were used as the initial base for the 2015 Tier 2 site selection survey. Fourteen of these sites yielded Indiana and or northern long-eared bat captures in 2004-2005 and were therefore given priority consideration as candidate sites for 2015; however, two of these sites were more than [redacted] from [redacted] and deemed to be too far removed from the representative alignment for consideration. The remaining seven sites consisted of three sites surveyed sites in 2004 that did not yield either Indiana bats or northern long-eared bats but exhibited quality habitat characteristics and good capture potential. Additionally, four new locations associated with the [redacted] and [redacted] were selected to fill in gaps along the corridor where smaller areas of potential habitat occur. The proposed survey sites were identified in the study plan submitted to the USFWS (Bloomington Field Office) on 28 June 2015 and approved on 29 June 2015. Appendix A, Figure 1 provides the location of the sites.

METHODOLOGY

Lochmueller Group, Inc. and Environmental Solutions and Innovations, Inc. completed the field survey in Section 6 under Federal Endangered Species Permit TE06845-A3 (Lochmueller Group) and TE02373A-6 (Environmental Solutions and Innovations, Inc.) State of Indiana Department of Natural Resources Permits issued to Mr. Rusty Yeager (15-046), Dr. Thomas Cervone (15-047), Jason Damm (15-141) and Kory Armstrong (15-151).

Property owner permission to access and conduct the mist net survey at each of the nineteen sites was obtained via phone or personal contact prior to conducting the investigation. Additionally, local law enforcement was notified of the survey dates prior to commencing each night's activity. In the event that the use of radio-telemetry was required to track an Indiana bat or northern long-eared bat fitted with a transmitter to roosts on other properties, all efforts were made to contact the relevant property owners prior to entry.

Mist Netting

This survey was conducted in accordance with the Phase 2 Presence/Absence Surveys guidelines in the *2015 Range-Wide Indiana bat Summer Survey Guidelines*, April 2015 (USFWS, 2015). The mist netting guidelines are summarized in Appendix B. GPS coordinates for the nineteen sites are provided in Appendix C, Table 1. Mist net site locations are shown on USGS topographic maps relative to the I-69 Section 6 representative alignment in Appendix A, Figures 2A, 2B 2C and 2D. The locations for 15 of the 19 sites (Sites 3, 5, 6, 7, 8, 10, 13, 14, 17, 19, 20, 21, 23, 24, and 25) were generally in the same locations as when surveyed in 2004 and 2005. The four new sites were coordinated with and approved by USFWS BFO staff prior to initiation of the survey. Each site included two net sets and was surveyed for a minimum of two nights for a total of four minimum net nights each. Sites 6, 13, 25 and 33 were surveyed for an additional third night due to "rain outs" on either the first or second day of the survey. Sites were surveyed on the nights indicated on Appendix C, Table 2.

Decontamination of field equipment and measures to reduce the potential transfer of *Pseudogymnoascus destructans* was conducted in accordance with the National White-Nose Syndrome Decontamination Protocol –Version 06.25.2012 (Appendix B).

Habitat and meteorological conditions were documented for each mist netting site. Habitat assessment at net sites focused on features indicative of suitability for Indiana bats and northern long-eared bats. Temperature, percent cloud cover, wind, and rainfall were monitored and recorded approximately every half hour during the mist netting effort to insure compliance with weather conditions outlined in the netting guidelines. Appendix C, Table 2 includes temperature ranges for each site for each night. Bat capture data sheets for each site are included in Appendix D.

All captured bats were identified to species using a combination of morphological and meristic characteristics (e.g., ear and tragus, calcar, pelage, size/weight, length of right forearm, and overall appearance of the animal). The species, sex, reproductive condition, age, weight, length of right forearm, and time and location/net site of capture were recorded for all bats. Age (adult or juvenile) of bats is determined by examining epiphyseal discs of long bones in the wing. Weight was measured to 0.25 gram using a Pesola® 30g spring scale. Length of the right forearm of each bat was estimated to the

nearest 1.0 mm (0.04 inch) using either calipers or metric rule. The reproductive condition of captured bats was classified as non-descended male, descended male, non-reproductive female, pregnant female (based on gentle abdominal palpation), lactating female, or post-lactating female. Additionally, wing damage was assessed in accordance with the "Wing-Damage Index for Characterizing Wing Condition of Bats Affected by White-nose Syndrome" (Reichard, 2008) by examining wing membranes, uropatagium and forearms with direct light and translumination. A score of "0" indicates no damage, while a score of "3" means heavy damage involving tissue necrosis, holes in wing membranes, and/or receding plagiopatagium or chiropatagium. A suffix "P" is used for conditions in which physical damage not associated with splotching or necrotic tissue are observed. Wing damage noted and scored is not however necessarily the result of WNS.

Bats were not banded as part of this survey. Bat processing and data collection was typically completed within 30 minutes of the time the bat was removed from the net. If two or more bats were captured at similar times, they were carefully placed in paper sacks for temporary containment until such time that they could be processed and released. Storage sacks were used only once and disposed of as a WNS transmission prevention measure. Captured bats were marked with a small dab of white correction fluid prior to release in order to document any recaptures.

Radio-telemetry

When warranted, radio-telemetry was conducted in accordance with guidelines provided by USFWS in Appendix B. Indiana bats and northern long-eared bats which were captured and suitable for radio-telemetry use were to be fitted with a Holohil Systems Ltd. LB-2N radio-transmitter weighing approximately 0.36 grams (0.01 ounce). The transmitter would be activated and tested at the manufacturer's designated frequency before attachment to the bat. A small inter-scapular area would be trimmed of fur and the transmitter would be attached to this area with non-toxic Torbot Group, Inc. bonding cement. This cement degrades over time allowing the transmitter to eventually become detached from the bat. Transmitter weight, weight of the bat before and after transmitter attachment, and holding time were recorded. Radio-transmitters were not placed on bats where the weight of the transmitter exceeded 10 percent of the bats weight.

The decision to place transmitters on captured Indiana bats or northern long-eared bats is summarized as follows:

- The first adult female or juvenile male/female captured at any site (1st or 2nd night) received a transmitter.
- A second adult female or juvenile male/female captured at any site on the 1st night would not receive a transmitter.
- A second adult female or juvenile male/female captured at any site on the 2nd night can receive a transmitter at the discretion of the field crew if for instance the bat captured the previous night could not be tracked to a roost.
- If an adult male was captured on the 1st night, no transmitter was attached.
- If an adult male was captured on the 2nd night and no other female had been fitted with a transmitter, then the male can receive a transmitter.

On subsequent days following release, transmitter bats would be tracked to daylight roosts using a Wildlife Materials, Inc. TRX-2000S multiple band receiver equipped with a Wildlife Materials, Inc. three element folding Yagi directional antenna. When possible transmitted bats would be tracked to roosts for a minimum of seven days. Mobile telemetry would be performed by driving public roads and screening likely roost habitats within 4 km (2.5 miles) of the capture site to establish the general location of the transmitter signal, after which pedestrian tracking was employed to locate the specific roost. Mobile telemetry routes were tracked using either GPS or mobile telemetry data sheets (Appendix E).

Roost Emergence Counts

Evening emergence counts, if warranted, were conducted for each roost tree discovered through radio-telemetry tracking. Exit counts at roost trees would begin at sunset, and last approximately 1 hour or until bats quit emerging and/or darkness precluded accurate counting. Unless otherwise indicated, emergence counts at roost trees identified are to be conducted for a minimum of two nights. In instances where more than 30 bats are observed emerging, up to five nights of emergence counts are recommended. Roost tree characterization and habitat were documented for each tree identified by a transmitted bat.

Acoustic Data Collection and Analysis

This Phase 2 presence/absence survey has been based on mist netting techniques as per the 2015 Range-Wide Indiana Bat Guidelines; however, at the request of USFWS BFO, acoustic data was collected in the vicinity of each bat survey site on each night using Anabat II detectors. This data was not analyzed using approved automated software or via visual identification of call sequences. The acoustic files will be provided to USFWS along with those generated from the bat survey sites in Sections 1 through 5 of the I-69 survey area.

RESULTS

Section 6 Mist Net Survey Results Summary

The 2015 Section 6 survey included a total of 38 complete survey nights and four partial survey nights. "Cold out" conditions precluded completion of complete surveys on 15, 16, 17 and 18 May. "Rain out" conditions precluded completion of full survey nights at Sites 6, 13, 25 and 33 on 26 July, 14 July, 8 July and 20 July respectively. The 38 complete and four partial survey nights yielded a total of 126 bats representing seven species: 72 big brown bats, 24 evening bats, 18 eastern red bats, 4 little brown bats, 3 Indiana bats, 3 northern long-eared bats, and 1 tri-colored bat. One bat escaped from the net at Site 3 before it could be retrieved and identified. USFWS listed species included Indiana bat (endangered) captures at Site 3 and Site 21, and northern long-eared bat (threatened 4(d) rule) captures at Site 7 (West Fork Clear Creek), Site 13 (Stotts Creek) and Site 20 (Goose Creek). No gray bats (endangered) were captured. Additionally, Indiana state endangered bat species included the evening bat at seven different sites (Site 10, 14, 19, 20, 23, 30 and 31). Appendix C, Tables 3, 4 and 5 include capture data by species and reproductive condition for each net site. Big brown bats comprised 57.1 percent of those captured (excludes unidentified escapees), evening bats comprised 19.0 percent of those captured,

eastern red bats comprised 14.2 percent, while little brown, Indiana, northern long-eared and tri-colored bats comprised 8.7 percent.

Site 5 on [redacted] did not result in any bat captures on either night. Site 6 ([redacted] Site 7 ([redacted] Site 17 ([redacted]) and Site 24 ([redacted] only yielded a single bat for the two nights of survey at each location. The remaining sites yielded multiple captures on either one or both nights. Site 23 ([redacted] Site 31 ([redacted] Site 19 ([redacted]) and Site 20 ([redacted] and Site 3 ([redacted] yielded the greatest number of captures at 22, 16, 14, 13 and 11 bats respectively. Of the 15 sites from the 2004 survey that were resurveyed in 2015, only Sites 23 and 20 were among the top five most producing sites in both survey years.

Including data from partial survey nights, the mean number of bats captured per site was 6.6 and the mean number of bats per night was 3.0. The mean number of species per site was 2.3. The diversity index of MacArthur (D= $1/\sum P_i^2$, where P_i is the proportion of each species of bat for the survey population) for the 2015 survey is 2.6 (Appendix C, Table 10).

Age, gender and reproductive condition were determined for 113 of the 126 bats captured (Appendix C, Tables 3, 4 and 5). Thirteen bats escaped before age, gender and reproductive data could be collected and are therefore not included in this synopsis. Adults (n=64) accounted for 57 percent and juveniles (n=49) represented 43 percent of those captured between 3 July and 6 August. Females (n=84) accounted for 74 percent of the bats captured and 58 percent of these (n=49) displayed signs (pregnant, lactating or post lactating) of reproduction. Species that showed at least one reproductively active female included: big brown bat (n=35), evening bat (n=7), eastern red bat (n=4), little brown bat (n=1), northern long-eared bat (n=1), and tri-colored bat (n=1). Adult and juvenile male captures included the big brown bat (n=18), northern eastern red bat (n=6), northern long-eared bat (n=1) and evening bat (n=4).

Individual Mist Net Site Summaries

Habitat data sheets and bat capture data sheets for each site are included in Appendix D.

Site 3

This survey site is located on [redacted] of [redacted] Indiana downstream of the [redacted] on the [redacted] A 6 m X 4.5 m (19.7 ft. x 14.8 ft.) and a 12 x x 6.5 m (39.4 ft. x 21.3 ft.) mist nets were set up over the channel. The channel is approximately 10 m (32.8 ft.) wide with 0.2m (8 inches) of water depth. Dominant canopy species (>40 cm [16 inch] dbh) were sycamore *(Plantanus occidentalis)*, green ash *(Fraxinus pennsylvanica*), and sugar maple (*Acer saccharum)* with subdominant canopy (<40 cm [16 inch] dbh) of cottonwood and sugar maple. The canopy is closed along this reach of the stream. Within the immediate area, roost tree potential is considered moderate, consisting mostly of a few large snags with quality habitat features and scattered shagbark hickory (*Carya ovata*) trees.

Four net nights at this site yielded eleven individuals from two species: big brown bat (n=8), Indiana bat (n=2) and unknown escapee (n=1). The capture rate was 2.8 bats/net night. The juvenile female Indiana bat captured on 20 July at 2328 was fitted with a 150.306 megahertz frequency transmitter and

designated as bat 306. The juvenile female Indiana bat captured on 21 July at 0247 was fitted with a 150.936 megahertz frequency transmitter and designated as bat 936.

Site 5

This survey site is located on [redacted] of [redacted] Indiana [redacted] of the [redacted] on the [redacted] property. Two 9 m X 4.5 m (29.5 ft. x 14.8 ft.) mist nets were set up over the channel. The channel is approximately 11 m (36.1 ft.) wide with 0.1m (4 inches) of water depth. Dominant canopy species (>40 cm [16 inch] dbh) were red oak (*Quercus* rubra), sycamore, and sugar maple with subdominant canopy (<40 cm [16 inch] dbh) of black walnut (*Juglans nigra*), hackberry (*Celtis occidentalis*) and sugar maple. The canopy is closed along this reach of the stream. Within the immediate area, roost tree potential is considered moderate, consisting mostly of large trees and some snags.

Four net nights at this site yielded no bats. The capture rate was 0.0 bats/net night.

Site 6

This survey site is located on [redacted] of [redacted] Indiana upstream of the [redacted] A 9 m x 6.5 m (29.5 ft. x 21.3 ft.) mist net and a 6 m x 6.5 m (19.7 ft. x 21.3 ft.) mist net were set up over the channel. The channel is approximately 11 m (36.1 ft.) wide with 0.1m (4 inches) of water depth. Dominant canopy species (>40 cm [16 inch] dbh) were sycamore, and black walnut with subdominant canopy (<40 cm [16 inch] dbh) of sycamore, black walnut and boxelder. The canopy was moderately open and the subcanopy clutter was closed consisting of low branches of canopy trees. Within the immediate area, roost tree potential is considered moderate, consisting mostly of large trees and some snags.

Six net nights (4 complete and 2 partial) at this site yielded one bat: big brown bat (n=1). The capture rate was 0.2 bats/net night (including the partial net nights).

Site 7

This site is located on [redacted] of [redacted] and [redacted] of [redacted] A 9 m x 6.5 m (29.5 ft. x 21.3 ft.) mist net and a 6 m x 6.5 m (19.7 ft. x 21.3 ft.) mist net were set up over the channel. The channel is approximately 9 m (29.5 ft.) wide with 0.2 m (8 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were sycamore, black walnut and green ash with subdominant canopy (<40 cm [16 inch] dbh) composition of cottonwood, sycamore and sugar maple. The canopy closure was moderate and the subconopy clutter was moderate, consisting of mostly shrubs. Within the immediate area, roost tree potential is considered low, consisting of only a few tall dead snags.

Four net nights at this site yielded one individual: northern long-eared bat (n=1). The capture rate was 0.3 bats/net night. The juvenile female Indiana bat captured on 28 July at 2228 was fitted with a 150.028 megahertz frequency transmitter and designated as bat 028.

Site 8

This site is located on [redacted] approximately [redacted] above the confluence with the [redacted] adjacent to the [redacted] A 12 x x 6.5 m (39.4 ft. x 21.3 ft.) and a 9 m x 6.5 m (29.5 ft. x 21.3 ft.) mist net were set up over the channel. The channel is approximately 12 m (39.4 ft) wide with 0.2 m (8 inches) of water depth. Dominant canopy (>40 cm [16

inch] dbh) species were sycamore and silver maple (*Acer saccharinum*) with subdominant canopy (<40 cm [16 inch] dbh) composition of sycamore, black walnut and silver maple. The canopy closure was moderate and the subconopy clutter was moderate, consisting of mostly saplings. Within the immediate area, roost tree potential is considered high, consisting of large trees with quality habitat features and small dead snags.

Four net nights at this site yielded five individuals from two species: big brown bats (n=4) and eastern red bat (n=1). The capture rate was 1.3 bats/net night.

Site 10

This site is located on the confluence of an unnamed tributary with the [redacted] at the boat launch facility downstream of the [redacted] A 9 m x 6.5 m (29.5 ft. x 21.3 ft.) net was set up at the confluence of the small [redacted] with the [redacted] A 12 x x 6.5 m (39.4 ft. x 21.3 ft.) net was set up immediately [redacted] of [redacted] at the [redacted] end of an open water wetland. The channel is approximately 10 m (32.8 ft) wide with 0.15 m (6 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were eastern cottonwood, sycamore and green ash, with subdominant (<40 cm [16 inch] dbh) canopy composition green ash, sugarberry (*Celtis laevigata*) and boxelder. The canopy was moderately closed with an open subcanopy clutter consisting of only a few small saplings. Within the immediate area, roost tree probability is considered moderate, consisting mostly of large trees and scattered dead snags.

Four net nights at this site yielded two individuals from two species: big brown bat (n=1) and evening bat (n=1). The capture rate was 0.5 bats/net night.

Site 13

This site is located on adjacent to [redacted] of [redacted] and [redacted] and approximately [redacted] from the [redacted] with the [redacted] A 12 m X 7.8 m (39.4 ft. x 25.6 ft.) and a 6 m x 7.8 m (19.7 ft. x 25.6 ft.) net were set up across a driveway adjacent to [redacted] Dominant canopy (>40 cm [16 inch] dbh) species were sycamore, sugar maple, and ash species (*Fraxinus sp.*), with subdominant canopy (<40 cm [16 inch] dbh) composition of sugar maple, ash species, and sycamore. The canopy was moderately closed with moderate subcanopy clutter consisting of saplings, shrubs, and lower branches of canopy trees. Roost tree potential is low and limited to a few snags in the immediate vicinity.

Six net nights (4 complete and 2 partial) at this site yielded six individuals from three species: big brown bats (n=3), eastern red bats (n=2), and northern long-eared bat (n=1). The capture rate was 1.0 bats/net night (including the partial net nights). The juvenile male northern long-eared bat captured on 14 July at 2210 was not fitted with a transmitter because the 0.36 gram (0.01 ounce) transmitter was greater than 5 percent of the bats body weight.

Site 14

This site is located on [redacted] downstream of [redacted] of [redacted] Indiana. On 5 July a 12 m X 6 m (39.4 ft. x 19.7 ft.) net and a 9 m x 6 m (29.5 ft. x 19.7 ft.) net were set up across the channel immediately [redacted] and [redacted] of a [redacted] on an [redacted] On 6 July two 6 m x 6 m (19.7 ft. x 19.7 ft.) nets were set up across the abandoned road. The channel is approximately 12 m (39.4 ft.) wide with 1 m (3.3 ft.) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were

cottonwood and black walnut, with subdominant (<40 cm [16 inch] dbh) canopy composition of boxelder and Ohio buckeye (*Aesculus glabra*). The canopy was moderately closed with moderately open subcanopy clutter consisting of mostly saplings. Roost tree potential in the immediate vicinity is considered high consisting of large trees with quality habitat features and many snags.

Four net nights at this site yielded eight individuals from three species: big brown bats (n=6), eastern red bats (n=1), and evening bat (n=1). The capture rate was 2.0 bats/net night.

Site 17

This site is located on [redacted] of [redacted] of [redacted] Indiana. Two 9 m X 5.2 m (29.5 ft. x 17.0 ft.) nets were set up across the channel. The channel is approximately 8 m (26.2 ft.) wide with 20 cm (7.8 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were sycamore, ash species, and silver maple, with subdominant canopy (<40 cm [16 inch] dbh) composition of red elm (*Ulmus rubra)*, ash species, and black walnut. The canopy was moderately closed with moderate subcanopy clutter consisting of saplings, shrubs, and lower branches of canopy trees. Roost tree potential is low and limited to a few small snags in the immediate vicinity.

Four net nights at this site yielded one individuals from one species: big brown bat (n=1). The capture rate was 0.3 bats/net night.

Site 19

This site is located on [redacted] of [redacted] of [redacted] A 6 m X 6 m (19.7 ft. x 19.7 ft.) net was set up across the channel and a 9 m x 6 m (29.5 ft. x 19.7 ft.) net was set up across a dirt path adjacent to the creek. The channel is approximately 2 m (6.6 feet) wide with 15 cm (5.9 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were sugar maple and hackberry, with subdominant canopy (<40 cm [16 inch] dbh) composition of sugar maple and white ash (*Fraxinus americana)*. The canopy was moderately closed with moderate subcanopy clutter consisting of saplings, shrubs, and lower branches of canopy trees. Roost tree potential is considered moderate and consists of a few large trees and scattered small snags in the immediate vicinity.

Four net nights at this site yielded fourteen individuals from three species: big brown bats (n=9), evening bats (n=3), and eastern red bats (n=2). The capture rate was 3.5 bats/net night.

Site 20

This site is located on [redacted] of [redacted] and approximately [redacted] of the [redacted] with the [redacted] just [redacted] of [redacted] Indiana. Two 9 m x 7.8 m (29.5ft. x 25.6 ft.) nets were set up across the channel. The channel is approximately 9 m (29.5 ft.) wide with 50 cm (20 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were ash species, red elm, and silver maple, with subdominant canopy (<40 cm [16 inch] dbh) composition of ash species, mulberry species (*Morus sp.*), and silver maple. The canopy was moderately closed with moderate subcanopy clutter consisting of lower branches of canopy trees. Roost tree potential is considered low and consists of scattered small snags in the immediate vicinity.

Four net nights at this site yielded thirteen individuals from five species: big brown bats (n=7), evening bats (n=2), little brown bats (n=2), northern long-eared bat (n=1), and eastern red bat (n=1). The capture

rate was 3.3 bats/net night. The juvenile female Indiana bat captured on 2 August at 2350 was fitted with a 172.189 megahertz frequency transmitter and designated as bat 189.

Site 21

This site is located on a forested corridor adjacent to the [redacted] off of [redacted] Indiana. One 9 m x 7.8 m (29.5ft. x 25.6 ft.) net was set up at the edge of the corridor and one 12 m x 7.8 m (39.4 ft. x 25.6 ft.) net was set up in an open field adjacent to the [redacted] Dominant canopy (>40 cm [16 inch] dbh) species were hackberry, ash species, and black walnut, with subdominant canopy (<40 cm [16 inch] dbh) composition of mulberry species, ash species, and hackberry. The canopy was considered open with open subcanopy clutter consisting of lower branches of canopy trees. Roost tree potential is considered low and consists of scattered snags in the immediate vicinity.

Four net nights at this site yielded four individuals from two species: big brown bats (n=3) and Indiana bat (n=1). The capture rate was 1.0 bats/net night. The juvenile female Indiana bat captured on 25 July was fitted with a 172.283 megahertz frequency transmitter and designated as bat 283.

Site 23

This site is located on [redacted] near [redacted] of [redacted] Indiana. One 9 m x 7.8 m (29.5ft. x 25.6 ft.) net and one 12 m x 7.8 m (39.4 ft. x 25.6 ft.) net were set up across the channel. The channel is approximately 15 m (49 ft.) wide with 50 cm (20 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were silver maple and sycamore, with subdominant canopy (<40 cm [16 inch] dbh) composition of boxelder and sycamore. The canopy was moderately closed with open subcanopy clutter consisting of a few lower branches of canopy trees. Roost tree potential is considered moderate and consists of large tree and scattered small snags in the immediate vicinity.

Four net nights at this site yielded 22 individuals from three species: evening bats (n=12), big brown bats (n=9), and eastern red bat (n=1). The capture rate was 5.5 bats/net night.

Site 24

This site is located on [redacted] of [redacted] in [redacted] County south of [redacted] Indiana. Two 9 m x 7.8 m (29.5 ft. x 25.6 ft.) nets were set up across the channel. The channel is approximately 11 m (36 ft.) wide with 25 cm (10 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were ash species and sycamore, with subdominant canopy (<40 cm [16 inch] dbh) composition of ash species, black locust (*Robinia pseudoacacia*), and sycamore. The canopy was moderately closed with moderate subcanopy clutter of shrubs and lower branches of canopy trees. Roost tree potential is considered low and consists of a few large tree and scattered small snags in the immediate vicinity.

Four net nights at this site yielded one individual from one species: big brown bat (n=1). The capture rate was 0.3 bats/net night.

Site 25

This site is located on a trail immediately adjacent to the [redacted] north of [redacted] in [redacted] County [redacted] of [redacted] Indiana. A 9 m x 7.8 m (29.5ft. x 25.6 ft.) net and a 9 m x 5.2 m (29.5ft. x 17.1 ft.) net were set up on ATV trails in a bottomland forest adjacent to the [redacted] and a

matrix of oxbows, sloughs and quarry ponds associated with the [redacted] Dominant canopy (>40 cm [16 inch] dbh) species were cottonwood, red elm and silver maple with subdominant canopy (<40 cm [16 inch] dbh) composition of cottonwood, red elm and black walnut. The canopy was moderately closed with moderate subcanopy clutter consisting of shrubs and lower branches of canopy trees. Roost tree potential is considered moderate and consists of a few large trees with quality habitat features and small snags in the immediate vicinity.

Four net nights at this site yielded four individuals from one species: big brown bat (n=4). The capture rate was 1.0 bats/net night.

Site 30

This site is located on an unnamed tributary to the [redacted] approximately [redacted] from the [redacted] of [redacted] in [redacted] County. One 9 m x 7.8 m (29.5 ft. x 25.6 ft.) net and one 9 m x 7.8 m (29.5 ft. x 25.6 ft.) were set up across the channel upstream from the confluence between the tributary and the [redacted] The channel is approximately 7 m (23 ft.) wide with 75 cm (30 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were cottonwood, ash species and sycamore, with subdominant canopy (<40 cm [16 inch] dbh) composition of ash species, mulberry species, and silver maple. The canopy was moderately closed with moderate subcanopy clutter consisting of saplings and lower branches of canopy trees. Roost tree potential is considered moderate and consists of several large snags in the immediate vicinity.

Four net nights at this site yielded six individuals from three species: evening bats (n=3), big brown bats (n=2) and eastern red bat (n=1). The capture rate was 1.5 bats/net night.

Site 31

This site is located in a slough wetland [redacted] of [redacted] on [redacted] property [redacted] of [redacted] Indiana. One 12 m x 7.8 m (39.4 ft. x 25.6 ft.) net was set up across the slough and one 9 m x 7.8 m (29.5 ft. x 25.6 ft.) net was set up in a flyway across a farm lane adjacent to the slough. Dominant canopy (>40 cm [16 inch] dbh) species were silver maple, with subdominant canopy (<40 cm [16 inch] dbh) composition of silver maple, red elm, and mulberry species. The canopy was moderately closed with moderate subcanopy clutter consisting of saplings and lower branches of canopy trees. Roost tree potential is considered moderate and consists of medium-high quality snags in the slough.

Four net nights at this site yielded sixteen individuals from four species: big brown bats (n=6), eastern red bats (n=7), evening bats (n=2), and little brown bat (n=1). The capture rate was 4.0 bats/net night.

Site 32

This site is located on [redacted] approximately [redacted] from the [redacted] confluence, west of [redacted] in [redacted] Indiana. Two 9 m x 7.8 m (29.5 ft. x 25.6 ft.) nets were set up across the channel [redacted] from the [redacted] bridge. The channel is approximately 11 m (36 ft.) wide with 1 m (39 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were silver maple, honeylocust (*Gleditsia* triacanthos) and hackberry, with subdominant canopy (<40 cm [16 inch] dbh) composition of silver maple, hackberry, and sycamore. The canopy was moderately closed with closed subcanopy clutter consisting of dense saplings, shrubs, and lower branches of canopy trees. Roost tree potential is considered low with few large trees or quality snags in the immediate vicinity.

Four net nights at this site yielded five individuals from two species: big brown bats (n=4) and eastern red bat (n=1). The capture rate was 1.3 bats/net night.

Site 33

This site is located on [redacted] west of [redacted] in [redacted] County approximately [redacted] ([redacted]) south of [redacted] at [redacted] Indiana. Two 9 m x 7.8 m (29.5 ft. x 25.6 ft.) nets were set up across the channel downstream from the Belmont Avenue bridge. The channel is approximately 11 m (36 ft.) wide and was dry at the time of the survey. Dominant canopy (>40 cm [16 inch] dbh) species were silver maple, sycamore, and cottonwood, with subdominant canopy (<40 cm [16 inch] dbh) composition of ash species, sycamore and silver maple. The canopy was moderately closed with moderate subcanopy clutter consisting of saplings, shrubs, and lower branches of canopy trees. Roost tree potential is considered low with few large trees or quality snags in the immediate vicinity.

Four net nights at this site yielded four individuals from four species: big brown bat (n=1), tri-colored bat (n=1), little brown bat (n=1) and eastern red bat (n=1). The capture rate was 1.0 bats/net night.

Endangered Species, Radio-telemetry, Roost Tree Description and Emergence Count Results

Radio-telemetry data sheets are included in Appendix E. Roost tree habitat and emergence count data sheets are included in Appendix F.

Indiana bat

All three of the juvenile female Indiana bats captured (Site 3 n=2, Site 21 n=1) were fitted with radio transmitters (Table 6).

The female juvenile Indiana bat (Bat 306) captured at Site 3 on West Fork Clear Creek at the Indiana Department of Natural Resources (IDNR) Cikana Fish Hatchery on 20 July was tagged with a 150.306 MHz transmitter. Mobile telemetry for Bat 306 was attempted on 21, 24, 27 and 28 July along public roads within the local [redacted] and throughout the [redacted] property, but no signal was ever detected. The transmitter was functioning properly at the time of attachment and was transmitting a signal post-release through monitoring from the capture site.

The female juvenile Indiana bat (Bat 936) captured at Site 3 on West Fork Clear Creek at the IDNR Cikana Fish Hatchery on 21 July was tagged with a 150.936 MHz. Mobile telemetry for Bat 936 was conducted on 22, 23, 24, 27, 28 and 30 July along public roads within the local [redacted] and throughout the [redacted] property, but no signal was detected. The transmitter was functioning properly at the time of attachment and was transmitting a signal post-release through monitoring from the capture site.

The juvenile female Indiana bat (Bat 283) captured at Site 21 on the [redacted] side of the [redacted] on 25 July was tagged with a 172.283 MHz transmitter and tracked to Roost 283-1 on two consecutive days (26 and 27 July) and Roost 283-2 for five consecutive days (28 July through 1 August). Roost 283-1 is a partially dead (stage 6 decay) eastern cottonwood (*Populus deltoides*) with a 45 cm (18 inch) dbh. Emergence counts on 27 and 30 July were 13 and 7 respectively. Roost 283-2 is a dead eastern cottonwood with a 35 cm (14 inch) dbh. Emergence counts on 28 and 29 July were 30 and 38

respectively (Table 9). Both roost trees are approximately [redacted] from the capture site and approximately [redacted] from each other (Table 7). These roosts are approximately [redacted] from the center of the [redacted] radius West Fork White River/ Pleasant Run Creek maternity colony defined from the Tier 1 data in 2004 and 2005.

Northern long-eared bat

Two of the three northern long-eared bats captured at Sites, 7, 13 and 20 were fitted with radio transmitters.

The juvenile male northern long-eared bat captured at Site 13 on 14 July was not fitted with a transmitter because the transmitter (approximate 0.35g) was more than 5 percent of the bats body mass and therefore not an acceptable candidate for radio telemetry.

The juvenile female bat (Bat 028) captured at Site 7 on 28 July was tagged with a 150.028 MHz transmitter and tracked on 29 July. The active transmitter was found on the ground in a wetland woods south of [redacted] approximately 217 meters southeast from the point of capture (Appendix E). The habitat for the area where the transmitter became detached from the bat includes numerous potential roosts (i.e., dead and dying trees with high quality roost potential).

The adult post-lactating female bat (Bat 189) captured at Site 20 on 2 August was tagged with a 172.189 MHz transmitter and tracked to roost 189-1 on four consecutive days (3 August to 6 August). No signal was detected on tracking attempts on 7 and 8 August, and no additional roosts were identified. Roost 189-1 is a partially dead (stage 4 decay) black cherry (*Prunus serotina*) with a 39 cm (15 inch) dbh. Emergence counts on 4 and 5 August were 3 and 6 respectively (Table 9). The roost trees is approximately [redacted] from the capture site (Table 8) and approximately [redacted] from the center of the [redacted] radius White River-Goose Creek maternity colony defined from the 2004 and 2005 Tier 1 data.

Evening bat

The IDNR state endangered evening bat was the second most abundant species captured (n=24), comprising 19 percent (including escaped bats not identified). It was identified at seven of the 19 sites (37 percent), most of which are in the central third of the study area. None were captured with the [redacted] in the [redacted] of in the [redacted] to the [redacted] Half of the captures (n=12) were from Site 23. Reproductive adult females (n=7) and juvenile females (n=12) dominated the gender and reproductive classes, with the remainder consisting of one non-reproductive female and four juvenile males.

DISCUSSION

In 2004 the entire proposed route of I-69 from Evansville to Indianapolis, Indiana was sampled to determine the presence/probable absence of the federally endangered Indiana bat. The route was broken into six sections with Section 6 following the route of SR37 between the cities of Martinsville and Indianapolis, Indiana.

A presence/absence survey is typically considered valid between three and five years. As such, the U.S. Fish and Wildlife Service requested Section 6 be resurveyed using the current 2015 Range-Wide Indiana

Bat Summer Survey Guidelines to provide up-dated data for the Section 6 Biological Assessment and the pending Environmental Impact Statement.

From 12 July to 26 July 2004, 29 net sites were surveyed for bats using mist nets as part of the Tier 1 EIS investigation for a total of 116 net nights. This effort yielded 253 bats representing seven species, or 2.18 bats per net night. Bats were captured from all but four of the 29 sites. The little brown bat was the most abundant (n=72, 18 sites), making up 28 percent of the total captures. The remaining species captured included the big brown bat (n=67, 17 sites), eastern tri-colored (n=30, 9 sites), evening bat (n=28, 4 sites), eastern red bat (n=25, 13 sites), and the northern long-eared bat (n=21, 11 sites) and Indiana bat (n=10, 8 sites). The greatest number of bats (n=31) was captured at Site 24; however, only three species were identified. Sites 10, 14, 15, and 20 each yielded five species.

From 12 July to 19 July 2005, seven of the 29 net sites from 2004 were resurveyed (Sites 7, 8, 10, 19, 20, 22 and 23) for a total of 24 net nights. This effort yielded 69 bats representing seven species, or 2.88 bats per net night. Bats were captured from all but one site (Site 22). The little brown bat was the most abundant (n=26, 6 sites), making up 38 percent of the total captures. The remaining species captured included the big brown bat (n=16, 4 sites), evening bat (n=15, 2 sites), northern long-eared bat (n=6, 4 sites), Indiana bat (n=3, 3 sites), eastern red bat (n=2, 1 site) and the eastern tri-colored (n=1, 1 site). Site 23 yielded the greatest number of bats (n=32) although this site was surveyed for three nights, while the other locations were only surveyed for one or two nights.

The 3 July to 6 August 2015 survey of 19 sites (84 net nights) yielded 126 bats representing seven species, or 1.5 bats per net night (includes partial night captures). The seven species for 2015 are the same as those from both the 2004 and 2005 surveys. The hoary bat, silver-haired bat and gray bat are the only other resident bats from Indiana (excluding the extirpated southeastern bat) not captured in these surveys. In stark contrast to the 2004 and 2005 surveys, the little brown bat was not the most abundant species captured in 2015. Only four individuals from three sites were captured in 2015 in comparison to the 72 individuals from 18 sites in 2004 and 26 individuals from six sites in 2005. While the big brown bat was the second most captured species in 2004 and 2005, it now appears to have replaced the little brown bat dominance, at least within the habitats that are being surveyed for the I-69 project. The eastern red and evening bats continue to be frequently encountered; however, the eastern tri-colored bat which was a relatively common capture in 2004 was only captured at one site (the new Site 33) from the 2015 effort.

The MacArthur diversity index for 2004 (29 sites) and 2005 (7 sites) was 5.3 and 3.9 respectively. For the 19 sites surveyed in 2015 the index experienced a reduction to 2.6 reflecting a reduction in the total number captured.

Ten Indiana bats from eight sites were captured in the 2004 survey including four reproductive females, five juveniles and a non-reproductive adult resulting in a species capture rate of 0.09 bats per net night. In 2005 three individuals (all adult reproductive females) captured from three sites resulted in a species capture rate of 0.12 per net night. In contrast, the three Indiana bats captured (all juvenile females) in 2015 from two sites resulted in a species capture rate of just 0.04 per net night. Table 11 provides a comparison of Indiana bat captures by site for the three years of surveys conducted in Section 6.

In 2004, four Indiana bat roost trees were identified within Section 6. Roost 203R1 was along [redacted] of [redacted] to the [redacted] of [redacted] opposite the [redacted] Roost 022R1 was in a [redacted] just above the confluence with the [redacted] Roosts 105R1 and 105R2 are a pair of ridgetop roosts west of the [redacted] between [redacted] and [redacted] In 2005, six additional roost trees were identified. Roost 6S2 was the same roost as 022R1 identified the previous year. Roosts 6S1, 6S3 and 6S4 are a group of trees within a [redacted] slough located on the east side of the river between the confluences of [redacted] and [redacted]. Roosts 6N1 and 6N2 are in the northern portion of the survey area in the bottomland wetland habitat associated with the [redacted] and [redacted] to the [redacted] of the [redacted]

Of the three Indiana bats that were fitted with radio transmitters (Bat 306, Bat 936 and Bat 283) only Bat 283 from Site 21 was tracked to roost trees. This pair of roosts (283-1 and 283-2) is associated with [redacted] bottomland habitat west of the river in the general vicinity of the [redacted]. These roosts are approximately [redacted] of the 6N1 and 6N2 roosts discovered in 2005. 2015 emergence counts from the two cottonwood trees (283-1 and 283-2) were 7, 13, 30 and 35 suggesting moderate use. In contrast, the counts from 6N1 and 6N2 in 2005 were 0 and 1.

Twenty-one northern long-eared bats from eleven sites were captured in the 2004 survey including two reproductive females, one non-reproductive female, twelve adult males and six juveniles resulting in a species capture rate of 0.18 bats per net night. In 2005 six individuals including a reproductive female, an adult male and four female juveniles were captured from four sites resulted in a species capture rate of 0.24 per net night. In contrast, the three northern long-eared bats captured (reproductive female and two juveniles) in 2015 from three sites resulted in a species capture rate of just 0.04 per net night, considerably less that the 2004 and 2005 efforts. Table 12 provides a comparison of northern long-eared bat captures by site for the three years of surveys conducted in Section 6.

As previously noted, no roost identification for the northern long-eared bat was conducted as part of the 2004 and 2005 surveys since the species was not listed as threatened by the USFWS at that time. The single roost discovered for the species from an adult female captured at Site 20 along [redacted] in 2015 is located in bottomland wetland habitat [redacted] of the [redacted] opposite of the [redacted]. Emergence counts on 4 and 5 August of just 3 and 6 suggest that this is likely an alternate roost.

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Appendix A

Figures

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Appendix B

USFWS Indiana Bat Mist Netting Guidelines

I-69 Radio Telemetry Guidelines

Disinfection Protocol for Bat Field Studies – USFWS Region 3

USFWS INDIANA BAT MIST NETTING GUIDELINES

Summer Acoustic Survey Season

- 15 May to 15 August

Personnel

- A qualified biologist must select or approve of mist net sites as suitable for capturing Indiana bats, be present at each site throughout the survey and confirm all bat species identifications
- A qualified biologist can monitor multiple sites provided they can be monitored every 10 minutes via walking.

Equipment:

- Fine mesh (38 cm = 1.5 inch) nets of 50 or 75 denier 2 ply nylon.

Level of Effort (Midwest)

- Linear projects require a minimum of 4 net nights per km (0.6 miles) of suitable summer habitat.
- Non-linear project require a minimum of 4 net night per 0.5 km^2 (123 acres) of suitable summer habitat.
- Generally, no more than two nights at a single net location.

Net Placement

- Place approximately perpendicular across potential travel corridors extending from one side of the corridor to the other and extend from stream/ground surface up to overhanging canopy.
- Net width and overall height should be dictated by the size of the corridor being surveyed. Typical minimum size is 6 meter (19.7 ft) wide and two stacked panels high (approximately 2.5 meter [8.2 ft]).
- Distribute net set-ups throughout suitable habitat.
- Avoid net set-ups illuminated by artificial light.
- Photo document net placements.

Mist Netting Operations

- Check nets approximately every 10 to 15 minutes.
- Minimize noise, lights and movement near nets.
- Remove bats within 3 to 4 minutes
- Indiana bats should not be held for more than 30 minutes, or no longer than 45 minutes if targeted for radio telemetry.

Monitoring Period

- Continuous survey for 5 hours beginning at sunset.
- If site conditions (i.e., landscape setting) result in bats flying before sunset, survey should commence at dusk.

Weather Conditions: Cancel or terminate monitoring if any of the following occur for a particular night:

- Temperatures fall below 50˚F (10˚C) during the survey period.
- Precipitation (rain and/or fog) exceeds 30 minutes or continues intermittently during the first 5 hours of the survey period.
- Sustained high wind speeds > 4 meters/second (9 miles/hour; Beaufort = 3) during the first 5 hours of the survey period.

Indiana Bat Captures

- Photograph all Indiana bats showing
    - ¾ view of face showing ear, tragus and muzzle
    - View of calcar showing presence/absence of keel
    - Transverse view of toes showing extent of toe hairs
- Document all capture and individual measurements/observations (i.e, time of capture, gender, age, reproductive condition, weight, RFA, etc.)
- If species cannot be readily determined in the field, collect one or more fecal pellets for DNA analysis by temporarily placing the bat in a holding bag for no more than 30 minutes.
- Contact the appropriate USFWS FO within 48 hours of captures

Source: 2014 Range-Wide Indiana Bat Summer Survey Guidelines (January 2014)

I-69 RADIO TELEMETRY GUILDLINES

The primary goal in conducting radio telemetry is to locate and enumerate as many maternity colonies and their maternity roost trees (primary and alternate) as possible that may be present within the I-69 Action Area so that I-69 related impacts may be avoided and/or minimized. For this reason, surveyors should attach radio transmitters to the first two bats that are either reproductively active adult females or juveniles at each site. As a general rule, the attached transmitter and adhesive should not weigh more than 5% of a bat's weight. Transmitters may be placed on pregnant females, but professional judgment should be used to determine whether the bat will be overly stressed from the additional weight.

Guidelines for placing transmitters on captured Indiana bats or northern long-eared bats is summarized as follows:

- The first adult female or juvenile male/female captured at any site (1st or 2nd night) received a transmitter.
- A second adult female or juvenile male/female captured at any site on the 1st night would not receive a transmitter.
- A second adult female or juvenile male/female captured at any site on the 2nd night can receive a transmitter at the discretion of the field crew if for instance the bat captured the previous night could not be tracked to a roost.
- If an adult male was captured on the 1st night, no transmitter was attached.
- If an adult male was captured on the 2nd night and no other female had been fitted with a transmitter, then the male can receive a transmitter.

To fulfill Term and Condition No. 1 of the December 3, 2003 I-69 Biological Opinion and Incidental Take Statement, surveyors are to track all radio-tagged bats to their diurnal roosts for at least 5 days (do not necessarily have to be consecutive days). However, surveyors are encouraged to voluntarily continue daily tracking each bat for as long as feasible to generate more data and to allow a more complete picture of each colony's roosting behavior. An exhaustive search should be conducted during daylight hours in an attempt to locate each radio-tagged bat's diurnal roost tree each day. Land owners should be notified before entering their property to search for a roost tree.

National White-Nose Syndrome Decontamination Protocol - Version 06.25.2012

The fungus *Geomyces destructans* (*G.d.*) is the cause of white-nose syndrome (WNS), a disease that has devastated populations of hibernating bats in eastern North America. Since its discovery in New York in 2007, WNS has spread rapidly through northeastern, mid-Atlantic, and Midwest states and eastern Canada. It continues to threaten bat populations across the continent. For the protection of bats and their habitats, comply with all current cave and mine closures, advisories, and regulations on the federal, state, tribal, and private lands you plan to visit. In the absence of cave and mine closure policy, or when planned activities involve close/direct contact with bats, their environments, and/or associated materials, the following decontamination procedures should be implemented to **reduce the risk of transmission** of the fungus to other bats and/or habitats. For the purposes of clarification, the use of the word "decontamination," or any similar root, in this document entails both the 1) cleaning and 2) treatment to disinfect exposed materials.

Under no circumstances should clothing, footwear, or equipment that was used in a confirmed or suspect WNS-affected state or region be used in a WNS-unaffected state or region. Some state/federal regulatory or land management agencies have supplemental documents[1] that provide additional requirements or exemptions on lands under their jurisdiction.

I. TREATMENTS TO REDUCE RISK OF TRANSFERRING *GEOMYCES DESTRUCTANS*[2]:

Applications/Products:

The most universally available option for treatment of submersible gear is:

Submersion in Hot Water: Effective at sustained temperatures ≥50ºC (122ºF) for 20 minutes

Secondary or non-submersible treatment options (for a minimum of 10 min.) include:

	PRODUCT	Clorox® (6% HOCl) Bleach	Lysol® IC Quaternary Disinfectant Cleaner	Professional Lysol® Antibacterial All-purpose Cleaner	Formula 409® Antibacterial All-Purpose Cleaner	Lysol® Disinfecting Wipes
APPROVED USES	**Hard, non-porous surfaces**	Yes	Yes	Yes	Yes	Yes
	Non-porous personal protective safety equipment	No	Yes (headgear, goggles, rubber boots, etc.)	No	No	No
	All surfaces, including: porous clothing, fabric, cloth footwear, rubber boots	Yes (Do not use on ropes, harnesses or fabric safety gear.)	No	No	No	No
DILUTION / TREATMENT (as per label)		Effective at 1:10 dilution (bleach : water) [3,4]	Effective at 1:128 dilution (1 ounce: 1 gallon of water) [3,4]	Effective at 1:128 dilution (1 ounce: 1 gallon of water)[3,4]	Effective at concentrations specified by label[3,4]	Effective at 0.28 % di-methyl benzyl ammonium chloride[3,4]

[1] To find applicable addenda and/or supplemental information, visit http://www.whitenosesyndrome.org/topics/decontamination

[2]The use of trade, firm, or corporation names in this protocol is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by state and/or federal agencies of any product or service to the exclusion of others identified in the protocol that may also be suitable for the specified use.

[3] Product guidelines should be consulted for compatibility of use with one another before using any decontamination product. Also, detergents and quaternary ammonium compounds (i.e. Lysol® IC Quaternary Disinfectant Cleaner) should not be mixed directly with bleach as this will inactivate the bleach and in some cases produce a toxic chlorine gas. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

[4] Final determination of suitability for any decontaminant is the sole responsibility of the user. Use of some treatments which utilize such method need to be applied carefully, especially in confined spaces, due to inhalation or contact risks of the product. All users should be aware of these risks

Other effective disinfectant(s) with similar chemical formulas (e.g., a minimum of 0.3% quaternary ammonium compound) or water based applications may exist but are unknown and not recommended at this time.

REMEMBER, the product label is the law!

It is the responsibility of the users of this protocol to read and follow the product label and MSDS.

Products must be used in accordance with the label:

Ensuring the safety of those who use any of the above products for treatment is of utmost importance. Material safety data sheets (MSDS) developed by product manufacturers provide critical information on the physical properties, reactivity, potential health hazards, storage, disposal, and appropriate first aid procedures for handling or working with substances in a safe manner. Familiarization with MSDS for chemical products prior to use will help to ensure appropriate use of these materials and assist in emergency response.

It is a violation of federal law to use, store, or dispose of a regulated product in any manner not prescribed on the approved product label and associated MSDS.

- Disinfectant products, or their contaminated rinse water, should be managed and disposed of as per product label directions to avoid contamination of groundwater, drinking water, or non-municipal water feature such as streams, rivers, lakes, or other bodies of water. Follow all local, state and federal laws. State-by-state requirements for product disposal may vary. Note: Quaternary ammonium wastewaters should not be drained through septic systems because of the potential for system upset and subsequent leakage into groundwater.

II. PLAN AHEAD AND CAVE CLEAN:

Dedicate your Gear: Many types of rope and webbing have not been thoroughly tested for integrity after decontamination. Dedicate your gear to a single cave/mine or don't enter caves/mines that require this gear.
Bag it Up: Bring bags on all of your trips. All gear not decontaminated on site should be isolated (quarantined) in a sealed plastic bag/s or container/s to be cleaned and disinfected off-site.

Before Each Cave/Mine or Site Visit:

1.) Determine *G.d.*/WNS status[5] of the state/county(s) where your gear was previously used.

2.) Determine *G.d.*/WNS status[5] of state/county(s) to be visited.

3.) Determine whether your gear is permitted for your cave/mine visit or bat related activity, as defined by the current WNS case definitions[6] and the flowchart below.

4.) Choose gear that can be most effectively decontaminated [i.e., rubber wellington type (which can be treated with hot water and/or secondary treatment options in section I.) vs. leather boots] or dedicated to a specific location**. Remember, under no circumstances should any gear that was used in a WNS-affected state or region be used in a WNS-unaffected state or region.** Brand new gear can be used at any location where access is otherwise permitted.

5.) Determine if any state/federal regulatory or land management agency addendum or supplemental document[1] provides additional requirements or exemptions on lands under its jurisdiction that supplement the final instruction identified in the flowchart below.

6.) Prepare a "Clean Caving" strategy (i.e., how and where all gear and waste materials will be stored, treated and/or disposed after returning to your vehicle and base area) for your particular circumstances that provides for cleaning and treatment of gear on a daily basis **unless** instructed above to do so more frequently throughout the day.

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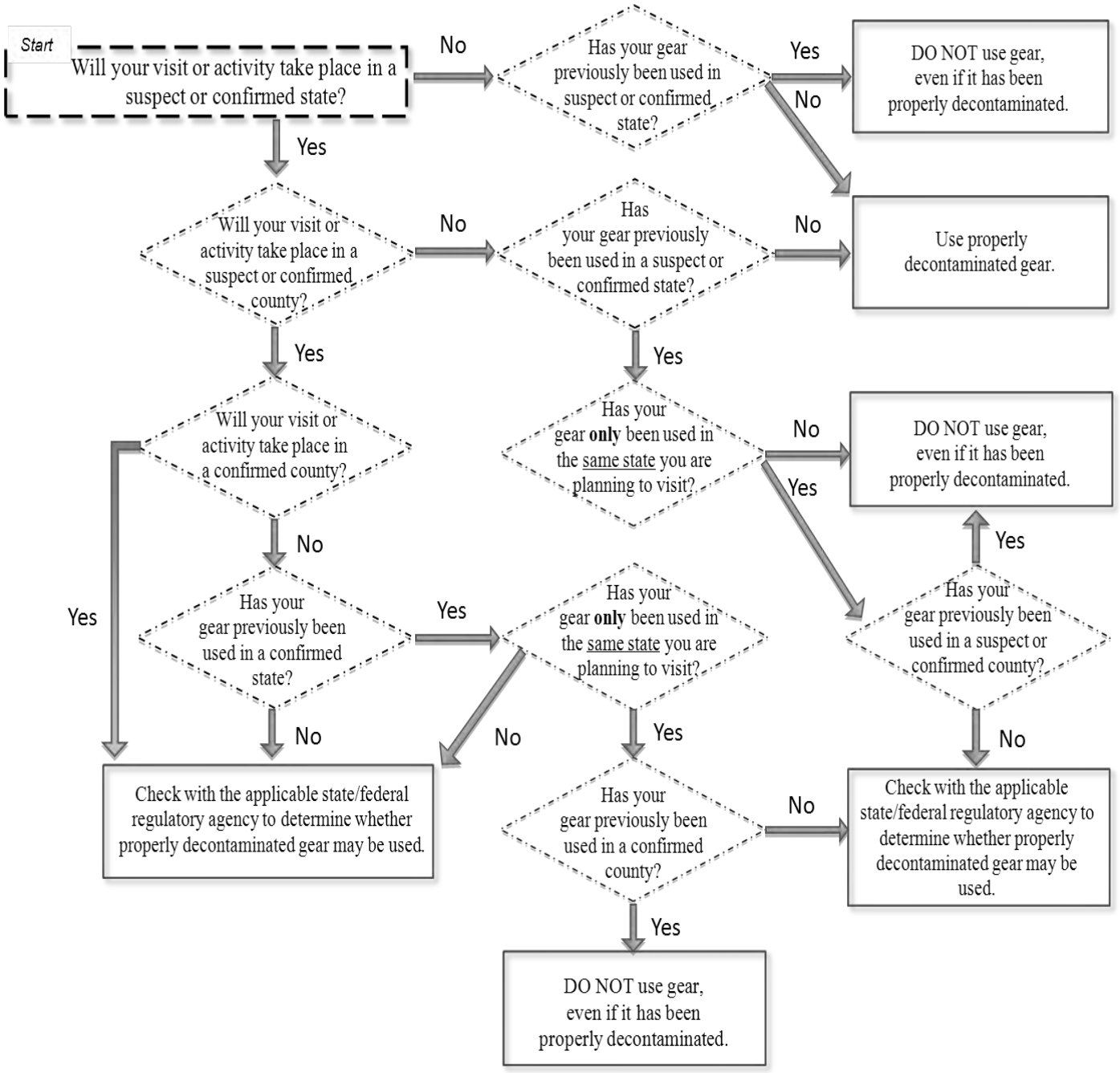
prior to entering cave environments and understand that products and corresponding procedures may cause irreversible harm. Always use personal protective equipment to reduce contact with these products, particularly when recommended by the manufacturer.

[5] Visit http://www.whitenosesyndrome.org/resources/map to determine the WNS status of a county or state.

[6] Visit http://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/wns_definitions.jsp for current WNS case definitions.

7.) When visiting multiple caves/mines or bat research sites on the same day, clean and treat all gear between **each** cave/mine/site, **unless** otherwise directed in an agency/landowner addendum. It is recommended that known confirmed or suspect caves/mines be visited only after those sites of unknown *G.d.* status have been visited, to further reduce the risk of inadvertent transmission.

Flowchart to Determine Gear Use or Decontamination



After Each Cave/Mine or Site Visit:

1.) Thoroughly scrub and remove sediment/dirt from clothing, footwear, and other gear immediately upon emerging from the cave/mine or bat research site. Avoid contamination of vehicles; store exposed gear separately from unexposed gear.

2.) Once fully scrubbed and rinsed of all soil and organic material, clothing, footwear, and any appropriate gear should be sealed, bagged in a plastic container and once at home, machine or hand-washed/cleaned using a conventional cleanser like Woolite® detergent or Dawn® antibacterial dish soap in water (the use of Dawn® antibacterial dish soap is **not intended** for use in conventional washing machines.) Once cleaned, rinse gear thoroughly in water. Clean/treat gear used in a suspect or confirmed state prior to transport when traveling back to or through a state **without** known cases of *G.d.*/WNS. Use the treatments listed under Applications/Products on page 1 for a minimum of 10 (products) or 20 (hot water) minutes.

Remember: Many types of rope and webbing have not been thoroughly tested for integrity after decontamination. Dedicate your gear to a single cave/mine or don't enter caves/mines that require this gear.

A.) Submersible Gear (i.e. clothing, footwear, and/or equipment that can be submerged in liquid)**:**

Clothing, footwear, and other submersible gear:

Following steps 1 and 2 above, the primary treatment for all submersible gear should always be submersion in **water of at least 50ºC (122ºF) for a minimum of 20 minutes, where possible**. Some submersible gear (depending on material) could be soaked for a minimum of 10 minutes in the appropriate products listed in the Applications/Products chart on page 1, rinsed thoroughly in water again, and air dried. Note: Although commercially available washing machines with sanitation cycles often sustain desirable water temperatures**,** their efficacy for killing the conidia of *G.d*. is unknown.

B.) Non-submersible Gear:

Gear that may be damaged by liquid submersion should be cleaned according to the manufacturer's recommendation between cave/mine visits and when appropriate, follow steps 1 and 2 above in addition to following:

Cameras and Electronic Equipment:

Until effective techniques are developed to comprehensively disinfect cameras and electronics, it is recommended that these items only be used in caves when absolutely necessary. Regardless of the cave/mine visited, clean/treat cameras and electronics after each visit using an appropriate product listed in the Applications/Products chart on page 1. Equipment that must be used in the cave/mine may be placed in a sealed plastic casing (i.e., underwater camera housing), plastic freezer bag, or plastic wrap that permits operation of the equipment (i.e., glass lens is exposed) and reduces the risk of exposure to the cave environment. Prior to opening or removing any plastic protections, wipe the outside surfaces with an appropriate product described in the Applications/Products chart on page 1. Plastic freezer bag or wrap should be removed and discarded after each visit. A sealed plastic casing may be reusable if properly submersed in appropriate product as described in the Applications/Products chart and the functionality and protective features of the casing are not sacrificed (check with manufacturer). After removal of any outside plastic protection, all non-submersible equipment surfaces (i.e., camera body, lens, etc.) should be wiped using an appropriate product described in the Applications/Products chart.

3.) Reduce the risk of vehicle contamination and transport of *G.d*. to new areas by making sure to

A) transport gear in clean containers,

B) remove outer clothing/footwear and isolate in a sealed plastic bag or container prior to entering a vehicle. Storage container options vary considerably depending on the type of vehicle; but **always clean and disinfect the outside surfaces of storage containers prior to putting them in the vehicle**.

C) remain outside of the vehicle after exiting a cave/mine or completing field work,

D) change into clean clothing and footwear prior to entering the vehicle, and

E) clean dirt and debris from the outside of vehicles (especially wheels/undercarriage).

OBSERVATION OF LIVE OR DEAD BATS

If you observe live or dead bats (multiple individuals in a single location) that appear to exhibit signs of WNS, contact a wildlife professional in your nearest state (http://www.fws.gov/offices/statelinks.html) or federal wildlife agency (http://www.fws.gov/offices/, http://www.fs.fed.us/, http://www.blm.gov/wo/st/en.html, or http://www.nps.gov/ index.htm). **Do not handle bats unless authorized in writing to do so by the appropriate government agency.**

Note on the use of Pesticides/Products listed above:

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. §136 et seq. (1996))
http://www.epa.gov/oecaagct/lfra.html

defines a pesticide as follows:

(u) Pesticide
The term "pesticide" means (in part)
(1) any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest.

FIFRA defines a pest at §136:
(t) Pest
The term "pest" means (in part)
(1) any insect, rodent, nematode, fungus, weed, or (2) any other form of terrestrial or aquatic plant or animal life or virus, bacteria, or other micro-organism (except viruses, bacteria, or other micro-organisms on or in living man or other living animals) which the Administrator declares to be a pest under section 25(c)(1).

This document is the product of the multi-agency WNS Decontamination Team, a sub-group of the Disease Management Working Group established by the National WNS Plan (A National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats, finalized May 2011). On 15 March 2012 a national decontamination protocol was adopted by the WNS Executive Committee, a body consisting of representatives from Federal, State, and Tribal agencies which oversees the implementation of the National WNS Plan. This version of the protocol contains some modifications to the 15 March version, intended to clarify the recommendations for the appropriate use of treatment options. This decontamination protocol will continue to be updated as necessary to include the most current information and guidance available.

Appendix C

Tables

Table 1. GPS coordinates for mist netting survey sites for I-69 Section 6

Site	County	Previous Survey IB and NLEB Captures			UTM Coordinates (meters)		
					Northing	Easting	UTM Zone
Site 3	Morgan	2004			[redacted]	[redacted]	16N
Site 5	Morgan	2004	IB	NLEB			16N
Site 6	Morgan	2004		NLEB			16N
Site 7	Morgan	2004	IB	NLEB			16N
Site 8	Morgan	2004	IB				16N
Site 10	Morgan	2004	IB	NLEB			16N
Site 13	Morgan	2004					16N
Site 14	Morgan	2004	IB	NLEB			16N
Site 17	Morgan	2004					16N
Site 19	Johnson	2004	IB	NLEB			16N
Site 20	Morgan	2004	IB	NLEB			16N
Site 21	Johnson	2004		NLEB			16N
Site 23	Johnson	2004	IB	NLEB			16N
Site 24	Johnson	2004		NLEB			16N
Site 25	Marion	2004		NLEB			16N
Site 30	Morgan	New					16N
Site 31	Morgan	New					16N
Site 32	Morgan	New					16N
Site 33	Marion	New					16N

IB = Indiana bat
NLEB = northern long-eared bat

Table 2. Maximum and minimum temperatures recorded during surveys for I-69 Section 6 in 2015

Site	Date	Maximum Temp		Minimum Temp	
		°C	°F	°C	°F
3	20 July 2015	25.0	77	20.6	69
	21 July 2015	20.6	69	14.4	58
5	21 July 2015	22.2	72	17.2	63
	22 July 2015	21.7	71	17.8	64
6	24 July 2015	21.7	71	22.8	62
	26 July 2015	22.8	73	21.7	71
	29 July 2015	27.2	81	17.8	64
7	27 July 2015	26.1	79	23.9	75
	28 July 2015	25.6	78	23.3	74
8	27 July 2015	26.7	80	21.7	71
	28 July 2015	not available	not available	not available	not available
10	22 July 2015	25.0	77	16.7	62
	23 July 2015	20.6	69	17.2	63
13	13 July 2015	not available	not available	not available	not available
	14 July 2015	26.2	79	22.2	72
	15 July 2015	25.0	19.0		66
14	5 July 2015	23.1	74	18.5	65
	6 July 2015	28.6	83	24.0	75
17	16 July 2015	27.2	81	20.4	69
	19 July 2015	29.3	85	22.9	73
19	3 July 2015	22.7	73	20.4	69
	4 July 2015	23.7	75	18.4	65
20	1 August 2015	26.3	79	18.8	66
	2 August 2015	26.8	80	23.7	75
21	25 July 2015	24.7	76	22.9	73
	27 July 2015	26.6	80	23.6	74
23	30 July 2015	25.5	78	20.5	69
	31 July 2015	26.3	79	21.3	70
24	5 August 2015	25.0	77	22.5	73
	6 August 2015	18.9	66	16.9	62
25	8 July 2015	21.6	71	20.3	69
	11 July 2015	25.1	77	21.7	71
	12 July 2015	23.8	75	21.4	71
30	28 July 2015	28.3	83	24.4	76
	29 July 2015	26.8	80	21.0	70
31	3 August 2015	27.1	81	19.1	66
	4 August 2015	25.0	77	19.9	68
32	23 July 2015	21.4	71	18.3	65
	24 July 2015	23.6	74	19.0	66
33	20 July 2015	24.5	78	24.5	76
	21 July 2015	24.0	75	16.2	61
	22 July 2015	23.4	74	21.7	71

Red highlight: Survey terminated due to "rain out" conditions

Table 3. Site specific and date specific data for mist net survey bat captures by sex and reproductive condition in Section 6

Site #	Date	Indiana bat										Little brown bat										Northern longear bat									
		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Escaped		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Escaped		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Escaped	
Site 3	20-Jul					1																									
	21-Jul					1																									
Site 5	21-Jul																														
	22-Jul																														
Site 6	24-Jul																														
	26-Jul																														
	29-Jul																														
Site 7	27-Jul																														
	28-Jul																									1					
Site 8	27-Jul																														
	28-Jul																														
Site 10	22-Jul																														
	23-Jul																														
Site 13	13-Jul																														
	14-Jul																													1	
	15-Jul																														
Site 14	5-Jul																														
	6-Jul																													1	
Site 17	16-Jul																														
	19-Jul																														
Site 19	3-Jul																														
	4-Jul																														
Site 20	1-Aug																														
	2-Aug												1								1			1							
Site 21	25-Jul					1																									
	27-Jul																														
Site 23	30-Jul																														
	31-Jul																														
Site 24	5-Aug																														
	6-Aug																														
Site 25	8-Jul																														
	11-Jul																														
	12-Jul																														
Site 30	28-Jul																														
	29-Jul																														
Site 31	3-Aug													1																	
	4-Aug																														
Site 32	23-Jul																														
	24-Jul																														
Site 33	20-Jul																														
	21-Jul													1																	
	22-Jul																														
Species Totals		0	0	0	0	3	0	0	0	0		0	0	1	0	2	0	0	0	1		0	0	1	0	1	0	0	1	0	
Study Totals		3										4										3									
P_i^2		0.000576										0.001024										0.000576									
$D=1/\Sigma P_i^2$		2.6																													

Site #	Date	Evening bat										Silver-haired bat										Big brown bat									
		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Escaped		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Escaped		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Juvenile male - reproductive	Escaped
Site 3	20-Jul																					1	2	2		1			1		
	21-Jul																							1							
Site 5	21-Jul																														
	22-Jul																														
Site 6	24-Jul																							1							
	26-Jul																														
	29-Jul																														
Site 7	27-Jul																														
	28-Jul																														
Site 8	27-Jul																							2							1
	28-Jul																												1		
Site 10	22-Jul																					1									
	23-Jul								1																						
Site 13	13-Jul																														
	14-Jul									1														1							
	15-Jul																							1					1		
Site 14	5-Jul																							1					1		
	6-Jul								1															1		1			2		
Site 17	16-Jul																								1						
	19-Jul																														
Site 19	3-Jul		1																							1		1	1		1
	4-Jul						1			1												1						2	1		1
Site 20	1-Aug		1																												
	2-Aug						1																	3		3			1		
Site 21	25-Jul																									1					2
	27-Jul																														
Site 23	30-Jul		3	1	4																			5							
	31-Jul		1		3																			4							
Site 24	5-Aug																												1		
	6-Aug																														
Site 25	8-Jul																					2									
	11-Jul																														
	12-Jul																							1		1			1		1
Site 30	28-Jul				1			1																1							
	29-Jul				1																			1							
Site 31	3-Aug		1		1																			1		2			1	1	
	4-Aug																									1					
Site 32	23-Jul																							1			1				
	24-Jul																							1			1				
Site 33	20-Jul																												1		
	21-Jul																														
	22-Jul																														
Species Totals		0	1	6	1	12	0	0	4	0		0	0	0	0	0	0	0	0	0		2	5	28	1	11	2	6	9	1	7
Study Totals		24										0										72									
P_i^2		0.036864										0										0.331776									
$D=1/\Sigma P_i^2$																															

Site #	Date	Hoary bat										Eastern red bat										Tri-colored bat										Unknown	Total # of bat per site & night	Total # of bats per site	Average # of bats per night	Number of Species	Diversity Index
		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Escaped		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Escaped		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Escaped								
Site 3	20-Jul																														1	9	11	5.5	2	1.8
	21-Jul																															2				
Site 5	21-Jul																															0	0	0	0	0.0
	22-Jul																															0				
Site 6	24-Jul																															1	1	0.33	1	1.0
	26-Jul																															0				
	29-Jul																															0				
Site 7	27-Jul																															0	1	0.5	1	1.0
	28-Jul																															1				
Site 8	27-Jul																															3	5	2.5	2	2.0
	28-Jul																															2				
Site 10	22-Jul																															1	2	1	2	2.0
	23-Jul																															1				
Site 13	13-Jul																															1				
	14-Jul																															3	6	2	3	2.6
	15-Jul																															2				
Site 14	5-Jul																															2	8	4	3	1.7
	6-Jul																															6				
Site 17	16-Jul																															1	1	0.5	1	1.0
	19-Jul																															0				
Site 19	3-Jul												1																			6	14	7	3	2.1
	4-Jul												1																			8				
Site 20	1-Aug																															2	13	6.5	5	2.9
	2-Aug																															11				
Site 21	25-Jul																															4	4	2	2	1.6
	27-Jul																															0				
Site 23	30-Jul																															14	22	11	3	2.1
	31-Jul																															8				
Site 24	5-Aug																															1	1	0.5	1	1.0
	6-Aug																															0				
Site 25	8-Jul																															2	6	3	1	1.0
	11-Jul																															0				
	12-Jul																															4				
Site 30	28-Jul																															4	6	3	3	2.6
	29-Jul																															2				
Site 31	3-Aug																															13	16	8	4	2.8
	4-Aug																															3				
Site 32	23-Jul																															3	5	2.5	2	1.5
	24-Jul																															2				
Site 33	20-Jul																															3	4	2	4	4.0
	21-Jul																															1				
	22-Jul																															0				
Species Totals		0	0	0	0	0	0	0	0	0		0	2	2	1	3	1	3	2	4		0	0	1	0	0	0	0	0	0	1	126				
Study Totals		0										18										1									1					
P_i^2		0										0.020736										0.000064														
$D=1/\Sigma P_i^2$																																				

Red shading indicates partial survey nights due to “rain out” conditions.

Table 4. Bat capture summary by sex and reproductive condition in Section 6

Species	Adult					Juvenile		Escaped	Total
	Male	Female				Male	Female		
		P	L	PL	NR				
Indiana bat							3		3
little brown bat				1			2	1	4
northern long-eared bat				1		1	1		3
evening bat			1	6	1	4	12		24
silver-haired bat									
big brown bat	8	2	5	28	1	10	11	7	72
hoary bat									
eastern red bat	4		2	2	1	2	3	4	18
tri-colored bat				1					1
escaped unknown								1	1
Total	12	2	8	39	3	17	32	13	126

[1] P = pregnant; L = lactating; PL = post-lactating; NR = non-reproductive

Table 5. Bats captured by sex and capture/net-night data in Section 6

Species	Male		Female		Escaped	c^2	*P*	Capture /net-night**
	Number	Percent	Number	Percent	Number			
Indiana bat		0.0%	3	3.6%		*	*	0.04
little brown bat		0.0%	3	3.6%	1	*	*	0.05
northern long-eared bat	1	3.4%	2	2.4%		*	*	0.04
evening bat	4	13.8%	20	23.8%		*	*	0.29
silver-haired bat		0.0%		0.0%		*	*	0.00
big brown bat	18	62.1%	47	56.0%	7	*	*	0.86
hoary bat		0.0%		0.0%		*	*	0.00
eastern red bat	6	20.7%	8	9.5%	4	*	*	0.21
tri-colored bat		0.0%	1	1.2%		*	*	0.01
unknown		0.0%		0.0%	1	*	*	0.01
Total	29	100.0%	84	100.0%	13			1.50

*The use of the Chi-squared test is not appropriate because in each case more than 20% of the expected frequencies are less than 5.

**Includes data from partial net nights

Table 6. Condition and telemetry information for Indiana bat and northern long-eared bat captured from in Section 6.

Bat Number	Capture Date	Capture Site	Transmitter Frequency	Species	Sex	Age Class	Reproductive Condition	Number of Roosts
306	20-Jul	3	150.306	MYSO	F	Juvenile	Non-reproductive	None
936	21-Jul	3	150.936	MYSO	F	Juvenile	Non-reproductive	None
028	28-Jul	7	150.028	MYSE	F	Juvenile	Non-reproductive	None
283	25-Jul	21	172.283	MYSO	F	Juvenile	Non-reproductive	2
189	2-Aug	20	172.189	MYSE	F	Adult	Post-lactating	1

MYSE = *Myotis septentrionalis*
MYSO = *Myotis sodalis*

Table 7. Capture site and roost tree distance matrix for Indiana bat 283

Bat 283	Capture Site 21	Roost 283-1	Roost 283-2
Capture Site 21		1203 m	244 m
		3947 ft.	801 ft.
Roost 283-1	1203 m		48 m
	3947 ft.		157 ft.
Roost 283-2	244 m	48 m	
	801 ft.	157 ft.	

Table 8. Capture site and roost tree distance matrix for northern long-eared bat 189

Bat 189	Capture Site 20	Roost 189-1
Capture Site 20		749 m
		2457 ft.
Roost 189-1	749 m	
	2457 ft.	

Table 9. Summary of roost tree information and emergence counts

Bat Number	Roost ID	Tree Species	Condition	dbh (cm)	Exfoliating bark %	Canopy closure %	Roost height (m)	Roost Habitat	Emergence Count Date	Emergence Count
189	189-1	*Prunus serotina* black cherry	dead	39	25-30	40	10	forest swamp	4 Aug 2015 8 Aug 2015	3 6
283	283-1	*Populus deltoides* cottonwood	partial dead	45	10	5	12	forest swamp	27 July 2015 30 July 2015	13 7
	283-2	*Populus deltoides* cottonwood	dead	35	30-40	40	10	forest swamp	28 July 2015 29 July 2015	30 35

Table 10. Section 6 diversity indices for 2004, 2005 and 2015 surveys

	2004	2005	2015
Site 1	0.0		
Site 2	1.8		
Site 3	2.4		1.8
Site 4	0.0		
Site 5	1.8		0.0
Site 6	1.7		1.0
Site 7	2.2	1.6	1.0
Site 8	3.0	3.0	2.0
Site 9	2.0		
Site 10	4.8	3.1	2.0
Site 11	1.0		
Site 12	1.6		
Site 13	2.0		2.6
Site 14	3.9		1.7
Site 15	1.9		
Site 16	0.0		
Site 17	0.0		1.0
Site 18	2.9		
Site 19	3.0	3.0	2.1
Site 20	4.8	1.8	2.9
Site 21	3.2		1.6
Site 22	2.0	3.2	
Site 23	2.9	0.0	2.1
Site 24	2.0		1.0
Site 25	2.0		1.0
Site 26	1.8		
Site 27	1.4		
Site 28	1.0		
Site 29	2.0		
Site 30			2.6
Site 31			2.8
Site 32			1.5
Site 33			4.0
Entire survey	5.3	3.9	2.6

Table 11. Section 6 2004, 2005 and 2015 Indiana bat capture summary and number of roosts identified

Site	Indiana bat		
	2004	2005	2015
Site 1			
Site 2			
Site 3			2 J-F
Site 4			
Site 5	1 A-M (1 roost)		
Site 6			
Site 7	1 A-F-PL	1 A-F-PL (2 roosts)	
Site 8	1 A-F-PL (1 roost)	1 A-F-L (2 roosts)	
Site 9			
Site 10	1 J-F		
Site 11			
Site 12			
Site 13			
Site 14	1 A-F-PL (2 roosts) 1 J-M		
Site 15			
Site 16			
Site 17			
Site 18			
Site 19	1 A-F-PL		
Site 20	1 J-M		
Site 21			1 J-F (2 roosts)
Site 22			
Site 23	1 J-M 1 J-F	1 A-F-L (2 roosts)	
Site 24			
Site 25			
Site 26			
Site 27			
Site 28			
Site 29			
Site 30			
Site 31			
Site 32			
Site 33			

Shaded cells indicate sites that were not surveyed in the respective year.
A = adult, J = juvenile, M = male, F = female
P = pregnant, L = lactating, PL = post-lactating

Table 12. Section 6 2004, 2005 and 2015 northern long-eared bat capture summary

Site	northern long-eared bat		
	2004	2005	2015
Site 1			
Site 2			
Site 3			
Site 4			
Site 5	1 A-M		
Site 6	1 A-F-PL 3 J-F 2 J-M		
Site 7		1 J-F	1 J-F
Site 8			
Site 9			
Site 10	1 J-F	2 J-F	
Site 11			
Site 12	3 A-M		
Site 13			1 J-M
Site 14	1 A-M		
Site 15	1 A-M		
Site 16			
Site 17			
Site 18			
Site 19	1 A-M	1 A-F-L	
Site 20	1 A-F-PL 2 A-M		1 A-F-PL (1 roost)
Site 21	2 A-M		
Site 22			
Site 23		1 A-M 1 J-F	
Site 24	1 A-M		
Site 25	1 J-M		
Site 26			
Site 27			
Site 28			
Site 29			
Site 30			
Site 31			
Site 32			
Site 33			

Shaded cells indicate sites that were not surveyed in the respective year.
A = adult, J = juvenile, M = male, F = female
P = pregnant, L = lactating, PL = post-lactating

Appendix D

Net Site Habitat and Bat Capture Data Sheets

This appendix has been removed in its entirety

Appendix E

Radio-telemetry Tracking Data

This appendix has been removed in its entirety

Appendix F

Roost Tree and Emergence Count Data Sheets

This appendix has been removed in its entirety