



United States Department of the Interior



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March 11, 2013

Mr. Timothy George
Chief, Compliance Section
U.S. Army Corps of Engineers
St. Louis District
1222 Spruce Street
St. Louis, Missouri 63103-2833

Subject: F-0022; Biological Opinion on the Wappapello Lake Timber Stand
Improvement Management Strategies ([Compartment.Stand] 6.16, 8.1, 8.8)

Dear Mr. George,

This document transmits our final biological opinion based on our review of the U.S. Army Corps of Engineers (USACE) proposed Wappapello Lake Timber Stand Improvement (TSI) Management Strategies under section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Your September 24, 2012 request for formal consultation was received on September 25, 2012. This formal consultation and biological opinion is based on information provided in the September 2012 Biological Assessment, other available literature, personal communications with experts on federally listed species that occur at Wappapello Lake, and other sources of information. A complete administrative record of this consultation is on file at this office.

The enclosed biological opinion addresses the effects of the project on the federally endangered Indiana bat (*Myotis sodalis*) and provides a statement of expected incidental take as a result of the project. Also included is a brief list of discretionary conservation recommendations that the Service considers to aid in the recovery of the species.

If you have any questions or concerns regarding this consultation and biological opinion, please contact Shauna Marquardt of this office at 573/234-2132, extension 174.

Sincerely,

Amy Salveter
Field Supervisor

Enclosure

SUMMARY OF FINDINGS

This document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion (BO) based on our review of the TSI management strategies. The BO evaluates the potential and actual effects of the implementation of the management strategies on the Indiana bat (*Myotis sodalis*) in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

The Biological Assessment (BA) states that the TSI management strategies are intended to insure the long range protection of the forest environment and support the practice of uneven aged management and diversification of species within the compartments, establishing a more stable biotic community. The fundamental timber management program goals are to improve the reservoir watershed habitats through best management practices (BMP's) that reduce erosion, and regenerate and promote forest tree and shrub species that benefit wildlife. The actions associated with this project involve roosting and foraging habitat modification in the summer range of the Indiana bat. The BA prepared by the U.S. Army Corps of Engineers (USACE) identifies adverse effects and outlines measures to avoid and minimize impacts to the Indiana bat.

Formal consultation was initiated by a letter dated October 16, 2012 from the Service to the USACE and conducted in cooperation with the Columbia Missouri Field Office. The purpose of the formal consultation process is for the Service to write a biological opinion that addresses the adverse effects identified in the BA submitted by the USACE.

This BO is based on information provided in the September 2012 BA prepared by the USACE, email correspondence and phone conversations with Mr. Eric Lemons of the USACE, field visits, survey data, personal communications with experts on federally listed species that occur at Wappapello Lake, and the 2007 Indiana Bat Draft Recovery Plan (First Revision) (USFWS 2007). The Service has determined that implementation of the management strategies described in the BA will not jeopardize the continued existence of the Indiana bat but will result in incidental take of this species.

This document represents our (a) concurrence with a "no effect" determination for running buffalo clover (*Trifolium stoloniferum*), pink mucket (*Lampsilis abrupta*), Hine's emerald dragonfly (*Somatochlora hineana*), Curtis' pearlymussel (*Epioblasma florentina curtisi*), snuffbox (*Epioblasma triquetra*), and rabbitsfoot (*Quadrula cylindrica cylindrica*), (b) concurrence with the "not likely to adversely affect" determination for the gray bat (*Myotis grisescens*) and, (c) biological opinion on the effects of the action leading to a "likely to adversely affect determination" for the Indiana bat.

The USACE considered potential effects to the gray bat that resulted in a "not likely to adversely affect" determination because no suitable caves for gray bat are known to occur in the project area so direct impacts to its roosting and hibernation habitat will not occur. Additionally, the proposed action will create more suitable forest stands in foraging areas

and temporary disturbances associated with the proposed activities are unlikely to result in adverse effects or take of the species.

Consultation History

October 31, 2011 – Shauna Marquardt (FWS) site visit with Eric Lemons (USACE) to project site.

April 4, 2012 – Shauna Marquardt email to Eric Lemons outlining need to go through consultation under section 7 proposed TSI activities.

April 25, 2012 – Timothy George (USACE) email to Shauna Marquardt regarding preparation of a biological assessment (BA).

July 19, 2012 – First draft of BA submitted to the Columbia Missouri Field Office (CMFO) for review.

July 27, 2012 – Shauna Marquardt emailed comments on the draft BA to Timothy George.

August 30, 2012 – Revised draft of the BA submitted to CMFO.

September 13, 2012 – Shauna Marquardt approved revised draft of the BA.

September 24, 2012 – Final BA mailed to CMFO.

September 25, 2012 – Final BA received at CMFO with USACEs initiation package requesting formal consultation for the Indiana bat.

September 25, 2012 – CMFO confirms initiation of formal consultation (F-0022).
Initiation letter sent to USACE October 16, 2012.

BIOLOGICAL OPINION

1. Description of the Proposed Action

The USACE proposed to use single tree selection forest management on approximately 397 acres in two compartments and three stands (Compartment 6, Stand 16; Compartment 8, Stands 1 and 8; See Appendix A) on USACE property adjacent to Wappapello Lake, Wayne County, Missouri. Single tree selection is the selective removal of low quality, cull, diseased, over-mature or undesirable trees from a stand to achieve target stocking and wildlife habitat objectives. This technique is a tool used in uneven-aged management to encourage wider distribution of tree diameters, dominant species, age class and enhancement of forest reproduction. Because of the nature of the work, tree felling and removal is proposed to take place on a year-round basis (largely because of weather conditions) – including within the time frame of mid-March through November 1st - the time period in this part of Missouri when timber cutting is normally prohibited in order to protect Indiana bats in their summer habitats.

Basal area in each Stand will be reduced as determined by the individual species overall health and the lack of desired hardwood regeneration. Specific basal area reduction can be reviewed in the “%Removal” column in tables for each of three respective Stands (Tables 1, 2, and 3). In Compartment 6, Stand 16, 186 acres will be treated, as well as 75 acres in Compartment 8, Stand 1, and 136 acres in Compartment 8, Stand 8. Pine stands within the treatment area of Compartment 8, Stand 1 are monocultures and will be thinned to promote growth of herbaceous vegetation and interspersions of oak.

Dead trees tallied during the inventory resulted in approximately 3 dead trees/acre in Compartment 6, Stand 16, 3.1 dead trees/acre in Compartment 8, Stand 1, and 3.3 dead trees/acres in Compartment 8, Stand 8 (Tables 1, 2, and 3 - “Stems/Acre”). These trees along with den trees and trees with splits will be retained. This combined with the natural recruitment of diseased and dying timber will provide quality roosting habitat for bat species. Additionally, shellbark hickory (*Carya laciniosa*) and sycamore (*Platanus occidentalis*) will be favored and retained (“% Removal” Table 1) for their exterior characteristics and den qualities.

Perennial and intermittent streams and wet weather drains that exist within the project area have been delineated and will be avoided during TSI operations.

Haul will consist of preexisting agricultural roads, abandoned farm roads, field edges, and wildfire plow lines. Landings will be established where necessary on ridge tops and flat areas suitable for access and appropriate to minimize soil disturbance

Physical treatment of all stands will take approximately one year to complete. This timeline may be reduced or slightly exceeded during periods of above-average precipitation.

Table 1. Summary of forest stand composition for 186 acres within Compartment 6, Stand 16, USACE, Lake Wappapello, Wayne County, Missouri. (BA = Basal Area)

| Species | Stems/Acre | %Forest | Volume | BA | % Remove | Residual |
|----------------------|-------------|-----------|----------|----------|----------|----------|
| White Oak | 6.33 | 23 | 1407 | 50 | 30 | 35 |
| Post Oak | .81 | 3 | 64 | 1 | 10 | .9 |
| Chinquapin Oak | .65 | 2 | 127 | 2 | 10 | 1.8 |
| Black Oak | 4.29 | 15 | 1067 | 30 | 60 | 12 |
| Scarlet Oak | .56 | 2 | 205 | 10 | 60 | 4 |
| S. Red Oak | .38 | 1 | 114 | 1 | 10 | .9 |
| N. Red Oak | .86 | 3 | 438 | 3 | 60 | 1.2 |
| Shellbark Hickory | .25 | <1 | 41 | 1 | 0 | 1 |
| Mockernut Hickory | 1.89 | 7 | 229 | 10 | 40 | 6 |
| Pignut Hickory | .75 | 3 | 458 | 7 | 40 | 4.2 |
| Black Hickory | 1.08 | 4 | 133 | 10 | 40 | 6 |
| Green Ash | .80 | 3 | 94 | 1 | 40 | 6 |
| Sweetgum | 1.40 | 5 | 201 | 10 | 60 | 4 |
| Blackgum | .15 | <1 | 34 | 3 | 60 | 1.2 |
| Elm | .48 | 2 | 0 | 1 | 60 | .4 |
| Sycamore | .41 | 2 | 21 | 2 | 10 | 1.8 |
| Walnut | .05 | <1 | 0 | 1 | 0 | 1 |
| Sugar Maple | 3.61 | 13 | 34 | 11 | 90 | 1.1 |
| Dogwood | .05 | <1 | 0 | 1 | 0 | 1 |
| Mulberry | .05 | <1 | 0 | 1 | 0 | 1 |
| Dead | 2.91 | 10 | 0 | 5 | 0 | 5 |
| Total | 27.76 | 100 | 4667 | 161 | 44% | 90.1 |

Table 2. Summary of forest stand composition for 186 acres within Compartment 8, Stand 1, USACE, Lake Wappapello, Wayne County, Missouri. (BA = Basal Area)

| Species | Stems/Acre | %Forest | Volume | BA | %Remove | Residual |
|-------------------|--------------|------------|---------------|-----------|-----------|-------------|
| White Oak | 4.66 | 9.7 | 801 | 23 | 35 | 15 |
| Post Oak | 3.73 | 7.8 | 226 | 18 | 20 | 14.4 |
| Chinquapin Oak | .66 | 1.4 | 8 | 1 | 0 | 1 |
| Black Oak | 2.01 | 4.2 | 256 | 10 | 60 | 4 |
| Shingle Oak | .27 | .56 | 29.6 | 1 | 0 | 1 |
| S. Red Oak | .93 | 1.9 | 168 | 4 | 10 | 3.6 |
| N. Red Oak | .66 | 1.4 | 120 | 1 | 10 | .9 |
| Mockernut Hickory | 2.13 | 4.5 | 100 | 5 | 10 | 4.5 |
| Pignut Hickory | .53 | 1.1 | 0 | 1 | 10 | .9 |
| Shellbark Hickory | .13 | .27 | 6.3 | 1 | 0 | 1 |
| Black Hickory | 1.19 | 2.5 | 68 | 3 | 10 | 2.7 |
| Green Ash | .15 | 3.1 | 42 | 1 | 50 | .5 |
| Sweet Gum | .13 | .27 | 10 | 1 | 10 | .9 |
| Black Gum | .13 | .27 | 0 | 1 | 0 | 1 |
| Elm | 4.92 | 10.3 | 0 | 3 | 30 | 2.1 |
| Sycamore | .13 | .27 | 0 | 1 | 0 | 1 |
| Cherry | .40 | .84 | 0 | 1 | 0 | 1 |
| Sugar Maple | .66 | 1.4 | 0 | 1 | 90 | .1 |
| Shortleaf | 5.86 | 12.2 | 738 | 29 | 50 | 14.5 |
| Dogwood | .54 | 1.1 | 0 | 1 | 0 | 1 |
| Cedar | .27 | .56 | 0 | 1 | 20 | .8 |
| Dead | 3.07 | 6.4 | 0 | 2 | 0 | 2 |
| Total | 27.86 | 100 | 2572.9 | 99 | 25 | 73.9 |

Table 3. Summary of forest stand composition for 186 acres within Compartment 8, Stand 8, USACE, Lake Wappapello, Wayne County, Missouri. (BA = Basal Area)

| Species | Stems/Acre | %Forest | Volume | BA | % Remove | Residual |
|----------------------|------------|-------------|----------|----------|----------|----------|
| White Oak | 8.01 | 27.8 | 1821 | 40 | 35 | 26 |
| Post Oak | .66 | 2.29 | 78 | 1 | 20 | .8 |
| Shingle Oak | 1.25 | 4.2 | 90 | 5 | 30 | 3.5 |
| Black Oak | 2.50 | 8.7 | 1228 | 20 | 60 | 8 |
| Scarlet Oak | 8.84 | 30.8 | 677 | 40 | 60 | 16 |
| S. Red Oak | .14 | .48 | 5 | 1 | 10 | .9 |
| N. Red Oak | .35 | 1.04 | 74 | 1 | 30 | .7 |
| Mockernut Hickory | .58 | 2.02 | 65 | 1 | 10 | .9 |
| Pignut Hickory | .14 | .48 | 9 | 1 | 10 | .9 |
| Green Ash | .22 | .77 | 10 | 1 | 50 | .5 |
| Black Gum | .07 | .24 | 25 | 1 | 0 | 1 |
| Elm | .59 | 2.05 | 0 | 1 | 0 | 1 |
| Sycamore | .07 | .24 | 0 | 1 | 0 | 1 |
| Walnut | .07 | .24 | 0 | 1 | 0 | 1 |
| Sugar Maple | 2.06 | 7.2 | 12 | 10 | 90 | 1 |
| Shortleaf | .14 | .48 | 22 | 1 | 30 | .7 |
| Dogwood | .15 | .52 | 0 | 1 | 0 | 1 |
| Cedar | .07 | .24 | 0 | 1 | 0 | 1 |
| Dead | 3.3 | 11.5 | 0 | 3 | 0 | 3 |
| Total | 28.71 | 100 | 4116 | 119 | 36 | 76.1 |

1.1 Conservation Measures

Conservation measures represent action pledged in the project description that the action agency will implement to further the recovery of the species under review. Conservation measures implemented to minimize harm to listed species which are proposed by the action agency are considered part of the project and their implementation is required under the terms of this consultation. The following conservation measures were proposed in the USACE BA, dated September, 2012.

1. Dead trees tallied during the inventory resulted in approximately 3 dead trees/acre in Compartment 6, Stand 16, 3.1 dead trees/acre in Compartment 8, Stand 1, and 3.3 dead trees/acres in Compartment 8, Stand 8 (Tables 1, 2, and 3 - "Stems/Acre"). These trees along with den trees and trees with splits will be retained.
2. Snag retention combined with the natural recruitment of diseased and dying timber will provide quality roosting habitat for bat species beyond the baseline of 3.0-3.3 dead trees/acre. Additionally, shellbark hickory (*Carya laciniosa*) and sycamore (*Platanus occidentalis*) will be favored and retained for their exterior characteristics and den qualities.
3. Tree felling will be conducted outside of the maternity season for the Indiana bat, to the extent practicable, to avoid direct take as a result of this action.

2. Status of the Species

This section presents the biological or ecological information relevant to formulating this BO. Appropriate information on the species' life history, its habitat and distribution, and other data on factors necessary to its survival are included to provide background for analysis in later sections. This analysis documents the effects of past human and natural activities or events that have led to the current range-wide status of the species. Portions of this information are also presented in listing documents, the recovery plan (USFWS 1983), and the draft recovery plan, first revision (USFWS 2007), and are referenced accordingly.

2.1 Species Description and Life History

The Indiana bat is an insectivorous, temperate, medium-sized bat that migrates annually from winter hibernacula to summer habitat in forested areas. The bat has a head and body length that ranges from 41 to 49 mm, with a forearm length of 35 to 41 mm. The fur is described as dull pinkish-brown on the back but somewhat lighter on the chest and belly, and the ears and wing membranes do not contrast with the fur (Barbour and Davis 1969). Although the bat resembles the little brown bat and the northern long-eared bat, it is distinguished by its distinctly keeled calcar and a long, pointed, symmetrical tragus.

Generally, Indiana bats hibernate from October through April (Hall 1962, LaVal and LaVal 1980), depending upon local weather conditions. Figure 1 provides a depiction of the annual cycle. They hibernate in large, dense clusters, ranging from 300 bats per

square foot to 484 bats per square foot (Clawson et al. 1980, Clawson, pers. observ. October 1996 in USFWS 2000). Upon arrival at hibernating caves in August-September, Indiana bats "swarm," a behavior in which large numbers of bats fly in and out of cave entrances from dusk to dawn. Relatively few bats roost in the caves during the day, but instead often use trees and snags as day roosts (Cope and Humphrey 1977). Swarming continues for several weeks and mating occurs during the latter part of the period. Fat supplies are replenished as the bats forage prior to hibernation.

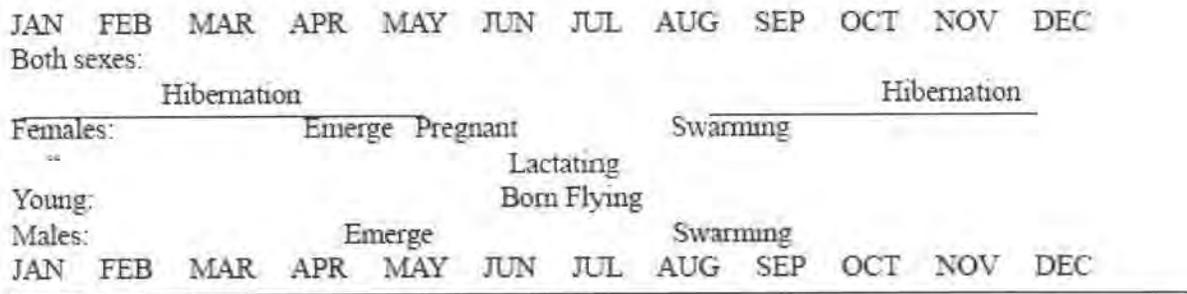


Figure 1. Indiana Bat Annual Chronology

Females emerge from hibernation ahead of males; most winter populations leave by early May. Some males spend the summer near hibernacula in Missouri (LaVal and LaVal 1980) and West Virginia (Stihler, pers. observ. October 1996, in USFWS 2000). In spring when fat reserves and food supplies are low, migration is probably hazardous (Tuttle and Stevenson 1977). Consequently, mortality may be higher in the early spring, immediately following emergence.

Females may arrive in their summer habitats as early as April 15 in Illinois (Gardner et al. 1991, Brack 1979). During this early spring period, a number of roosts (e.g., small cavities) may be used temporarily, until a roost with larger numbers of bats is established. Humphrey et al. (1977) reported that Indiana bats first arrived at their maternity roost in early May in Indiana, with substantial numbers arriving in mid-May. Birth of young occurs in late June and early July (Easterla and Watkins 1969, Humphrey et al. 1977) and the young are able to fly between mid-July and early August (Mumford and Cope 1958, Cope et al. 1974, Humphrey et al. 1977, Clark et al. 1987, Gardner et al. 1991, Kurta et al. 1996). Female Indiana bats exhibit strong site fidelity to summer roosting and foraging areas. That is, they return to the same summer range annually to bear their young (Garner and Gardner 1992).

Trees in excess of 16 inch diameter at breast height (dbh) with exfoliating bark are considered optimal for maternity colony roost sites, but trees in excess of 9 inch dbh appear to provide suitable maternity roosting habitat (Romme et al. 1995). Cavities and crevices in trees may also be used for roosting. In Illinois, Gardner et al. (1991) found that forested stream corridors and impounded bodies of water were preferred foraging habitats for pregnant and lactating Indiana bats.

After the summer maternity period, Indiana bats migrate back to traditional winter hibernacula. Some male bats may begin to arrive at hibernacula as early as July.

Females typically arrive later and by September the number of males and females are present in comparable numbers. Autumn “swarming” occurs prior to hibernation. During swarming, bats fly in and out of cave entrances from dusk to dawn and use trees and snags as day roosts. By late September many females have entered hibernation, but males may continue swarming well into October in what is believed to be an attempt to breed with late arriving females.

Male Indiana bats may be found throughout the entire range of the species. Males appear to roost singly or in small groups, except during brief summer visits to hibernacula. Males have been observed roosting in trees as small as 3 inch dbh, but the average roost diameter for male Indiana bats is 13” (USFWS 2007).

2.2 Diet and Foraging

Indiana bats forage over a variety of habitat types but prefer to forage in and around the tree canopy of both upland and bottomland forest, along roads, or along the corridors of small streams. Bats forage at a height of approximately 2-30 meters under riparian and floodplain trees (Humphrey et al. 1977). They forage between dusk and dawn and feed exclusively on flying insects, primarily moths, beetles, and aquatic insects. Females in Illinois were found to forage most frequently in areas with canopy cover of greater than 80%, and typically utilize larger foraging ranges than males (Garner and Gardner 1992).

2.3 Range and Population Dynamics

The historical summer range of the Indiana bat is thought to be similar to its modern range. However, the bat has been locally extirpated due to fragmentation and loss of summer habitat. The current species range includes much of the eastern half of the United States, from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida.

Based on censuses taken at all hibernacula, the total known Indiana bat population was estimated to number about 440,708 bats in 2011 (Figure 2). Population trend data showed a steady increase from 2001 to 2007, a drop in 2009, and then an increase in 2011. The 2011 estimate included 16,000+ Indiana bats discovered at a new hibernaculum in Missouri (Shauna Marquardt, USFWS, pers. comm. 2012). Population estimates for 2012-2013 in Missouri will reflect a more thorough survey and bat count of the new hibernaculum and will reflect an estimated 90,000¹ Indiana bats found at the new location (Shauna Marquardt, USFWS, pers. comm. 2013).

¹ 2012-2013 population estimates are currently being calculated and verified and are subject to change. Final estimates will be posted at www.fws.gov/midwest/Endangered/mammals/inba.

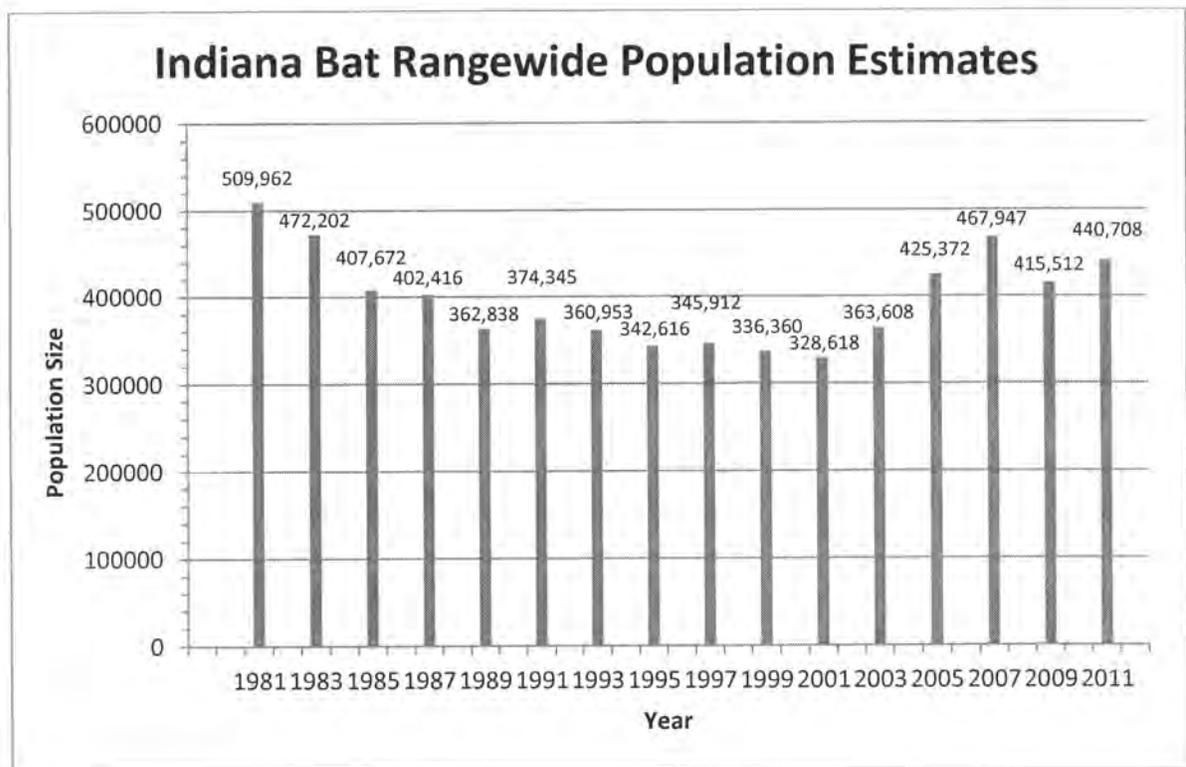


Figure 2. Indiana bat rangewide population estimates from 1981 – 2011 (www.fws.gov/midwest/Endangered/mammals/inba/pdf/2011inbaPopEstimate04Jan12.pdf, (Shauna Marquardt, USFWS, pers. comm. 2011).

2.4 Status

The Indiana bat (*Myotis sodalis*) was listed as an endangered species on March 11, 1967 (Federal Register 32(48):4001) under the Endangered Species Preservation Act of October 15, 1966 (80 Stat. 926; 16 U. S. C. 668aa(c)). The reasons for listing the species were summarized in the original Recovery Plan (USFWS 1983) were: declines in populations at major hibernacula despite efforts to implement cave protection measures, the largest known hibernating population at Pilot Knob Mine, Missouri continued to be threatened due to mine collapse, and other hibernacula throughout the species range were not adequately protected.

Eleven caves and two mines in six states were listed as critical habitat on September 24, 1976 (41 FR 41914). These sites along, with other known hibernacula, were classified in the Indiana Bat Recovery Plan as Priority 1, containing at least 30,000 bats; Priority 2, containing 1,000 to 30,000; and Priority 3 with less than 1,000 bats (USFWS 1983).

The 2007 draft revised recovery plan changes the Priority 1 limits from 30,000 to containing at least 10,000 bats, and further divides Priority 1 hibernacula into two subcategories, “A” and “B”, depending on their recent populations sizes (USFWS 2007). Priority 1A hibernacula are those that have held 5,000 or more Indiana bats during one or more winters surveys conducted during the past 10 years. Priority 1B hibernacula are

those that sheltered > 10,000 Indiana bats at some point in their past, but have consistently contained fewer than 5,000 bats over the past 10 years (USFWS 2007). Priority 2 hibernacula in the 2007 revised recovery plan have a current or observed population of 1,000 or greater but fewer than 10,000 Indiana bats (USFWS 2007). The draft recovery plan also includes Priority 3 hibernacula with 50 – 1,000 bats, and Priority 4 hibernacula with fewer than 50 bats.

The current revised recovery plan (USFWS 2007) also delineates recovery units based on population discreteness, differences in population trends, and broad level differences in land-use and macrohabitats. There are currently four recovery units for the Indiana bat: Ozark-Central, Midwest, Appalachian Mountains, and Northeast.

2.5 Reasons for Decline

Not all of the causes of Indiana bat population declines have been determined. Although several known human-related factors have caused declines in the past, they may not solely be responsible for recent declines.

Documented causes of Indiana bat population decline include:

Disturbance and vandalism. A major cause of Indiana bat decline has been human disturbance of hibernating bats during the decades of the 1960s through the 1980s. Bats enter hibernation with only enough fat reserves to last until spring. When a bat is aroused, as much as 68 days of fat supply is used in a single disturbance (Thomas et al. 1990). Human use (e.g., including recreational cavers and researchers) near hibernating Indiana bats can cause arousal (Humphrey 1978, Thomas 1995, Johnson et al. 1998). If this happens too often, the bats' fat reserves may be exhausted before the species is able to forage in the spring.

Active programs by State and Federal agencies have led to the acquisition and protection of a number of Indiana bat hibernacula. Of 127 caves/mines with populations >100 bats, 54 (43%) are in public ownership or control, and most of the 46 (36%) that are gated or fenced are on public land. Although such conservation efforts have been successful in protecting Indiana bats from human disturbance, they have not been sufficient to reverse the downward trend in many populations.

Improper cave gates and structures. Some hibernacula have been rendered unavailable to Indiana bats by the erection of solid gates in the entrances (Humphrey 1978). The exclusion of Indiana bats from caves and changes in air flow have caused major losses in some hibernating populations of Indiana bats in Indiana, Kentucky, and Missouri (USFWS 2007). Improperly constructed or engineered cave gates modified the climate of hibernacula and Indiana bats were unable to survive the winter because changes in air flow elevated temperatures caused an increase in metabolic rate and a premature exhaustion of fat reserves (Richter et al. 1993).

Natural hazards. Indiana bats are subject to a number of natural hazards. River flooding in Bat Cave, Mammoth Cave National Park, drowned large numbers of Indiana bats (Hall 1962). Other cases of hibernacula being flooded have been recorded by Hall (1962) and DeBlase et al. (1965), (USFWS 2007). A case of internal cave flooding occurred when tree slash and debris (produced by forest clearing to convert the land to pasture) were bulldozed into a sinkhole, blocking the cave's rain water outlet and drowning an estimated 150 Indiana bats (USFWS 2007).

Another hazard exists because Indiana bats hibernate in cool portions of caves that tend to be near entrances, or where cold air is trapped. Some bats may freeze to death during severe winters (Humphrey 1978, Richter et al. 1993). Temperatures within maternity roosts can also affect Indiana bats. Development of young bats is directly affected by temperatures inside the roost (Tuttle 1975, Racey 1982). Humphrey et al. (1977) reported that a cold summer delayed the recruitment of Indiana bats by 2.5 weeks and the completion of migration by 3 weeks exposing bats to freezing weather at the nursery and possibly affecting mortality, autumn mating, or fat storage for winter (USFWS 2007).

Suspected causes of Indiana bat decline include:

Microclimate effects. Changes in the microclimates of caves and mines may have contributed more to the decline in population levels of the Indiana bat than previously estimated (Tuttle, in lit. August 4, 1998). Entrances and internal passages essential to air flow may become larger, smaller, or close altogether, with concomitant increases or decreases in air flow. Blockage of entry points, even those too small to be recognized can be extremely important in hibernacula that require chimney-effect air flow to function.

Land use practices. The Indiana bats' maternity range has changed dramatically since pre-settlement times (Schroeder 1981; Giessman et al. 1986; MacCleery 1992; Nigh et al. 1992). Most of the forest in the upper Midwest has been fragmented, fire has been suppressed, and native prairies have been converted to agricultural crops or to pasture and hay meadows for livestock. Native plant species have been replaced with exotics in large portions of the maternity range, and plant communities have become less diverse than occurred prior to settlement. Additionally, numerous chemicals are applied to these intensely cropped areas.

In the eastern U. S., the area of land covered by forest has been increasing in recent years (MacCleery 1992; Iverson 1994; Crocker et al. 2006). Whether or not this is beneficial to the Indiana bat is unknown. The age, composition, and size class distribution of the woodlands will have a bearing on their suitability as roosting and foraging habitat for the species outside the winter hibernation season. It is likely that the closing of forest canopies due to fire suppression and over stocked stands has been detrimental to the species because in addition to high quality roost trees, maternity colonies need some openness to the canopy for thermoregulation and to facilitate foraging (Romme et al. 1995).

Chemical contamination. Pesticides have been implicated in the declines of a number of insectivorous bats in North America (Mohr 1972, Reidinger 1972, Reidinger 1976, Clark

and Prouty 1976, Clark et al. 1978, Geluso et al. 1976, Clark 1981). The effects of pesticides on Indiana bats have yet to be studied. McFarland (1998) studied two sympatric species; the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*M. septentrionalis keenii*) as surrogates in northern Missouri and documented depressed levels of acetylcholinesterase, suggesting that bats there may be exposed to sublethal levels of organophosphate and/or carbamate insecticides applied to agricultural crops. McFarland (1998) also demonstrated that bats in northern Missouri are exposed to significant amounts of agricultural chemicals, especially those applied to corn. BHE Environmental, Inc. (1999) collected tissue and guano samples from five species of bats at Fort Leonard Wood, Missouri and documented the exposure of bats to p,p'-DDE, heptachlor epoxide, and dieldrin.

New Threats/Disease epidemics. White Nose Syndrome (WNS): WNS was first documented in New York in February of 2006 and has since been confirmed in 19 states and 4 Canadian Provinces (www.whitenosesyndrome.org/resources/map). It is currently unknown if WNS is the primary cause or a secondary indicator of another pathogen, but it has been correlated with erratic behavior such as early or mid-hibernation arousal that leads to emaciation and mortality in several species of bats, including the Indiana bat (<http://whitenosesyndrome.org/>; www.fws.gov).

Overall mortality rates, primarily of little brown bats, have ranged from 90 to 100 percent in hibernacula in the northeastern United States (www.whitenosesyndrome.org). It is currently estimated that 5.7 to 6.7 million bats have died from WNS in infected regions (www.whitenosesyndrome.org/about-white-nose-syndrome). Apparent losses of 685 Indiana bats in Hailes Cave and all but 124 of 13,014 Indiana bats in the Williams Preserve Mine in New York were documented during the first winter WNS was observed at each site. Additionally, Indiana bat surveys conducted at hibernacula in New York during early 2008 estimated the population declined 15,662 bats, which represents 3.3% of the 2007 revised rangewide population estimate.

WNS is thought to be transmitted by direct bat contact with an infected bat and by transmission of the causative agent from cave to cave. The distribution of WNS appears to be expanding in all directions from its epicenter in Albany and Schoharie Counties, New York. Between 2007 and 2008, it was documented to have spread from a 9 km radius to a 200 km radius, and at the end of the 2008-2009 winter, it was documented in all major hibernacula in New York. Most recently it has been found in eastern Missouri, northern Alabama, and suspected in eastern Iowa. The Service and partners are conducting research to develop management strategies to reduce the spread and impacts of WNS. However, it remains a significant and immediate threat to the Indiana bat.

In response to many of these threats and in accordance with Federal law, a revised recovery plan has been drafted for the species that outlines strategies and actions believed to be necessary for the recovery of a species. In sum, the objectives of the Recovery Plan are to: (1) protect hibernacula; (2) maintain, protect, and restore summer maternity habitat; and (3) monitor population trends through winter censuses.

At the time the revised recovery plan was drafted in 2007, the causative agent for WNS had not yet been discovered and the additive impacts to the already declining Indiana bat were not yet considered. Given the documented deaths of Indiana bat due to WNS in the Northeast since 2006, the species is further threatened with extinction. Numerous research projects have been completed and are ongoing at a rapid rate since the first discovery of WNS, a national response plan has been completed (available at www.whitenosesyndrome.org), multiple states and agencies have approved or are in the process of developing response action plans, and various management actions have been undertaken to slow the spread of the disease (e.g., cave closures, the development of decontamination protocols, etc.). Despite these efforts, there is no known cure for the disease and all bats in North America that hibernate in caves could be threatened with extinction.

3. Environmental Baseline

The purpose of the environmental baseline is to describe past and ongoing human and natural factors that have contributed to the current status of the species and its habitat in the project vicinity. Range-wide factors affecting the species include those listed previously under Reasons for Decline. Other factors with the potential to adversely affect roosting habitat and foraging include forest clearing by private industry within the summer range in Missouri, woodlot management and wetland drainage by landowners, and other private and municipal land management activities that affect the structure and abundance of forest resources in Missouri.

Even though the majority of maternity roosting habitat for Indiana bats exists in north Missouri, recent surveys have revealed that southeast Missouri also provides summer and maternity habitat for the species, especially along the St. Francis River. Much of the remaining forested land cover classes in south and southeast Missouri suffer from lack of management. This has led to a degraded overall forest component in even-aged stands, diseased and dying trees that have not reached maturity, and undesirable tree species regeneration, which equates to poor habitat conditions for the Indiana bat.

3.1 Status of the Indiana Bat within the Action Area

The action area includes the stands within Compartments 6 and 8 to be treated as well as a 4.02 km (2.5 mi) area around these stands. The action area is in the summer range of the Indiana bat and was defined by what the Service considers to be the home range of a maternity colony (i.e., a radius of 4.02 km or 2.5 mi from a maternity roost). The project area is defined as the three forest stands, 6.16, 8.1, and 8.8.

The 33,571-acre action area is composed of a mix of approximately 235 acres of agricultural fields; 24,507 acres of deciduous forest; 604 acres of evergreen forest; 1,544 acres of woodland; 1937 acres of wetland; 2350 acres of grazing, hay production, and/or grassland; 346 acres of low-intensity urban, barren, impervious, farmstead and associated lands; and 2,048 acres of open water. Forest stands within the project area are dominated

by white oak, black oak, sugar maple, elm, shortleaf pine, and scarlet oak. Oak, hickory, sugar maple and elm are the dominant regeneration species.

From 2003-2008, 12 Indiana bats were captured SW of Greenville, including four adult females, two of which were pregnant. In addition, a primary maternity tree was located in 2011 SW of Greenville; an exit count resulted in a count of 166 bats occupying the tree. Compartment 6 lies within 8.05 km (5 mi) of these records. Stand 16.6 lies 120.7 km (7.5 mi) from the same capture and roost locations.

A bat survey was conducted by the U.S. Forest Service (USFS) and USACE in 2012 near Asher Creek. Asher Creek is SE of Compartment 8, less than 0.8 km (0.5 mi) from the Butler-Wayne County line. A total of 5 Indiana bats were captured, including 2 adult females (one lactating, one post-lactating), and three non-scrotal males. The roost tree was located via radio telemetry and an exit count was conducted revealing 59 bats occupying the tree. Compartment 8 falls within 8.05 km (5 mi) of the Asher Creek records. Stand 8.8 lies approximately 6.4 km (4 mi) from the capture locations, and Stand 8.1 lies approximately 10.5 km (6.5 mi) from the capture locations.

3.2 Factors Affecting the Indiana Bat Environment within and adjacent to the Action Area

Landownership in the action area is approximately 25% private and 75% public, with the public portion being owned and managed by the USACE, USFS Mark Twain National Forest, and Missouri Department of Conservation (MDC). Current land-use in the action area varies. Timber production and forest management activities are implemented on USFS and MDC-managed lands. There are limited agricultural areas with row crops and grazing. Ecosystem restoration and recreational opportunities occur on portions of all public lands in the action area.

4. Effects of the Action

This section includes an analysis of the direct and indirect effects of the proposed action and associated interrelated and interdependent activities on the Indiana bat and all areas potentially used by the species.

The proposed action and associated activities are discussed below in relation to the factors considered. Additionally, the expected response of the species to the listed actions is identified, where applicable.

4.1 Proposed Action

The proposed TSI management strategies through single tree selection would be implemented on approximately 397 acres of forest adjacent to Wappapello Lake. Although no Indiana bats have been captured within the Compartments or Stands, this area likely contains many trees that could potentially provide suitable Indiana bat habitat.

It is possible that some of these trees are being utilized by resident maternity colonies. Whereas, there is no guarantee that a primary or secondary roost tree will not be lost, the action agency has inventoried each forest stand and evaluated all trees relative to their potential to serve as a maternity roost tree. Based on the described TSI prescription and Conservation Measures, trees that are suitable as maternity trees (i.e., trees that have a dbh of 16" or greater, exfoliating bark, cracks, and crevices) will not be felled. Some trees 16" dbh or greater will be felled and removed, but these trees have been verified by a trained resource biologist to not have the characteristics of a maternity roost tree. Potential roost trees that will be felled are more likely to be smaller diameter trees or trees that have less optimal bark characteristics that could be used by males and non-reproductive females during summer or by migrating individuals in the spring and fall.

The proposed activities are intended to improve forest health in the future and improve foraging and roosting opportunities for Indiana bats and other forest wildlife. Some of the impacts would be temporary, such as loss of a roost tree. Senescence of trees within the stands would provide a long-term supply of potential roost trees. Dead trees and other trees with qualities that provide roosting opportunities will be left standing to provide roosting opportunities in the short-term. The likely behavioral response of bats returning in the spring if a previously utilized tree was removed will be to disperse to adjacent suitable habitat. However, dispersal to adjacent suitable habitat may affect the bat in the short term by causing increased energetic demands, exposure to inter and intra-specific competition, and exposure to predation while searching unfamiliar habitat for new roosting and foraging areas if high quality roosting habitat is not available in close proximity to their previous maternity area. The proposed TSI practices that include single tree selection ensure availability of quality roosting habitat within the project area.

Tree felling will be conducted outside of the maternity season for the Indiana bat, to the extent practicable, to avoid direct take as a result of this action. However, because of unfavorable weather conditions and the reluctance to impact forest soils if undertaken during cold winter months, some activities might take place during the active season. Permanent impacts can include direct mortality of Indiana bats if an occupied roost tree is felled, which would most likely be males or non-reproductive females based on the TSI prescription. Because removal of a roost tree while Indiana bats are present may result in killing, injuring, or otherwise harming individuals or a colony, the action agency has proposed in the above Conservation Measures to retain all trees that could provide roosting habitat to avoid direct mortality of individuals. Trees that will be left standing include all dead trees, snags, wolf trees, split trees, trees with cavities. Trees 16" dbh or larger of preferred tree species (white oak, shellbark hickory, sycamore, cottonwood, American elm, shortleaf pine) should be retained as often as possible.

Loss of familiar roost trees and associated foraging habitat, while adverse in the short term, are not expected to have long term consequences for a colony because of the remaining forested habitat within the known foraging range of the Indiana bat (Sparks et.al. 2005) and the propensity of the species to utilize alternative roost sites (Carter and Feldhammer 2005). Additionally, forest management actions implemented in

unmanaged forest habitat will serve to benefit Indiana bats in the long-term by improving foraging and roosting opportunities.

4.2 Interrelated Activities, Interdependent Activities, and Indirect Effects

4.2.1 Interrelated Activities

Haul Roads, Skid Trails, and Landings. Haul roads will consist of agricultural roads, abandoned system roads, wildfire plow lines, and field edges. Landings will be established where necessary on ridge tops and flat areas suitable for access and appropriate to minimize soil disturbance. Landings will be established in locations to avoid the need to remove potential roost trees. Most landings will be sited in naturally open areas or where prior timber harvest has occurred.

4.2.2 Indirect Effects

Indirect effects of the action may include other Federal activities that have not undergone Section 7 consultation but will result from the action under consideration and non-Federal actions that might reasonably be expected to occur in the future as a result of the subject action. In this consultation, the Service considered the potential for such future activities on the action area and determined that other additional Federal activities in the action area are reasonably certain to occur include treatment of additional stands with TSI and prescribed burning. It is also possible that actions by individual landowners could occur in the action area and include activities such as timber harvest.

We expect that potentially occupied trees may be cut to preserve human health and safety while the bats are present in the area. In addition, tree clearing and general silviculture practices as part of forest management or landscaping scheduled during the hibernation period could also result in the further removal of roost trees, rendering them unavailable to pregnant bats that exhibit roosting area and/or roost tree fidelity following migration in the spring. However, decreases in the long-term reproductive success and viability of the colony in the area are unlikely because of the remaining habitat on the surrounding landscape. Additionally, the anticipated benefits of the conservation measures proposed by the action agency will help reduce impacts to individual bats and provide roosting habitat.

5. Cumulative Effects

Cumulative effects include the effects of future State, local or private actions that are reasonably certain to occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Act.

University Forest Conservation Area, owned and managed by the MDC, lies within the action area. Although specific projects are unknown, activities that are on-going and

likely to continue into the future include forest ecosystem restoration and enhancement to benefit forest health and wildlife.

To date, much of the private land interspersed among public lands in the action area have undergone intensive timber harvest. If such activities have not occurred on existing forest stands, they are likely to occur in the future.

Wayne County was quarantined for emerald ash borer (*Agrilus planipennis*) in 2008. Quarantines are in place to prevent infested ash firewood, logs or nursery trees from being transported and starting new infestations. Ash logs that are cut to go to market must be taken to a certified mill. Other methods that are implemented on State, local, and private land include phloem reduction which was slash and burn of ash trees within the highly infested area to remove the availability of the desired host.

6. Conclusion

After reviewing the current status of the Indiana bat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed project is not likely to jeopardize the continued existence of the Indiana bat. There is no critical habitat for the Indiana bat in the project area, and therefore, destruction or adverse modification of critical habitat as a result of the project is not foreseen.

Implementation of the proposed project, however, will temporarily have negative effects to summer habitat for both female and male Indiana bats. Potential modification to Indiana bat habitat in the project area includes the removal of roost trees and disruption of normal foraging and sheltering behavior in response to short-term habitat modifications. If occupied roost trees are felled during the active season, direct mortality could occur. Given the presence of the Indiana bat in the project area and the level of habitat modification proposed, it is unlikely that all adverse impacts can be avoided, and therefore, take will occur. However, the proposed conservation measures offered by the applicant and the Reasonable and Prudent Measures in conjunction with the Terms and Conditions identified by the Service in the Incidental Take Statement are anticipated to minimize the level of impact such that neither reproductive success nor survival of the species will be further reduced or appreciably affected.

7. Incidental Take Statement

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibits the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns, including breeding, feeding,

or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the USACE so that they become binding conditions of any grant, permit, or action for the exemption of Section 7(o)(2) to apply. The USACE has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the USACE (1) fails to assume and implement the terms and conditions, or (2) fails to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit, the protective coverage of Section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the USACE must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement, pursuant to 50 CFR § 402.14(i)(3).

7.1 Extent of Take Anticipated

Felling and removal of trees for TSI, skid trails, and landing establishment will affect resident Indiana bats in the action area. Given the proposed conservation measures, we anticipate that tree removal during the hibernation season and active season will result in take in form of harm, harassment, and death of no more than 12 male or non-reproductive Indiana bats. This is based on the potential presence of 1-12 undetected adult males and non-reproductive females. Because no potential maternity roost trees (i.e. trees that are 16" dbh or greater of the preferred tree species with exfoliating bark, cracks, crevices, etc.) will be removed, take of reproductive females and juveniles is not likely to occur. We expect take to occur within in the period of one year based on the anticipated work schedule of one year to complete activities in all three stands.

Tree removal during the maternity season for purposes of human health and safety, as provided in Section 7.3 Reasonable and Prudent measures and Section 8 Terms and Conditions, may cause take in the form of harm, harassment, or death if undetected bats are present in a felled tree. This action is therefore expected to result in take in the form of harm, harassment, or death, of 1 bat per year per stand (3 bats for the life of the project).

Management activities on the action area that prevent enactment of the conservation measures and/or would significantly increase the number or types of trees removed during the non-hibernation season would be considered to affect this determination and would require reinitiating consultation. Such activities should be documented in the monitoring reports described subsequently.

7.2 Effect of the Take

In the accompanying Biological Opinion, the Service determines that this level of expected take is not likely to result in jeopardy to the species.

7.3 Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of the Indiana bat:

1. Avoid direct mortality of females and non-volant juveniles in maternity roosts
2. Locate, maintain, and monitor known occupied maternity trees
3. Ensure the presence of an adequate short-term supply of roost trees and maintain a continuous, long-term supply of high quality roost trees

8. Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the Act, the Corps must comply with the following terms and conditions. These terms and conditions are non-discretionary.

1. Avoid direct mortality of females and non-volant juveniles in maternity roosts
 - a. All potential maternity roost trees will be retained. Tree characteristics conducive to maternity roosts by Indiana bats will be visually assessed by a trained resource professional. A determination will be made regarding whether or not trees provide maternity roosting opportunities. All trees that provide maternity roosting habitat will not be felled and removed.
 - b. If removal of a potential maternity roost tree larger than 16" dbh is necessary outside of the hibernation period to protect human health and safety, the Service shall be notified, and reasonable effort shall be made to determine if the tree is occupied by one or more Indiana bats. If the tree is determined to be occupied, further coordination with the Service is required.
2. Locate, maintain, and monitor known occupied maternity trees and resident Indiana bat population
 - a. Presence and use of the project area by Indiana bats will be determined through surveys (capture and radio telemetry) and location of primary and alternate maternity roost trees in the project area will be determined, if applicable.
 - b. Prevent the cutting or felling and maintain occupied/active maternity roost trees until they naturally fall to the ground.
 - c. Monitoring of the Indiana bat's use of the project area should be conducted on three occasions to determine the response to the proposed actions and the

efficacy of the Conservation and Reasonable and Prudent Measures. The first monitoring event should be conducted during the maternity season after TSI treatment. Additional surveys should also be conducted two and five years after the first monitoring survey. In order to adequately monitor the response of the bat community or maternity colony, all surveys should encompass the same scope for three consecutive survey efforts to ensure scientific comparability.

- d. To determine the location of occupied roost trees, researchers federally permitted to place radio transmitters on Indiana bats, and who capture the species within the project area during mist-net surveys are required to place a radio transmitter on the first female Indiana bat captured following permit conditions outlined in approved Section 10 (a)(1)(A) Federal permit and report such activities within 24 hours of the Service's Columbia, Missouri Ecological Services Field Office.
 - e. Monitoring results shall be submitted to the Columbia Missouri Ecological Services Field Office of the Service by December 31 of the year in which the monitoring event occurred. Reports must contain:
 - i. Any management or habitat manipulations that have occurred to date
 - ii. The results of the mist netting survey, including number, sex, age (mature or juvenile) and reproductive status of all bat captured, including Indiana bats, if any.
 - iii. Whether or not dead Indiana bats were found in the project area. Should one or more Indiana bats be encountered during the course of the project, the Columbia Missouri Field Office must be notified upon the discovery, and the number, age, sex, and reproductive status of the bat(s) is to be reported.
3. To the maximum extent possible and logistically feasible, provide an adequate short-term supply of high quality roost trees and maintain a continuous, long-term supply of high quality roost trees
 - a. Snags will be created to exceed current baseline habitat (3 snags per acre) conditions in order to provide adequate short-term roosting opportunities. Natural recruitment of snags due to timber harvest will be accepted as created snags.

CLOSING

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the monitoring period, the level of incidental take described above is exceeded, reinitiation of consultation and review of the reasonable and prudent measures is required. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the BA submitted by the USACE for the Wappapello Lake TSI management strategies project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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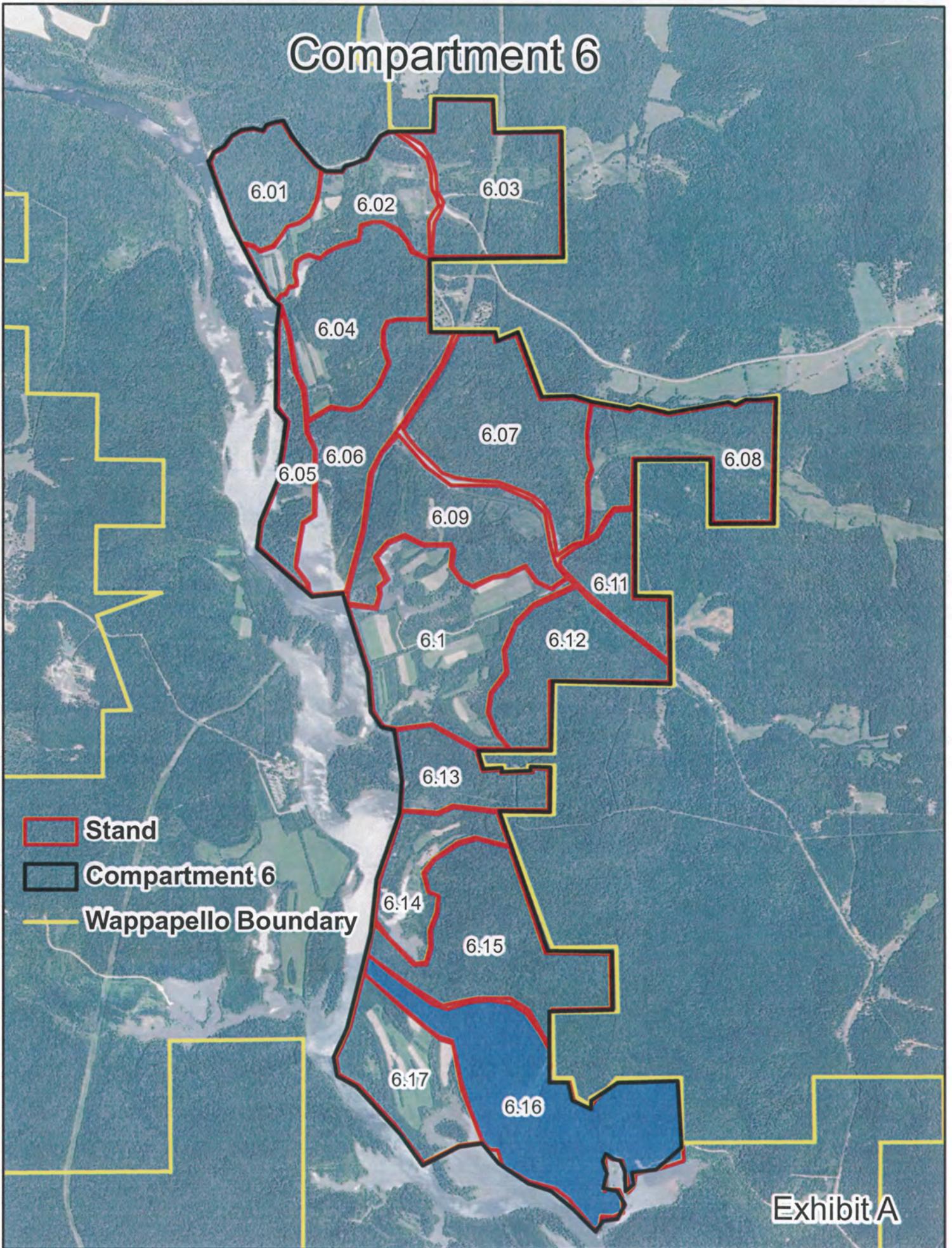
Personal Communication

Andrew King, U.S. Fish and Wildlife Service, 2012.

Shauna Marquardt, U.S. Fish and Wildlife Service, 2012

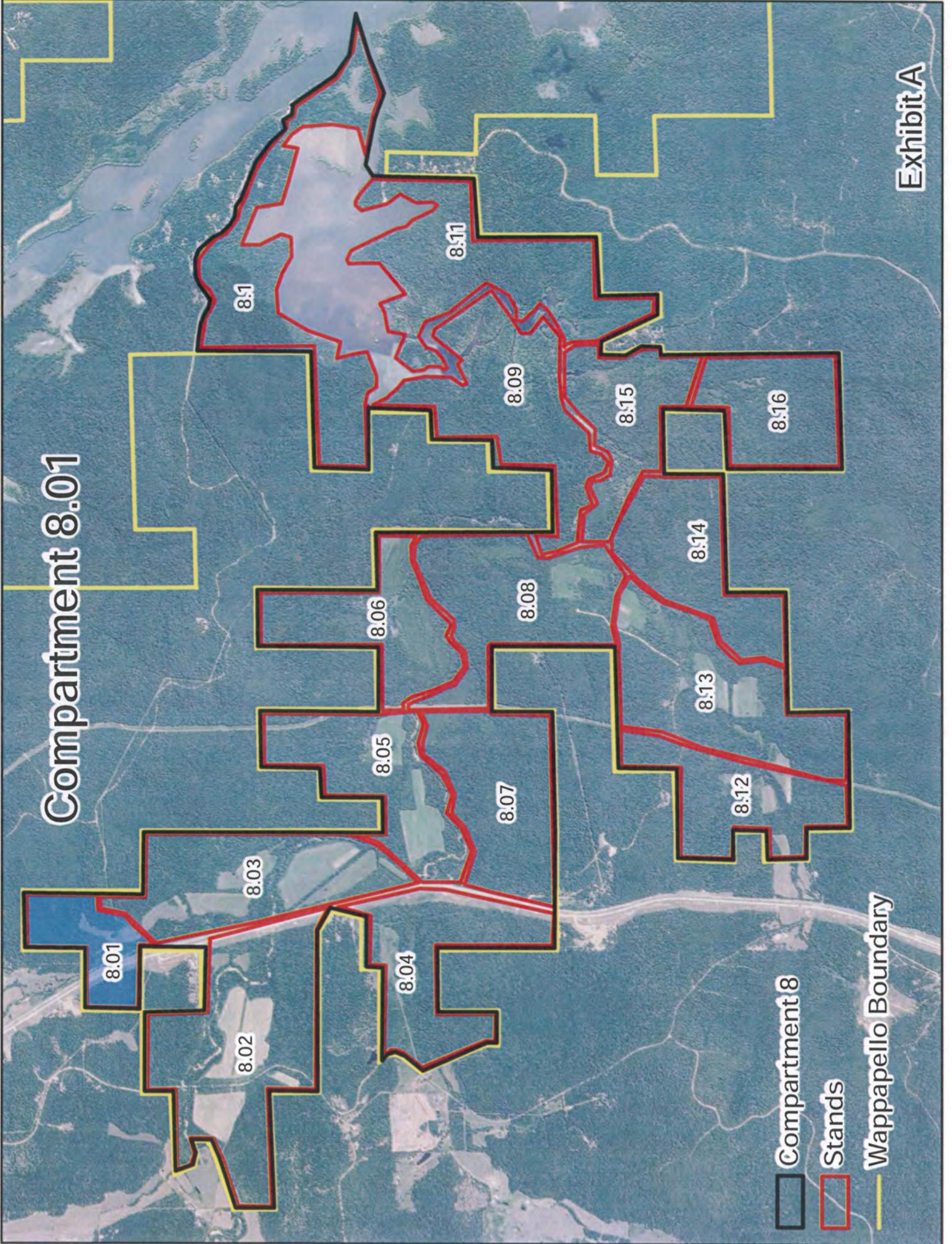
APPENDIX A: Stand maps

Compartment 6



-  Stand
-  Compartment 6
-  Wappapello Boundary

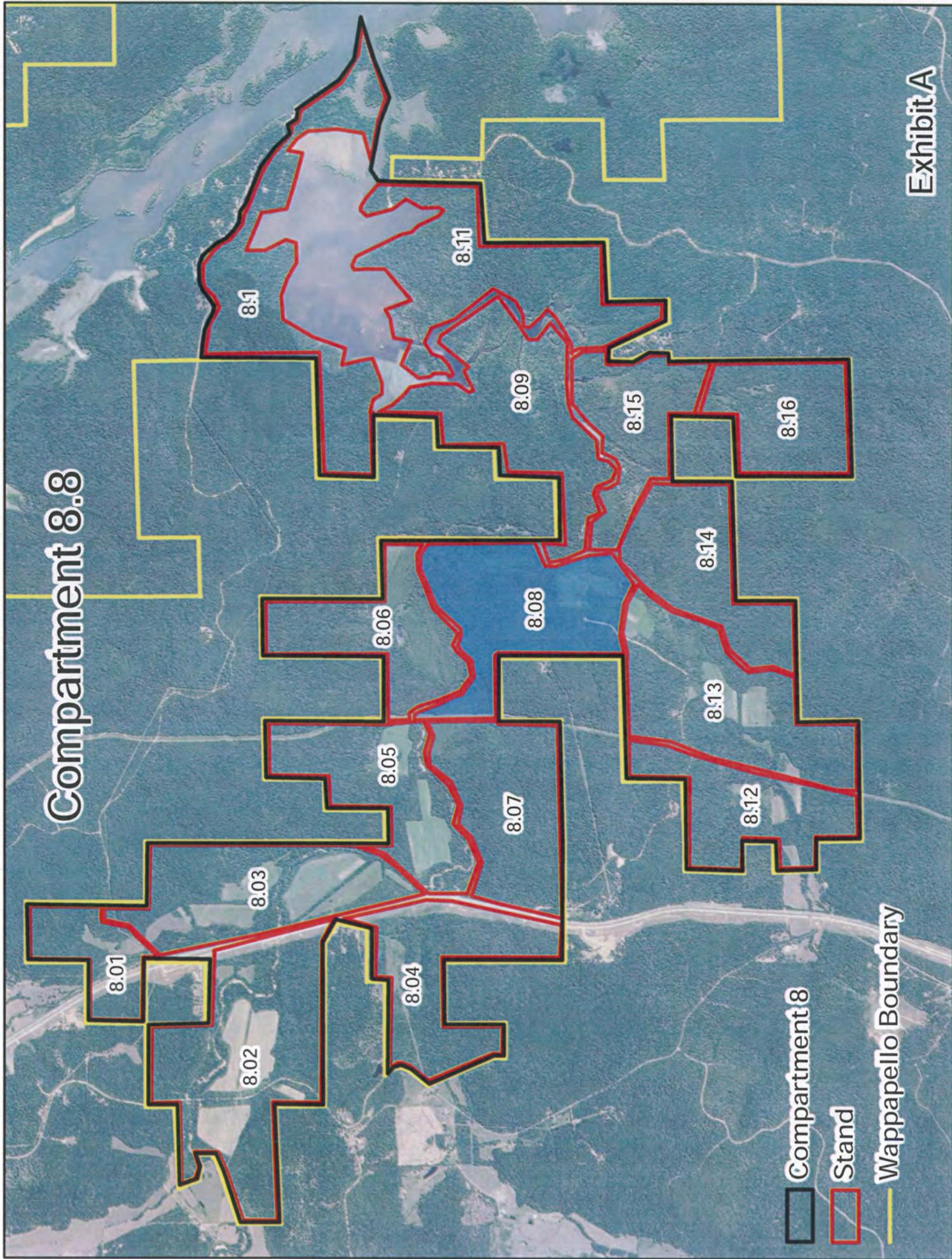
Exhibit A



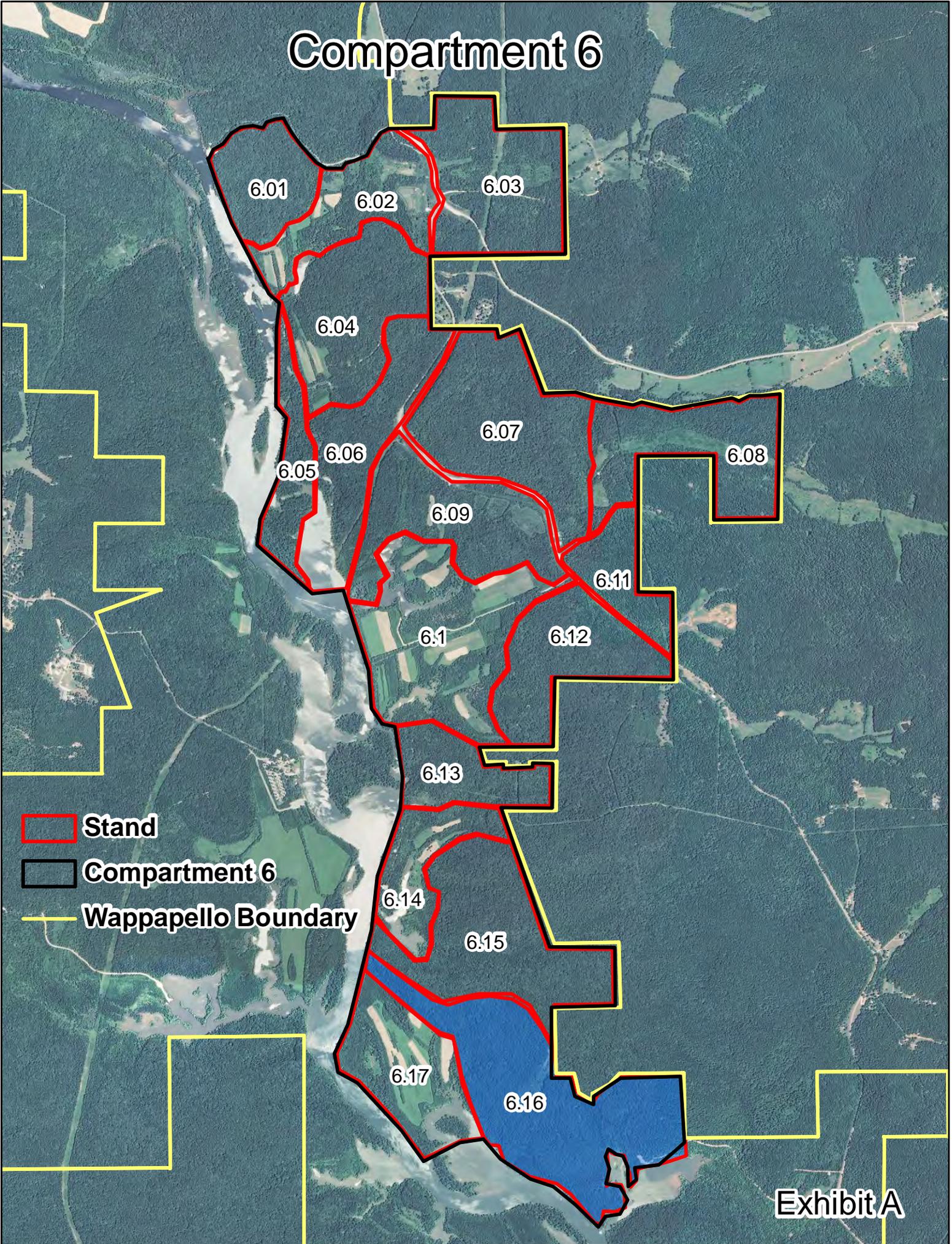
Compartment 8.01

- Compartment 8
- Stands
- Wappapello Boundary

Compartment 8.8

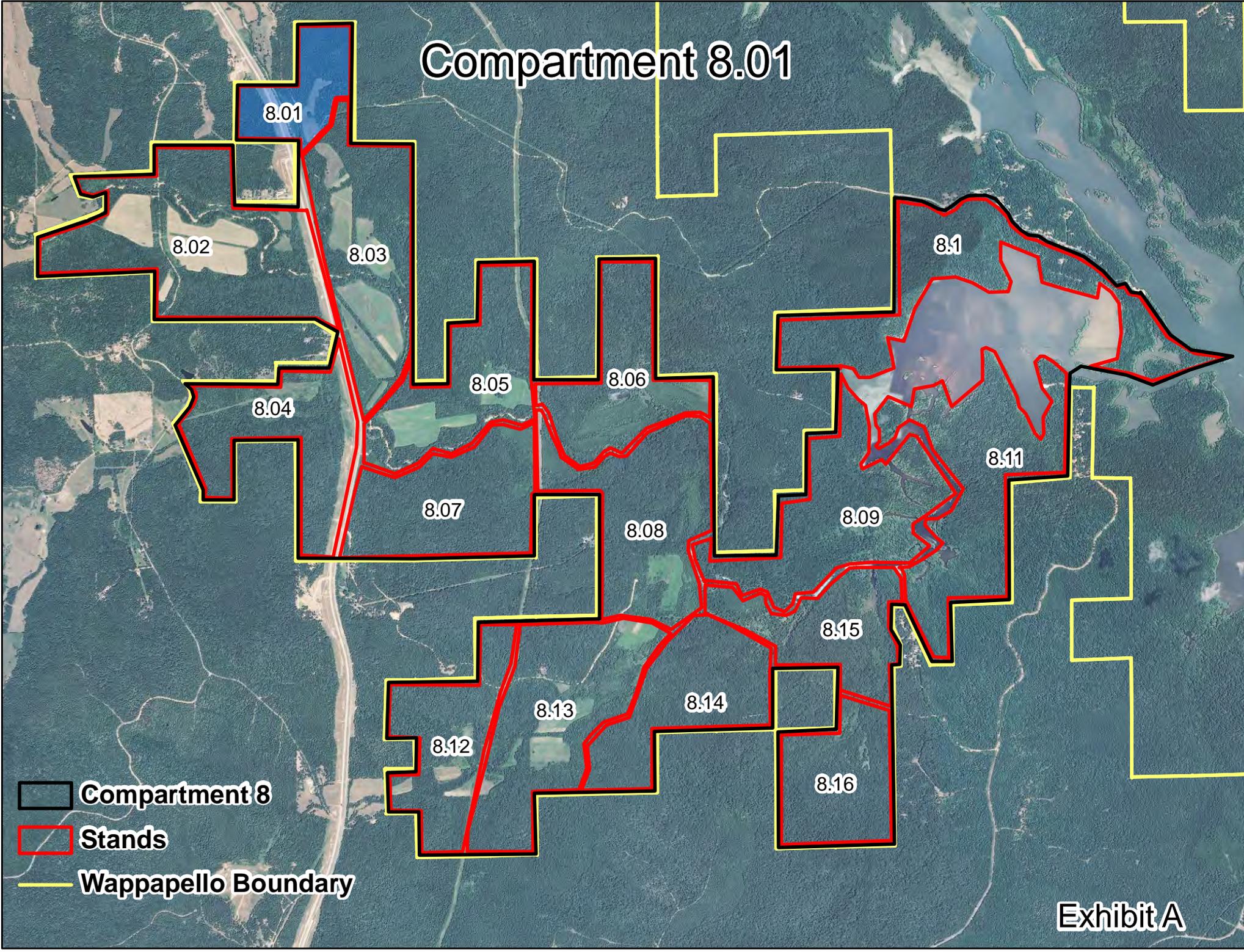


Compartment 6



-  Stand
-  Compartment 6
-  Wappapello Boundary

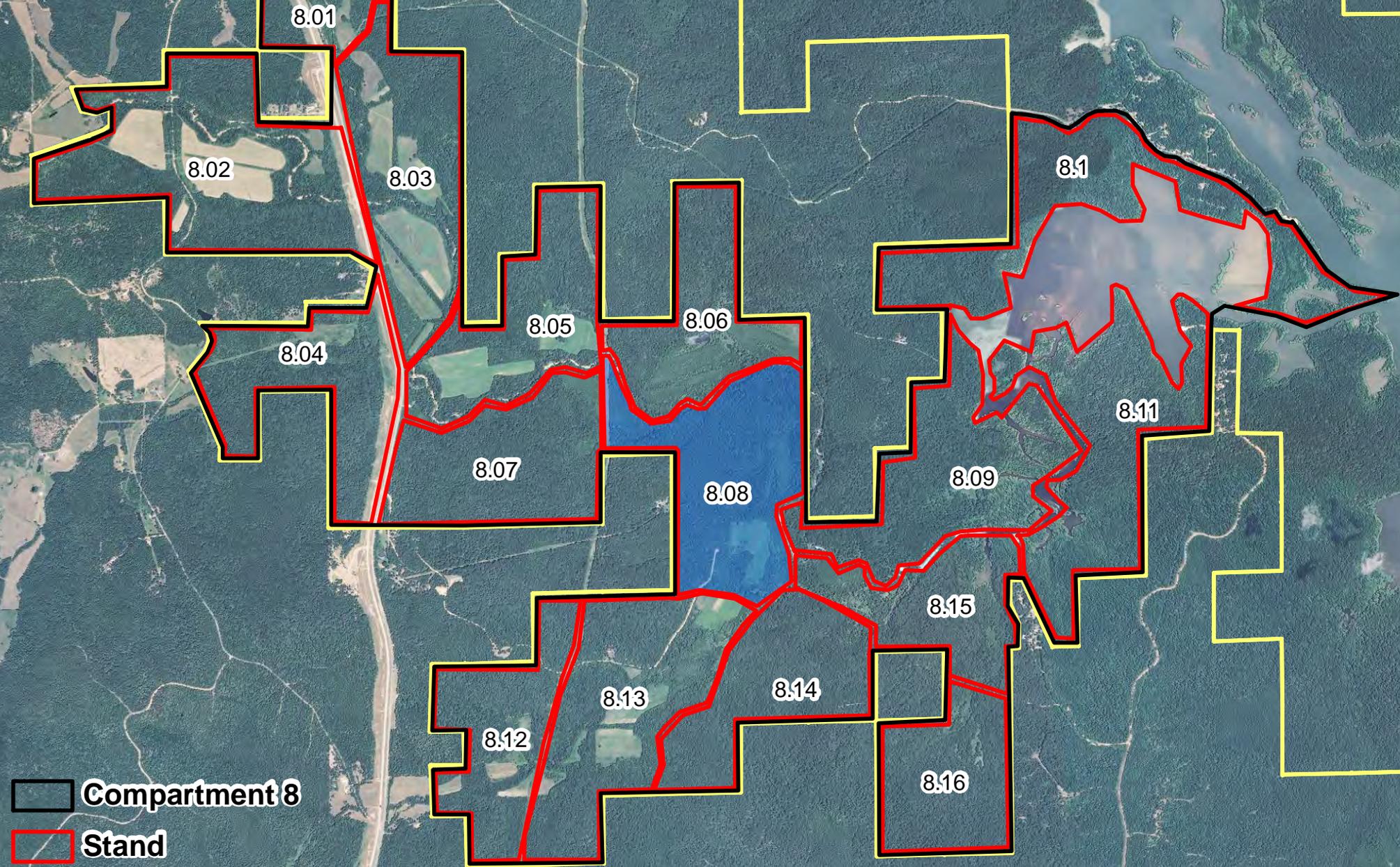
Compartment 8.01



- Compartment 8
- Stands
- Wappapello Boundary

Exhibit A

Compartment 8.8



- Compartment 8
- Stand
- Wappapello Boundary