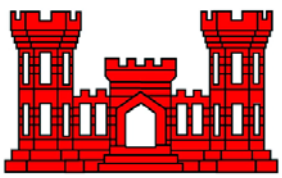
Appendix O

Terrestrial Wildlife



U.S. Army Corps of Engineers
Memphis District

TERRESTRIAL WILDLIFE

Habitat Evaluation Procedures
Analysis and Results

IMPACT ANALYSIS

The Habitat Evaluation Procedures (HEP), USFWS (1980), was used to evaluate impacts of the St. Johns Bayou Basin and New Madrid Floodway Project on terrestrial wildlife habitat. The HEP is an accounting system for quantifying and displaying availability index (HSI) models that quantitatively describe the habitat requirements of a species or group of species. HSI models use measurements of appropriate variables to rate the habitat on a scale of zero (unsuitable) to 1.0 (optimal). Habitat units (HU) are the basic unit of HEP to measure project effects on fish and wildlife and are calculated by multiplying the evaluation species' HSI and the acreage of available habitat at a given target year. Changes in habitat quality (HSI) and quantity (i.e., acreages) are predicted for selected target years over the project's period of analysis for future without-project and future with-project conditions. Those values are then annualized over the period of analysis for the project providing average annual habitat units (AAHUs) for each of the modeled species. The difference in AAHUs under future with-project conditions and versus future without-project conditions provides a quantitative measure of project impacts. A decrease in AAHUs indicates the project will negatively affect the evaluation species; whereas, an increase in AAHUs indicates the project will benefit the evaluation species.

A subgroup of the interagency team was utilized to guide the evaluation, monitor its progress, approve assumptions and intermediate results, and make changes in direction, if needed. The subgroup, composed of biologists from USACE, USFWS, and MDC, selected eight HEP evaluation species to represent the terrestrial wildlife community utilizing three distinct habitat types in the project area: bottomland hardwood habitat (i.e., large bottomland hardwood tracts), riparian ditchbank habitat, and marsh-scrub/shrub habitat. The evaluation species for bottomland hardwood and riparian ditchbank habitats included the fox squirrel (Sciurus niger), barred owl (Stix varia), Carolina chickadee (Parus carolinensis), Pileated woodpecker (Dryocopus pileatus), and mink (Mustela vison). The evaluation species used for marsh or scrub/shrub habitats included red-winged blackbird (Agelaius phoeniceus), great blue heron (Ardea herodias), and muskrat (Ondatra zibethicus). Published HSI models were used for the fox squirrel (Allen, 1982), barred owl (Allen, 1987), pileated woodpecker (Schroeder, 1983a), mink (Allen, 1986), red-winged blackbird (Short, 1985), great blue heron (Short and Cooper, 1985), and muskrat (Allen and Hoffman, 1984). The model for the Carolina chickadee was previously developed by USFWS for projects in the region and was based on an existing model for the Black-Capped Chickadee (Parus atricapillus; Schroder, 1983b). Each of the evaluation species represented a guild (i.e., a group of species utilizing a common environmental resource); thus, habitat changes to any one of the evaluation species would be reflected on all the species within that particular guild. For example, the evaluation species: fox squirrel, barred owl, Carolina chickadee, pileated woodpecker, and mink, would also represent amphibians and reptiles normally associated with riparian ditchbank and bottomland hardwood habitats. Likewise, the evaluation species: red-winged blackbird, great blue heron, and mink, would also represent amphibians and reptiles

normally associated with marsh or scrub/shrub habitats. It is also important to note that additional hydrologic impacts associated with the proposed project are addressed with other habitat models discussed in the EIS (e.g., wetlands, waterfowl, shorebirds, and fisheries).

Habitat variables were measured according to the eight selected HSI models on 12 bottomland hardwood forest plots, 12 riparian ditchbank plots, and 6 marsh scrub/shrub plots in the project area. A map of the HEP plot locations is shown in Attachment 1. Habitat variables measured for each habitat type are shown on the representative impact data sheets in Attachment 2. Each plot was 0.2 acres in area. A description of each habitat type is listed below:

Riparian Ditchbank Habitat

For this analysis, riparian ditchbank habitat was defined as those wooded lands immediately adjacent to the ditches within the project area. Most of this habitat contained various stages of vegetative growth over existing spoil piles which ranged from approximately 3 to 15 feet in height. The vegetative growth ranged from <5 years in age to > 25 years in age depending on the time since the previous cleanout. Observations of this terrestrial wildlife habitat included a dominant overstory of sugarberry and silver maple (~10-12 inches in diameter at breast height (dbh)) with a few larger (~18-24 in. dbh) cottonwoods and red oaks present. Mean dbh of the overstory trees from all HEP plots was less than 16 inches. A dense understory was also observed in this habitat type. All of the ditches adjacent to the riparian ditchbank habitats are considered perennial streams with surface water present 100% of the year; thus, the riverine version of the mink model was used for the impact anlaysis.

Bottomland Hardwood Habitat

For this analysis, bottomland hardwood habitat was defined as those contiguous bottomland hardwood tracts >1,000 acres in size. Some ditches or other bodies of water may extend throughout these habitats, but the contiguous wooded lands extend much larger distances from these bodies of water and generally contained more mature woods than the riparian ditchbank habitats. Observations of this terrestrial wildlife habitat included a dominant overstory of various oak and hickory species with a large number of sugarberry also observed. Mean dbh of the overstory trees from all HEP plots was over 19 inches. Understory was generally less dense than what was observed in the riparian ditchbank habitat. Percent of year with surface water present was calculated from the hydrologic period of record at each HEP plot location for the impact analysis. The palustrine forested (>1,000 acres) version of the mink model was used for the impact analysis of bottomland hardwood habitat.

Marsh or Scrub-Shrub Habitat

For this analysis, marsh or scrub/shrub habitat consisted of either fallow fields (most likely enrolled in WRP/CRP program) or homogenous stands of either small willows or buttonbush. Observations of the fallow fields included a dominant vegetation of cocklebur and Indian hemp. Standing water was present in only a few of the plots located in fallow fields, and each appeared to be

recently flooded (past ~1-2 weeks) from artificial hydrology. Percent of year with surface water present was calculated from the hydrologic period of record at each HEP plot location for the impact analysis. Aquatic macroinvertebrates observed in those plots with standing water included: crayfish, chironomids, backswimmers, water boatmen, predacious diving beetles, and mosquito larvae. No dragonfly larvae (odonata) were observed at any plot; thus, Condition B of the red-winged blackbird model was used for the impact analysis.

Utilizing a Geographic Information System (GIS), estimates regarding the necessary project rights-of-ways were overlaid on the land cover shapefile. Project rights-of-ways include all areas that will be necessary to conduct channel modifications (*e.g.,* enlargement, vegetative clearing, etc.) as well as necessary disposal areas for enlargement reaches. GIS was also used to determine the acreages of each cover type that falls within the proposed project right of way.

HSI scores for the three habitat types and changes in habitat type quantity were projected over the 50-year project life for future with- and future without-project conditions for both St. Johns Bayou Basin and New Madrid Basin (see Attachment 3). Assumptions made to future conditions are as follows:

- HSI scores of the impact areas were assumed to be the same over the 50-year project life for the without-project scenario. In reality, some of this riparian habitat would be cleared for maintenance purposes while other areas would continue to mature. Additionally, some areas could be harvested for timber/pulp production in the future. Due to the uncertainty of future actions, the HEP team used an unchanged overall condition in these impact areas for the without-project scenario.

- For the with-project scenario, the HEP team used a conservative assumption of a complete loss of riparian habitat after construction throughout the period of analysis even though some of the losses to the wooded riparian hardwoods would be partially regained through the grass berm on the working side of the channel, and vegetative regeneration on the spoil piles. These measures were not included in the HEP analysis due to the uncertainty of impacts associated with future maintenance.

- Construction of the project would take up to five years to complete and be conducted at different phases. Due to the uncertainty of how much construction would take place at years one and five, the HEP team assumed a complete loss of the riparian ditchbank habitat at both target years.

- Although the existing 6.8 acres of forested area cleared for construction of the closure levee was previously cleared and replanted pursuant to the Court Order, the area of impact was assumed to have the same HSI value as the riparian ditchbank habitats in the St. Johns Bayou Basin.

Authorized Project Alternative - St. Johns Bayou Improvements Only

Alternative 2.1 consists of managing flood risks in the St. Johns Bayou Basin only. The alternative consists of channel enlargement and drainage improvements along the lower 4.5 miles of St. Johns Bayou, beginning at New Madrid, Missouri, continuing along the Birds Point New Madrid Setback Levee Ditch, and ending with 10.8 miles along St. James Ditch. Selective clearing and snagging has already been completed along a 4.3-mile reach of the Setback Levee Ditch beginning at it confluence with St. James Ditch. In addition, a 1,000-cfs pumping station will be constructed a few hundred feet east of the existing gravity outlet at the lower end of St. Johns Bayou.

The lower 4.5 miles of St. Johns Bayou would be cleared and enlarged on both sides; bottom widths would be increased from approximately 80 feet to 200 feet. Approximately 2,485,000 cubic yards of material would be deposited along both banks creating a 220-foot wide embankment on each side**.** Following construction, the embankments would be allowed to re-vegetate naturally as part of a conservation easement.

The lower 8.1 miles of the Birds Point New Madrid Setback Levee Ditch would be enlarged from approximately 40 feet to 50 feet. The work would take place along the left descending bank and approximately 675,000 cubic yards of material would be placed in a 120-foot wide embankment located along the left descending bank. The area would be allowed to re-vegetate naturally as part of a conservation easement.

St. James Ditch would be enlarged along the left descending bank. Bottom width along the lower 3.5 miles would be enlarged from 35 feet to 45 feet. No changes to bottom width are anticipated along the remaining 7.8 miles of channel. However, top width along the left descending bank would be widened to an 80-foot average. Approximately 630,000 cubic yards of excavated material would be placed on a 100-foot wide embankment along the left descending bank. The area would be allowed to re-vegetate naturally as part of a conservation easement.

A 1,000 cfs pumping station would be constructed several hundred feet to the east of the existing gravity outlet structure on St. Johns Bayou. The pumping station would discharge interior impounded runoff over the levee during high Mississippi River stages. Pumping would commence when water in the sump area reached an elevation of 279.0 feet NGVD and would continue until the sump elevation dropped to 277.0 feet NGVD. Gates would remain closed when river stages are greater than the sump elevation, thus preventing Mississippi River backwater flooding. Gates would remain open when the sump elevation is greater than the Mississippi River elevation, thus allowing for drainage through the St. Johns Bayou gravity outlet structure. During waterfowl season (1 December to 31 January) gates would be closed to impound interior runoff in the lower St. Johns Bayou Basin for the benefit of waterfowl. Impounded interior runoff would be managed to an elevation of 285.0 NGVD by gravity drainage (stop log structure) or by turning on pumps in the event of high Mississippi River stages. Detailed descriptions of the alternatives including gate and pump management are discussed in the Alternatives Section of the EIS (Section 2.0).

Approximately 673 acres of riparian ditchbank habitat would be impacted from the clearing and associated channel work in St. Johns Bayou, Setback Levee Ditch, and St. James Ditch for the Authorized Project Alternative resulting in a loss of 1,262.73 AAHUs in the St. Johns Bayou Basin (Table 1).

Avoid and Minimize Project Alternative - St. Johns Bayou Improvements Only

The lower 4.3 miles of St. Johns Bayou would be excavated from the right descending bank only and the bottom width would be decreased from 200 feet to 120 feet. Excavated material would be placed in the project right of way along the right descending bank and would be allowed to revegetate naturally. Setback Levee Ditch would be enlarged from one side (left descending bank). The Setback Levee runs parallel to Setback Levee Ditch along the left descending bank. Therefore, existing riparian vegetation that is located along the right descending back would be preserved. Rights of way along St. James Ditch would be obtained along alternate sides to protect areas of riparian vegetation (*i.e.*, spoil material would be placed into areas that are likely prior converted cropland as opposed to vegetated areas, where practical). Detailed descriptions of the Avoid and Minimize Alternative including gate and pump management are discussed in the Alternatives Section of the EIS (Section 2.0).

The Avoid and Minimize Project Alternative would impact approximately 409 acres of riparian ditchbank habitat from the from the clearing and associated channel work in St. Johns Bayou, Setback Levee Ditch, and St. James Ditch resulting in the loss of 765.65 AAHUs in the St. Johns Bayou Basin (Table 1).

Table 1. Average Annual Habitat Units Lost by the Authorized Project Alternative and the Avoid and Minimize Project Alternative due to construction in the St. Johns Bayou Basin

Habitat Type	Authorized Project Alternative	Avoid and Minimize Project Alternative
Riparian Ditchbank	-1262.73	-765.65
Bottomland Hardwood Forest	0	0
Marsh or Scrub/shrub	0	0
Total	**-1262.73**	**-765.65**

Both Authorized Project Alternative and Avoid and Minimize Project Alternative – New Madrid Levee Closure Only

Alternative 2.2 would close the 1,500-foot levee gap at the lower end of the New Madrid Floodway between setback levee mile 35 and 37. The levee would be constructed of approximately 233,000 cubic yards of material, have a crown elevation of 317.0 feet NGVD, top

width of 16 feet, base width of approximately 302 feet, and have side slopes of 4.5:1. The footprint would be approximately 9 acres of which 6.8 acres were considered forested. Four 10 by 10-foot gated box culverts would be constructed in Mud Ditch to maintain drainage in the New Madrid Floodway. Gates would be managed in a similar fashion as the existing St. Johns Bayou gravity outlet structure. Gates would be closed when the river elevation is higher than the sump elevation. Subsequently, gates would be opened when the sump elevation is greater than the river elevation.

Closing the levee gap at the lower end of the New Madrid Floodway would reduce the conveyance for flood water passage when the floodway is operated. Therefore, interior runoff would be impounded resulting in an increase to water elevation along portions of the Birds Point Setback Levee. To maintain the authorized 3-foot freeboard above the project design flood, a 14.1-mile section of the Setback Levee would require a grade raise to ensure flood protection in the St. Johns Bayou Basin at the authorized level of protection. Setback Levee grade raises range from 0.1 feet to three feet (Average 1.28 feet) and would require 2.4 million cubic yards of material. Material would be obtained from 387 acres of borrow pits that would be ecologically designed to benefit floodplain fisheries. Detailed descriptions of the alternatives including gate and pump management are discussed in the Alternatives Section of the EIS (Section 2.0).

Both the Authorized Project Alternative and the Avoid and Minimize Project Alternative would impact approximately 6.8 acres of riparian ditchbank habitat due to construction of the New Madrid Floodway levee closure resulting in a loss of 12.76 AAHUs in the New Madrid Basin (Table 2).

Table 2. Average Annual Habitat Units Lost by the Authorized Project Alternative and the Avoid and Minimize Project Alternative due to construction in the New Madrid Basin

Habitat Type	**Authorized Project Alternative**	**Avoid and Minimize Project Alternative**
Riparian Ditchbank	-12.76	-12.76
Bottomland Hardwood Forest	0	0
Marsh or Scrub/shrub	0	0
Total	**-12.76**	**-12.76**

COMPENSATION ANALYSIS

An adaptive mitigation strategy will be employed to compensate for significant unavoidable project related impacts. HSI values for any particular mitigation tract depend on the overall mitigation method and the species of vegetation restored on the site. For example, mitigation tracts with a high abundance of mast producing trees would generally result in high HSI values for fox squirrel. In contrast, mast producing trees do not tolerate long periods of inundation and therefore, would not necessarily result in high HSI values for mink. Therefore, site specific

mitigation plans will be developed and submitted to the interagency team for review as mitigation lands become identified and available. Additional information can be found in Section 6.0 of the EIS.

Although site specific areas are required to be known to quantify benefits of compensatory mitigation, general assumptions can be made regarding six different mitigation zones found within the project area. Similar to the impact analysis, habitat variables (and associated HSI scores) for the six mitigation zones were projected over the 50-year project life for future with- and future without-project conditions to determine appropriate compensation for unavoidable impacts to terrestrial resources (see Attachment 4). To maintain consistency, the same evaluation species for bottomland hardwood and riparian ditchbank habitats were used in the impact analysis and compensation analysis (i.e., fox squirrel, barred owl, Carolina chickadee, pileated woodpecker, and mink). Brief descriptions of the six mitigation zones used for the HEP analysis are discussed below. Detailed descriptions of the mitigation plan are discussed in the Comparison of Alternatives Section of the EIS (Section 2.4) and the Mitigation Section of the EIS (Section 6.0).

Mitigation Zone 1:

A priority will be given to Big Oak Tree State Park. This includes increasing the footprint of the park by 1,800 acres and restoring hydrology by means of a gated structure located in the Mississippi River Frontline Levee. Restoration of the 1,800 acres includes site preparation (e.g., deep disking, sub-soiling), restoration of site-specific hydrology (e.g., plugging drainage ditches, removing farm drains, etc.) in addition to re-establishing the Mississippi River connection, restoration of microtopography (i.e., shallow excavation of deeper areas and filling higher areas to create topographical heterogeneity), and plantings of appropriate vegetation according to the site-specific hydrologic zones detailed in the Big Oak Tree State Park Natural Resource Management Plan (McCarty, 2005). Utilizing GIS, assumptions for this restoration are based on elevation data and include the following composition: 39% of the area planted with cypress/tupelo (hydrologic zone II); 5% of the area planted with cypress, pumpkin ash, and tupelo (hydrologic zone III); and 56% of the area planted with various oak and hickory species (hydrologic zones IV and V). A total of 1,744.20 AAHUs is expected by the restoration of 1,800 acres surrounding Big Oak Tree State Park for a net benefit of 0.97 AAHUs/acre (Table 3).

Although restoring hydrology to the park itself will result in changes to species composition and thus produce ecological benefits, no benefits were calculated for the restoration of hydrology to the park for this particular model. Benefits of restoring hydrology to the park are described with the fish, wetland, and waterfowl models.

Mitigation Zone 2:

This analysis includes a hypothetical 100-acre tract of land pursued within the fish and wildlife management pool (Zone 2). Restoration would include site preparation, restoration of hydrology, restoration of microtopography, and plantings of appropriate seedlings according to the site-specific hydrological regime. Assumptions for this restoration include the following composition: 50% of the area planted with cypress/tupelo seedlings, 25% of the area allowing for natural succession of herbaceous vegetation, and 25% of the area remaining in open water. A

total of 72.80 AAHUs would be gained through the restoration of a hypothetical 100-acre tract in Zone 2 for a net benefit of 0.73 AAHUs/acre (Table 3).

Mitigation Zone 3 and Zone 4:
This analysis includes a hypothetical 100-acre tract of land within Zone 3, those lands within the maximum flood elevation (i.e., lands still connected to Mississippi River or within post-project interior inundated runoff elevations), and Zone 4, those lands located at higher elevations than the post-project maximum flood elevation. Restoration would include site preparation, restoration of hydrology, restoration of microtopography, and plantings of appropriate seedlings according to the site-specific hydrological regime. Assumptions for this restoration include the following composition: 10% of area allowing for natural succession of herbaceous vegetation, 30% of area planted with drier oak/hickory species (e.g. cherrybark oak, pignut hickory, etc.), and 60% of area planted with wetter oak/hickory species (e.g. overcup oak, nuttal oak, etc.). A total of 82.15 AAHUs would be gained through the restoration of a hypothetical 100-acre tract in Zones 3 and 4 for a net benefit of 0.82 AAHUs/acre (Table 3).

Mitigation Zone 5:
This analysis includes restoration of a hypothetical 100-acre tract from cleared lands located within the batture of the Mississippi River. Assumptions for this restoration include 100% of the land reverting to cottonwood/willow communities through natural succession. A total of 80.40 AAHUs would be gained through the restoration of a hypothetical 100-acre tract in Zone 5 for a net benefit of 0.80 AAHUs/acre (Table 3).

Mitigation Zone 6:
This analysis includes a hypothetical 10-mile reach of stream which would be buffered by planting warm season grasses. Although there would be numerous benefits to terrestrial wildlife (*e.g.*, northern bobwhite quail, rabbit, etc) and water quality by the establishment of warm season grasses habitat cannot be quantified by the methods utilized in this particular model. Therefore, according to this model, establishment of warm season grass buffers on area ditches would not result in a benefit.

Table 3. Average Annual Habitat Units Gained for each Mitigation Zone in the St. Johns Basin and New Madrid Floodway Project Area

Mitigation Zone	Estimated Total Benefits (AAHUs)	AAHUs gained/acre
Zone 1	+1744.20	+0.97
Zone 2	+72.80	+0.73
Zones 3 and 4	+82.15	+0.82
Zone 5	+80.40	+0.80
Zone 6	0	0

The amount of compensatory mitigation (acreage estimates) for project-induced terrestrial habitat losses can be calculated by dividing the total AAHUs lost due to impacts of the project by

the AAHUs gained/acre due to proposed mitigation (e.g., restoration of bottomland hardwoods, buffer strips, etc.). Mitigation calculations for each mitigation zone due to the Authorized Project and the Avoid and Minimize Project Alternatives are shown in Table 4.

Table 4. Calculations of compensatory mitigation estimates for project-induced terrestrial habitat losses of the Authorized Project Alternative and the Avoid and Minimize (A&M) Project Alternative for each Mitigation Zone*

Construction in St. Johns Bayou Basin						
Mitigation Zone	**Project Alternative**	**Total AAHUs lost**	÷	**Total AAHUs gained/acre**	=	**Compensatory Mitigation Amounts**
Zone 1	Authorized	1,262.73	÷	0.97	=	1,301.78 acres
	Avoid and Minimize	765.65	÷	0.97	=	789.33 acres
Zone 2	Authorized	1,262.73	÷	0.73	=	1,729.77 acres
	Avoid and Minimize	765.65	÷	0.73	=	1,048.84 acres
Zones 3 & 4	Authorized	1,262.73	÷	0.82	=	1,539.92 acres
	Avoid and Minimize	765.65	÷	0.82	=	933.72 acres
Zone 5	Authorized	1,262.73	÷	0.80	=	1,578.41 acres
	Avoid and Minimize	765.65	÷	0.80	=	957.06 acres
Zone 6	Authorized	1,262.73	÷	0	=	N/A
	Avoid and Minimize	765.65	÷	0	=	N/A
Construction in New Madrid Floodway						
Mitigation Zone	***Project Alternative**	**Total AAHUs lost**	÷	**Total AAHUs gained/acre**	=	**Compensatory Mitigation Amounts**
Zone 1	Authorized or A&M	12.76	÷	0.97	=	13.16 acres
Zone 2	Authorized or A&M	12.76	÷	0.73	=	17.48 acres
Zones 3 & 4	Authorized or A&M	12.76	÷	0.82	=	16 acres
Zone 5	Authorized or A&M	12.76	÷	0.80	=	15.95 acres
Zone 6	Authorized or A&M	12.76	÷	0	=	N/A

*The compensatory mitigation amounts calculated in this table show the mitigation required to fully compensate for project induced terrestrial losses for each mitigation zone; however, mitigation will likely be performed utilizing a combination of multiple zones (not just one).
**The Authorized Project Alternative and the Avoid and Minimize (A&M) Project Alternative both include a closure levee (i.e., result in same impacts) in the New Madrid Floodway.

It is important to note that Table 4 shows the acreages that would be required to compensate for project-induced terrestrial habitat losses within each specific mitigation zone. However, it is anticipated that mitigation will be conducted in multiple zones with a priority given to Big Oak Tree State Park. A more detailed description of how mitigation will be pursued is discussed in the Mitigation Section of the EIS (Section 6.0).

LITERATURE CITED

Allen, A. W. 1982. Habitat Suitability Index Models: Fox Squirrel, FWS/OBS-82/10.18. U.S. Fish and Wildlife Service, Washington, DC. (http://www.nwrc.usgs.gov/wdb/pub/hsi/hsi-018.pdf).

Allen, A. W. 1986. Habitat Suitability Index Models: Mink (Revised), FWS/OBS-82/10.127. U.S. Fish and Wildlife Service, Washington, DC. (http://www.nwrc.usgs.gov/wdb/pub/hsi/hsi-061.pdf).

Allen, A. W. 1987. Habitat Suitability Index Models: Barred Owl, Biological Report 82 (10.127). U.S. Fish and Wildlife Service, Washington, DC. (http://www.nwrc.usgs.gov/wdb/pub/hsi/hsi-143.pdf).

Allen, A. W., and Hoffman, R. D. 1984. Habitat Suitability Index Models: Muskrat, FWS/OBS-82/10.46. U.S. Fish and Wildlife Service, Washington, DC. (http://www.nwrc.usgs.gov/wdb/pub/hsi/hsi-046.pdf).

McCarty, K. 2005. Big Oak Tree State Park Natural Resources Management Plan. Missouri Department of Natural Resources, Jefferson City, Missouri.

Schroder, R. L. 1983a. Habitat Suitability Index Models: Pileated Woodpecker, FWS/OBS-82/10.39. U.S. Fish and Wildlife Service, Washington, DC. (http://www.nwrc.usgs.gov/wdb/pub/hsi/hsi-039.pdf).

Schroder, R. L. 1983b. Habitat Suitability Index Models: Black-Capped Chickadee, FWS/OBS-82/10.39. U.S. Fish and Wildlife Service, Washington, DC. (http://www.nwrc.usgs.gov/wdb/pub/hsi/hsi-037.pdf).

Short, H. L. 1985. Habitat Suitability Index Models: Red-winged Blackbird, Biological Report 82 (10.95). U.S. Fish and Wildlife Service, Washington, DC. (http://www.nwrc.usgs.gov/wdb/pub/hsi/hsi-095.pdf).

Short, H. L., and Cooper, R. J. 1985. Habitat Suitability Index Models: Great Blue Heron, Biological Report 82 (10.99). U.S. Fish and Wildlife Service, Washington, DC. (http://www.nwrc.usgs.gov/wdb/pub/hsi/hsi-099.pdf).

U.S. Fish and Wildlife Service. 1980. Habitat Evaluation Procedures (HEP), 102 ESM. U.S. Fish and Wildlife Service, Washington, DC.

ERRATA

The revised analyses for the new project alternatives, 4.1 and 4.2, compared to the future without project are provided below.

Habitat Type	Alternative 4.1	Alternative 4.2
Riparian Ditchbank	-12.76	1,048.27
Bottomland Hardwood Forest	0	10,992.24
Marsh or Scrub/Schrub	0	0
Total	-12.76	12,040.51

Alternative 4 is similar to Alternative 3 in that all project features are constructed, including the 1,000 cfs St. Johns Bayou pumping station, 24 miles of reduced width channel enlargement in the St. Johns Bayou Basin, 1,500-foot closure levee, 1,500 cfs pump in the New Madrid Floodway, and waterfowl management in both basins. Alternative 4.1 calls for construction of the flood risk management features only with no additional measures to areas below an elevation of 289.5 feet. Alternative 4.2 calls for reforestation of agricultural lands below an elevation of 289.5 feet in conjunction with the structural flood risk management measures previously stated. There are 13,340 acres of agricultural lands below an elevation of 289.5 feet. Alternative 4.2 yields considerable gains in AAHU, as seen in the preceding table.

ATTACHMENTS

Attachment 1. Map of HEP plot locations

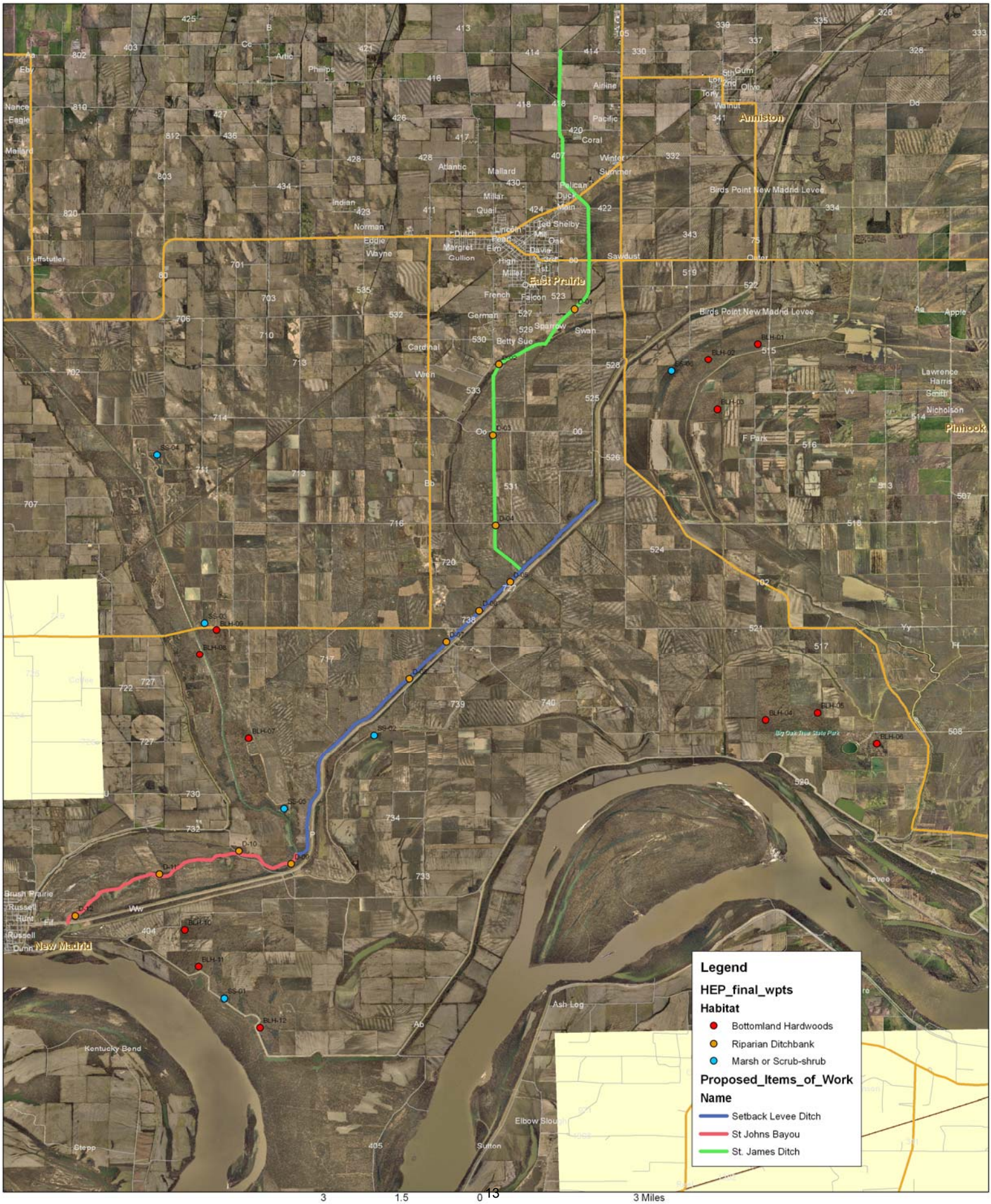
Attachment 2. Representative Data Sheets for Impact Analysis

Attachment 3. Impact Analysis

Attachment 4. Compensation Analysis

ATTACHMENT 1

SJNM Project Area - HEP Plot Locations
25-28 Oct. 2010



ATTACHMENT 2

ST. JOHNS/NEW MADRID PROJECT – HEP DATA SHEET

Site # D-06 GPS (dd.ddddd) 36.67856 Date: 26 Oct. 2010

Habitat (Cover Type): Riparian Ditchbank 89.39582 Plot size: 1/5 acre

Species – Variable#	Variable Description	Raw Data	SI Value
fs1	% canopy closure of trees that produce hard mast (e.g. oak, hickory, walnut, pecan, beech) ≥ 10 in. (25.4 cm) dbh.	5%	0.1
fs2	Distance to available grain (linear distance in yards or meters to farm fields with corn, soybeans, wheat, oats, or fruit crops).	3 yds	1.0
fs3, bo2	Mean dbh of overstory trees (i.e. trees that are ≥ 80% of the height of tallest tree in plot	12 in	0.575 0.45
fs4, cc1, pw1	% tree canopy closure of all trees (all woody vegetation ≥ 16.5 ft. (5m) tall).	75%	fs4, cc1, pw1 0.8 1.0 0.9
fs-5	% shrub crown cover (all woody vegetation ≤ 16.5 ft. (5m) tall).	45%	0.7
bo1, pw2	# of trees ≥ 20 in. dbh /acre (i.e. # of both living trees and/or snags that are ≥ 20 in. (51cm) dbh per 0.4 ha (~1acre)).	0	bo1, pw2 0.1 0
bo3	% canopy cover of overstory trees (i.e. trees that are ≥ 80% of the height of tallest tree in plot	75%	1.0
cc2	Average height of overstory trees (i.e. trees that are ≥ 80% of the height of tallest tree in plot	80 ft.	1.0
cc3	Combined # of living trees with ≥ 1cavity and # of snags (both have to be ≥ 10cm (4in.) dbh), per hectare (~2.5acres).	5 x 12.5 (62.5)	1.0
pw3	# of tree stumps > 1 ft. (0.3m) in height and > 7 in. (18cm) in diameter and/or logs > 7 in. (18cm) in diameter per acre (0.4ha). (log diameter measured at largest point).	5 x 5 (25)	1.0
pw4	# of snags > 15 in. (38cm) dbh / acre (0.4ha). (snags include trees which at least 50% of the branches no longer bear foliage; also have to be at least 6ft tall).	0	0
pw5	mean dbh of snags > 15 in.(38cm) dbh.	0	0
	Use for "ditch" sites (riverine model)		
mi1	% of year with surface water present	100%	1.0
mi5	% of tree and shrub canopy cover within 328 ft. (100m) of water's edge.	30%	0.4
mi6	% shoreline cover within 3.3 ft. (1m) of water's edge. (Cover may be provided by overhanging emergent vegetation, undercut banks, logjams, debris, or exposed roots.)	40%	0.4
	Use for other BLH sites (palustrine forested >1,000 acres model)		
mi1	% of year with surface water present		
mi2	% tree canopy closure of all trees (all woody vegetation ≥ 20 ft. (6m) tall).		
mi3	% shrub canopy closure of all shrubs (all woody vegetation < 20 ft. (6m) tall).		
mi4	% canopy cover of emergent herbaceous vegetation (% of water surface shaded by a vertical projection of the canopies of emergent herbaceous vegetation both persistent and nonpersistent).		

Pic.107-0049 facing N
0050 " E

ST. JOHNS/NEW MADRID PROJECT – HEP DATA SHEET

Site # BLH-06 GPS (dd.ddddd) 36.64167 Date: 28 Oct. 2010

Habitat (Cover Type): BLH 89.28543 Plot size: 1/5 acre

Species – Variable#	Variable Description	Raw Data	SI Value
fs1	% canopy closure of trees that produce hard mast (e.g. oak, hickory, walnut, pecan, beech) ≥ 10 in. (25.4 cm) dbh.	25%	0.60
fs2	Distance to available grain (linear distance in yards or meters to farm fields with corn, soybeans, wheat, oats, or fruit crops).	280, 1/5	0.86
fs3, bo2	Mean dbh of overstory trees (i.e. trees that are ≥ 80% of the height of tallest tree in plot	31, 30, 13 (25 in)	fs3 1.0 bo2 1.0
fs4, cc1, pw1	% tree canopy closure of all trees (all woody vegetation ≥ 16.5 ft. (5m) tall).	35%	fs4, 1.0 cc1, 0.5 pw1 0.2
fs-5	% shrub crown cover (all woody vegetation ≤ 16.5 ft. (5m) tall).	10%	1.0
bo1, pw2	# of trees ≥ 20 in. dbh /acre (i.e. # of both living trees and/or snags that are ≥ 20 in. (51cm) dbh per 0.4 ha (~1acre)).	(15)	bo1, 1.0 pw2 0.4
bo3	% canopy cover of overstory trees (i.e. trees that are ≥ 80% of the height of tallest tree in plot	10%	0
cc2	Average height of overstory trees (i.e. trees that are ≥ 80% of the height of tallest tree in plot	90ft	1.0
cc3	Combined # of living trees with ≥ 1cavity and # of snags (both have to be ≥ 10cm (4in.) dbh), per hectare (~2.5acres).	6+12.5 (75)	1.0
pw3	# of tree stumps > 1 ft. (0.3m) in height and > 7 in. (18cm) in diameter and/or logs > 7 in. (18cm) in diameter per acre (0.4ha). (log diameter measured at largest point).	(40)	1.0
pw4	# of snags > 15 in. (38cm) dbh / acre (0.4ha). (snags include trees which at least 50% of the branches no longer bear foliage; also have to be at least 6ft tall).	(5)	0.3
pw5	mean dbh of snags > 15 in.(38cm) dbh.	23in.	1.0
	Use for "ditch" sites (riverine model)		
mi1	% of year with surface water present		
mi5	% of tree and shrub canopy cover within 328 ft. (100m) of water's edge.		
mi6	% shoreline cover within 3.3 ft. (1m) of water's edge. (Cover may be provided by overhanging emergent vegetation, undercut banks, logjams, debris, or exposed roots.)		
	Use for other BLH sites (palustrine forested >1,000 acres model)		
mi1	% of year with surface water present Check hydrologic data	15%	0.0
mi2	% tree canopy closure of all trees (all woody vegetation ≥ 20 ft. (6m) tall).	35%	0.5
mi3	% shrub canopy closure of all shrubs (all woody vegetation < 20 ft. (6m) tall).	10%	0.2
mi4	% canopy cover of emergent herbaceous vegetation (% of water surface shaded by a vertical projection of the canopies of emergent herbaceous vegetation both persistent and nonpersistent).	20%	0.3

Pic 102-0080 facing NW

ST. JOHNS/NEW MADRID PROJECT – HEP DATA SHEET

Site # SS-01 GPS (dd.ddddd) 36.57079 Date: 26 Oct. 2010

Habitat (Cover Type): Scrub-Shrub 89.46659 Plot Size: 1/5 acre (unless otherwise noted)

Species – Variable#	Variable Description	Notes	Raw Data	SI Value
gbh-1	Distance between potential nest site (i.e. wooded tracts > 0.4 ha (1acre)) and foraging area (i.e. open water ≤ 0.5m (1.6ft) deep with huntable populations of small fish ≤ 25cm (0.20in) and a firm substrate).	Use GIS or observed distance to closest water body. None observed	0.3 km	1.0
gbh-2	Potential foraging habitat usually having shallow, clear water with a firm substrate and a huntable population of small fish = 1.0. or Potential foraging habitat not providing the desirable combination of conditions = 0.0.	Ground truth foraging areas in field.	0.0	0
gbh-3	If a disturbance-free zone ≥ 100m (328ft.) around potential foraging area (occasional vehicular traffic/ag-production is allowed) = 1.0. or Above conditions not usually met = 0.0.	Disturbance-free zone allows for roads with slow moving traffic or occasional mechanized ag-operations. HEP team will decide; likely to use 1.0 for all sites. No ponded water observed	1.0	1.0
gbh-4	If trees (within 250 m (820ft.) of water/swamp) are ≥ 5 m (16.4 ft.) tall, have many branches ≥ 2.5 cm (1 inch) in diameter, and have an open canopy allowing easy access to nest = 1.0. or if trees do not fulfill conditions above = 0.0.	Stand of willows ~3in dbh avg. is dominant veg.	0.0	0
gbh-5	If exclusion zone (250m buffer on land or 150m (492ft.) buffer on water) is usually free from human disturbances during nesting season (Feb.-Aug.) = 1.0 or If exclusion zone is usually not free from human disturbances during nesting season = 0.0	Disturbances include houses, roads, dredging, timbering, and mechanized ag-operations. HEP team will decide value for those large tracts surrounded by agriculture.	1.0	1.0
gbh-6	Distance to closest active nest site. Nest Location @ Donaldson Point from MK. (-89.462849, 36.557717)	Use graph illustrated in model (max. distance is 25km (15.5mi.). USACE not aware of any active nest site; HEP team should provide any available data.	1.5 km	0.98
mu-1	% canopy coverage of emergent herbaceous vegetation (both persistent and non-persistent)		5%	0.1
mu-2	% of year with surface water present	Determine using the hydrologic period of record at each point.	10%	0.0

over

mu-8	% of emergent herbaceous vegetation consisting of Olney bulrush, common three-square bulrush, or cattail.		02	0.0
rwb – Condition A (open water present, supports odonates)				
rwb-1	Emergent vegetation is old or new growth of broad-leaved monocots, (e.g. cattails) = 1.0 or Emergent vegetation is predominantly narrow-leaved monocots or other herbaceous material = 0.1	Determine from dominant species of emergent vegetation.		
rwb-2	If water is usually present in wetland throughout year = 1.0 or wetland usually dry during some portion of the year = 0.1	Determine using hydrologic period of record at each point.		
rwb-3	If carp are absent from wetland = 1.0 or if carp are present within wetland = 0.1	Carp are potentially present during overbank flood events but not likely to be prevalent during most of year. Unless observations show otherwise, use 1.0.		
rwb-4	If Odonata larvae (damselflies or dragonflies) are present in wetland = 1.0 or if odonata larvae are not present = 0.1	Use dip net along bottom of clumps of emergent herbaceous veg. for a total of 5 minutes per plot. Identify as present/absent.		
rwb-5	If wetland area contains an equal mix of emergent herbaceous vegetation and open water = 1.0 or if covered by a dense stand of emergent herbaceous vegetation = 0.3 or if area contains a few patches of emergent herbaceous vegetation and extensive areas of open water = 0.1			
rwb – Condition B (no open water present, does not support odonates)				
rwb-6	if only suitable foraging substrate is understory (i.e. midstory and/or overstory provide < 10% cover) = 0.1 or if only suitable foraging is midstory and/or overstory (i.e. midstory and/or overstory provide ≥ 10% cover) = 0.4 or if suitable foraging is a condition A wetland (i.e. open water supporting odonata within 200 m (656ft) = 0.9	Use large plot size of 200 m (656 ft.) radius for this variable. Coverage is predominantly Gray willows (little midstory or understory observed). Fairly homogenous site.	0.4	0.4

Notes

Homogenous stand of small willows (~3in dbh). No standing water observed (in ~250 ft. radius)

Pic 102-0055 facing N
56 facing E
57 facing S
58 facing W

ATTACHMENT 3

Impacts due to construction of the Authorized Project Alternative in the St. Johns Bayou Basin
HEP Analysis - Fox Squirrel

		Without Project				With Project			
Habitat Type	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Riparian Ditchbank	0	673	0.35	235.62		673	0.35	235.62	
	1	673	0.35	235.62	235.62	0	0.00	0.00	78.54
	5	673	0.35	235.62	942.48	0	0.00	0.00	0
	15	673	0.35	235.62	2356.20	0	0.00	0.00	0.0
	25	673	0.35	235.62	2356.20	0	0.00	0.00	0.0
	50	673	0.35	235.62	5890.50	0	0.00	0.00	0.0
		Cumulative Habitat Units			11781.00	Cumulative Habitat Units			78.54
		Average Annual Habitat Units			235.62	Average Annual Habitat Units			1.57

NET IMPACT (AAHU)
-234.05

NOTE: There were no project-related changes to large bottomland hardwood (BLH) tracts or Marsh/Scrub-shrub habitats; thus, those HEP results are not shown.

Impacts due to construction of the Authorized Project Alternative in the St. Johns Bayou Basin
HEP Analysis - Barred Owl

		Without Project				**With Project**			
Habitat Type	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Riparian Ditchbank	0	673	0.30	201.96		673	0.30	201.96	
	1	673	0.30	201.96	201.96	0	0.00	0.00	67.32
	5	673	0.30	201.96	807.84	0	0.00	0.00	0.00
	15	673	0.30	201.96	2019.60	0	0.00	0.00	0.00
	25	673	0.30	201.96	2019.60	0	0.00	0.00	0.00
	50	673	0.30	201.96	5049.00	0	0.00	0.00	0.00
		Cumulative Habitat Units			10098.00	Cumulative Habitat Units			67.32
		Average Annual Habitat Units			201.96	Average Annual Habitat Units			1.35

NET IMPACT (AAHU)
-200.61

NOTE: There were no project-related changes to large bottomland hardwood (BLH) tracts or Marsh/Scrub-shrub habitats; thus, those HEP results are not shown.

Impacts due to construction of the Authorized Project Alternative in the St. Johns Bayou Basin
HEP Analysis - Carolina Chickadee

		Without Project				With Project			
Habitat Type	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Riparian Ditchbank	0	673	0.68	457.78		673	0.68	457.78	
	1	673	0.68	457.78	457.78	0	0.00	0.00	152.59
	5	673	0.68	457.78	1831.10	0	0.00	0.00	0.00
	15	673	0.68	457.78	4577.76	0	0.00	0.00	0.00
	25	673	0.68	457.78	4577.76	0	0.00	0.00	0.00
	50	673	0.68	457.78	11444.40	0	0.00	0.00	0.00
		Cumulative Habitat Units			22888.80	Cumulative Habitat Units			152.59
		Average Annual Habitat Units			457.78	Average Annual Habitat Units			3.05

NET IMPACT (AAHU)
-454.72

NOTE: There were no project-related changes to large bottomland hardwood (BLH) tracts or Marsh/Scrub-shrub habitats; thus, those HEP results are not shown.

Impacts due to construction of the Authorized Project Alternative in the St. Johns Bayou Basin
HEP Analysis - Pileated Woodpecker

		Without Project				**With Project**			
Habitat Type	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Riparian Ditchbank	0	673	0.06	40.39		673	0.06	40.39	
	1	673	0.06	40.39	40.39	0	0.00	0.00	13.46
	5	673	0.06	40.39	161.57	0	0.00	0.00	0.00
	15	673	0.06	40.39	403.92	0	0.00	0.00	0.00
	25	673	0.06	40.39	403.92	0	0.00	0.00	0.00
	50	673	0.06	40.39	1009.80	0	0.00	0.00	0.00
		Cumulative Habitat Units			2019.60	Cumulative Habitat Units			13.46
		Average Annual Habitat Units			40.39	Average Annual Habitat Units			0.27

NET IMPACT (AAHU)
-40.12

NOTE: There were no project-related changes to large bottomland hardwood (BLH) tracts or Marsh/Scrub-shrub habitats; thus, those HEP results are not shown.

Impacts due to construction of the Authorized Project Alternative in the St. Johns Bayou Basin
HEP Analysis - Mink

		Without Project				With Project			
Habitat Type	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Riparian Ditchbank	0	673	0.50	336.60		673	0.50	336.60	
	1	673	0.50	336.60	336.60	673	0.00	0.00	168.30
	5	673	0.50	336.60	1346.40	673	0.00	0.00	0.00
	15	673	0.50	336.60	3366.00	673	0.00	0.00	0.00
	25	673	0.50	336.60	3366.00	673	0.00	0.00	0.00
	50	673	0.50	336.60	8415.00	673	0.00	0.00	0.00
			Cumulative Habitat Units		16830.00		Cumulative Habitat Units		168.30
			Average Annual Habitat Units		336.60		Average Annual Habitat Units		3.37

NET IMPACT (AAHU)
-333.23

NOTE: There were no project-related changes to large bottomland hardwood (BLH) tracts or Marsh/Scrub-shrub habitats; thus, those HEP results are not shown.

Impacts due to construction of the Avoid and Minimize Project Alternative in the St. Johns Bayou Basin
HEP Analysis - Fox Squirrel

		Without Project				With Project			
Habitat Type	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Riparian Ditchbank	0	673	0.35	235.62		673	0.35	235.62	
	1	673	0.35	235.62	235.62	264	0.35	92.40	164.01
	5	673	0.35	235.62	942.48	264	0.35	92.40	369.6
	15	673	0.35	235.62	2356.20	264	0.35	92.40	924.0
	25	673	0.35	235.62	2356.20	264	0.35	92.40	924.0
	50	673	0.35	235.62	5890.50	264	0.35	92.40	2310.0
		Cumulative Habitat Units			11781.00	Cumulative Habitat Units			4691.61
		Average Annual Habitat Units			235.62	Average Annual Habitat Units			93.83

NET IMPACT (AAHU)
-141.79

NOTE: There were no project-related changes to large bottomland hardwood (BLH) tracts or Marsh/Scrub-shrub habitats; thus, those HEP results are not shown.

Impacts due to construction of the Avoid and Minimize Project Alternative in the St. Johns Bayou Basin
HEP Analysis - Barred Owl

		Without Project				**With Project**			
Habitat Type	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Riparian Ditchbank	0	673	0.30	201.96		673	0.30	201.96	
	1	673	0.30	201.96	201.96	264	0.30	79.20	140.58
	5	673	0.30	201.96	807.84	264	0.30	79.20	316.80
	15	673	0.30	201.96	2019.60	264	0.30	79.20	792.00
	25	673	0.30	201.96	2019.60	264	0.30	79.20	792.00
	50	673	0.30	201.96	5049.00	264	0.30	79.20	1,980.00
		Cumulative Habitat Units			10098.00	Cumulative Habitat Units			4,021.38
		Average Annual Habitat Units			201.96	Average Annual Habitat Units			80.43

NET IMPACT (AAHU)
-121.53

NOTE: There were no project-related changes to large bottomland hardwood (BLH) tracts or Marsh/Scrub-shrub habitats; thus, those HEP results are not shown.

Impacts due to construction of the Avoid and Minimize Project Alternative in the St. Johns Bayou Basin
HEP Analysis - Carolina Chickadee

		Without Project				**With Project**			
Habitat Type	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Riparian Ditchbank	0	673	0.68	457.78		673	0.68	457.78	
	1	673	0.68	457.78	457.78	264	0.68	179.52	318.65
	5	673	0.68	457.78	1831.10	264	0.68	179.52	718.08
	15	673	0.68	457.78	4577.76	264	0.68	179.52	1,795.20
	25	673	0.68	457.78	4577.76	264	0.68	179.52	1,795.20
	50	673	0.68	457.78	11444.40	264	0.68	179.52	4,488.00
		Cumulative Habitat Units			22888.80	Cumulative Habitat Units			9,115.13
		Average Annual Habitat Units			457.78	Average Annual Habitat Units			182.30

NET IMPACT (AAHU)
-275.47

NOTE: There were no project-related changes to large bottomland hardwood (BLH) tracts or Marsh/Scrub-shrub habitats; thus, those HEP results are not shown.

Impacts due to construction of the Avoid and Minimize Project Alternative in the St. Johns Bayou Basin
HEP Analysis - Pileated Woodpecker

		Without Project				**With Project**			
Habitat Type	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Riparian Ditchbank	0	673	0.06	40.39		673	0.06	40.39	
	1	673	0.06	40.39	40.39	264	0.06	15.84	28.12
	5	673	0.06	40.39	161.57	264	0.06	15.84	63.36
	15	673	0.06	40.39	403.92	264	0.06	15.84	158.40
	25	673	0.06	40.39	403.92	264	0.06	15.84	158.40
	50	673	0.06	40.39	1009.80	264	0.06	15.84	396.00
				Cumulative Habitat Units	2019.60			Cumulative Habitat Units	804.28
				Average Annual Habitat Units	40.39			Average Annual Habitat Units	16.09

NET IMPACT (AAHU)
-24.31

NOTE: There were no project-related changes to large bottomland hardwood (BLH) tracts or Marsh/Scrub-shrub habitats; thus, those HEP results are not shown.

Impacts due to construction of the Avoid and Minimize Project Alternative in the St. Johns Bayou Basin
HEP Analysis - Mink

		Without Project				With Project			
Habitat Type	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Riparian Ditchbank	0	673	0.50	336.60		673	0.50	336.60	
	1	673	0.50	336.60	336.60	264	0.50	132.00	234.30
	5	673	0.50	336.60	1346.40	264	0.50	132.00	528.00
	15	673	0.50	336.60	3366.00	264	0.50	132.00	1320.00
	25	673	0.50	336.60	3366.00	264	0.50	132.00	1320.00
	50	673	0.50	336.60	8415.00	264	0.50	132.00	3300.00
		Cumulative Habitat Units			16830.00	Cumulative Habitat Units			6702.30
		Average Annual Habitat Units			336.60	Average Annual Habitat Units			134.05

NET IMPACT (AAHU)
-202.55

NOTE: There were no project-related changes to large bottomland hardwood (BLH) tracts or Marsh/Scrub-shrub habitats; thus, those HEP results are not shown.

Impacts due to construction from either Authorized or Avoid and Minimize Project Alternatives in the New Madrid Floodway
HEP Analysis - Fox Squirrel

		Without Project				**With Project**			
Habitat Type	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Riparian Ditchbank	0	7	0.35	2.38		7	0.35	2.38	
	1	7	0.35	2.38	2.38	0	0.00	0.00	0.79
	5	7	0.35	2.38	9.52	0	0.00	0.00	0
	15	7	0.35	2.38	23.80	0	0.00	0.00	0.0
	25	7	0.35	2.38	23.80	0	0.00	0.00	0.0
	50	7	0.35	2.38	59.50	0	0.00	0.00	0.0
		Cumulative Habitat Units			119.00	Cumulative Habitat Units			0.79
		Average Annual Habitat Units			2.38	Average Annual Habitat Units			0.02

NET IMPACT (AAHU)
-2.36

NOTE: There were no project-related changes to large bottomland hardwood (BLH) tracts or Marsh/Scrub-shrub habitats; thus, those HEP results are not shown.

Impacts due to construction from either Authorized or Avoid and Minimize Project Alternatives in the New Madrid Floodway
HEP Analysis - Barred Owl

		Without Project				With Project			
Habitat Type	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Riparian Ditchbank	0	7	0.30	2.04		7	0.30	2.04	
	1	7	0.30	2.04	2.04	0	0.00	0.00	0.68
	5	7	0.30	2.04	8.16	0	0.00	0.00	0.00
	15	7	0.30	2.04	20.40	0	0.00	0.00	0.00
	25	7	0.30	2.04	20.40	0	0.00	0.00	0.00
	50	7	0.30	2.04	51.00	0	0.00	0.00	0.00
		Cumulative Habitat Units			102.00	Cumulative Habitat Units			0.68
		Average Annual Habitat Units			2.04	Average Annual Habitat Units			0.01

NET IMPACT (AAHU)
-2.03

NOTE: There were no project-related changes to large bottomland hardwood (BLH) tracts or Marsh/Scrub-shrub habitats; thus, those HEP results are not shown.

Impacts due to construction from either Authorized or Avoid and Minimize Project Alternatives in the New Madrid Floodway
HEP Analysis - Carolina Chickadee

		Without Project				With Project			
Habitat Type	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Riparian Ditchbank	0	7	0.68	4.62		7	0.68	4.62	
	1	7	0.68	4.62	4.62	0	0.00	0.00	1.54
	5	7	0.68	4.62	18.50	0	0.00	0.00	0.00
	15	7	0.68	4.62	46.24	0	0.00	0.00	0.00
	25	7	0.68	4.62	46.24	0	0.00	0.00	0.00
	50	7	0.68	4.62	115.60	0	0.00	0.00	0.00
			Cumulative Habitat Units		231.20		Cumulative Habitat Units		1.54
			Average Annual Habitat Units		4.62		Average Annual Habitat Units		0.03

NET IMPACT (AAHU)
-4.59

NOTE: There were no project-related changes to large bottomland hardwood (BLH) tracts or Marsh/Scrub-shrub habitats; thus, those HEP results are not shown.

Impacts due to construction from either Authorized or Avoid and Minimize Project Alternatives in the New Madrid Floodway
HEP Analysis - Pileated Woodpecker

		Without Project				With Project			
Habitat Type	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Riparian Ditchbank	0	7	0.06	0.41		7	0.06	0.41	
	1	7	0.06	0.41	0.41	0	0.00	0.00	0.14
	5	7	0.06	0.41	1.63	0	0.00	0.00	0.00
	15	7	0.06	0.41	4.08	0	0.00	0.00	0.00
	25	7	0.06	0.41	4.08	0	0.00	0.00	0.00
	50	7	0.06	0.41	10.20	0	0.00	0.00	0.00
			Cumulative Habitat Units		20.40		Cumulative Habitat Units		0.14
			Average Annual Habitat Units		0.41		Average Annual Habitat Units		0.00

NET IMPACT (AAHU)
-0.41

NOTE: There were no project-related changes to large bottomland hardwood (BLH) tracts or Marsh/Scrub-shrub habitats; thus, those HEP results are not shown.

Impacts due to construction from either Authorized or Avoid and Minimize Project Alternatives in the New Madrid Floodway
HEP Analysis - Mink

		Without Project				With Project			
Habitat Type	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Riparian Ditchbank	0	7	0.50	3.40		7	0.50	3.40	
	1	7	0.50	3.40	3.40	7	0.00	0.00	1.70
	5	7	0.50	3.40	13.60	7	0.00	0.00	0.00
	15	7	0.50	3.40	34.00	7	0.00	0.00	0.00
	25	7	0.50	3.40	34.00	7	0.00	0.00	0.00
	50	7	0.50	3.40	85.00	7	0.00	0.00	0.00
		Cumulative Habitat Units			170.00	Cumulative Habitat Units			1.70
		Average Annual Habitat Units			3.40	Average Annual Habitat Units			0.03

NET IMPACT (AAHU)
-3.37

NOTE: There were no project-related changes to large bottomland hardwood (BLH) tracts or Marsh/Scrub-shrub habitats; thus, those HEP results are not shown.

ATTACHMENT 4

Benefits gained from mitigation zones of the St. Johns Basin - New Madrid Floodway Project
HEP Analysis - Fox Squirrel

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 1	0	1,800	0.00	0.00		1,800	0.00	0.00	
	1	1,800	0.00	0.00	0.00	1,800	0.00	0.00	0.00
	5	1,800	0.00	0.00	0.00	1,800	0.00	0.00	0.00
	15	1,800	0.00	0.00	0.00	1,800	0.00	0.00	0.00
	25	1,800	0.00	0.00	0.00	1,800	0.46	828.00	4,140.00
	50	1,800	0.00	0.00	0.00	1,800	0.88	1,584.00	30,150.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		34,290.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		685.80
								NET BENEFIT (AAHU)	
								685.80	

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 2	0	100	0.00	0.00		100	0.00	0.00	
	1	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	5	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	15	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	25	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	50	100	0.00	0.00	0.00	100	0.33	33.00	577.50
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		577.50
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		11.55
								NET BENEFIT (AAHU)	
								11.55	

Benefits gained from mitigation zones of the St. Johns Basin - New Madrid Floodway Project

HEP Analysis - Fox Squirrel

Mitigation Zone	TargetYear	Without Project: Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	With Project: Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zones 3 & 4	0	100	0.00	0.00		100	0.00	0.00	
	1	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	5	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	15	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	25	100	0.00	0.00	0.00	100	0.49	49.00	245.00
	50	100	0.00	0.00	0.00	100	0.86	86.00	1,687.50
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		1,932.50
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		38.65

NET BENEFIT (AAHU)
38.65

Mitigation Zone	TargetYear	Without Project: Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	With Project: Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 5	0	100	0.00	0.00		100	0.00	0.00	
	1	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	5	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	15	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	25	100	0.00	0.00	0.00	100	0.17	17.00	85.00
	50	100	0.00	0.00	0.00	100	0.17	17.00	425.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		510.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		10.20

NET BENEFIT (AAHU)
10.20

Benefits gained from mitigation zones of the St. Johns Basin - New Madrid Floodway Project

HEP Analysis - Fox Squirrel

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (miles)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (miles)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 6	0	10	0.00	0.00		10	0.00	0.00	
	1	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	5	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	15	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	25	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	50	10	0.00	0.00	0.00	10	0.00	0.00	0.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		0.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		0.00
								NET BENEFIT (AAHU)	
								0.00	

Benefits gained from mitigation zones of the St. Johns Basin - New Madrid Floodway Project
HEP Analysis - Barred Owl

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 1	0	1,800	0.00	0.00		1,800	0.00	0.00	
	1	1,800	0.00	0.00	0.00	1,800	0.00	0.00	0.00
	5	1,800	0.00	0.00	0.00	1,800	0.00	0.00	0.00
	15	1,800	0.00	0.00	0.00	1,800	0.00	0.00	0.00
	25	1,800	0.00	0.00	0.00	1,800	0.00	0.00	0.00
	50	1,800	0.00	0.00	0.00	1,800	0.47	846.00	10,575.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		10,575.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		211.50
								NET BENEFIT (AAHU)	
								211.50	

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 2	0	100	0.00	0.00		100	0.00	0.00	
	1	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	5	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	15	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	25	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	50	100	0.00	0.00	0.00	100	0.07	7.00	122.50
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		122.50
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		2.45
								NET BENEFIT (AAHU)	
								2.45	

Benefits gained from mitigation zones of the St. Johns Basin - New Madrid Floodway Project

HEP Analysis - Barred Owl

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zones 3 & 4	0	100	0.00	0.00		100	0.00	0.00	
	1	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	5	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	15	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	25	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	50	100	0.00	0.00	0.00	100	0.44	44.00	550.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		550.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		11.00
								NET BENEFIT (AAHU)	11.00

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 5	0	100	0.00	0.00		100	0.00	0.00	
	1	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	5	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	15	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	25	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	50	100	0.00	0.00	0.00	100	1.00	100.00	1,250.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		1,250.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		25.00
								NET BENEFIT (AAHU)	25.00

Benefits gained from mitigation zones of the St. Johns Basin - New Madrid Floodway Project

HEP Analysis - Barred Owl

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (miles)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (miles)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 6	0	10	0.00	0.00		10	0.00	0.00	
	1	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	5	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	15	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	25	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	50	10	0.00	0.00	0.00	10	0.00	0.00	0.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		0.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		0.00

NET BENEFIT (AAHU)
0.00

Benefits gained from mitigation zones of the St. Johns Basin - New Madrid Floodway Project
HEP Analysis - Carolina Chickadee

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 1	0	1,800	0.00	0.00		1,800	0.00	0.00	
	1	1,800	0.00	0.00	0.00	1,800	0.00	0.00	0.00
	5	1,800	0.00	0.00	0.00	1,800	0.00	0.00	0.00
	15	1,800	0.00	0.00	0.00	1,800	0.05	90.00	450.00
	25	1,800	0.00	0.00	0.00	1,800	0.44	792.00	4,410.00
	50	1,800	0.00	0.00	0.00	1,800	0.85	1,530.00	29,025.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		33,885.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		677.70
								NET BENEFIT (AAHU)	
								677.70	

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 2	0	100	0.00	0.00		100	0.00	0.00	
	1	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	5	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	15	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	25	100	0.00	0.00	0.00	100	0.04	4.00	20.00
	50	100	0.00	0.00	0.00	100	0.18	18.00	315.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		335.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		6.70
								NET BENEFIT (AAHU)	
								6.70	

Benefits gained from mitigation zones of the St. Johns Basin - New Madrid Floodway Project

HEP Analysis - Carolina Chickadee

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zones 3 & 4	0	100	0.00	0.00		100	0.00	0.00	
	1	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	5	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	15	100	0.00	0.00	0.00	100	0.05	5.00	25.00
	25	100	0.00	0.00	0.00	100	0.40	40.00	225.00
	50	100	0.00	0.00	0.00	100	0.70	70.00	1,375.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		1,625.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		32.50
								NET BENEFIT (AAHU)	
								32.50	

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 5	0	100	0.00	0.00		100	0.00	0.00	
	1	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	5	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	15	100	0.00	0.00	0.00	100	0.04	4.00	20.00
	25	100	0.00	0.00	0.00	100	0.44	44.00	240.00
	50	100	0.00	0.00	0.00	100	0.92	92.00	1,700.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		1,960.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		39.20
								NET BENEFIT (AAHU)	
								39.20	

Benefits gained from mitigation zones of the St. Johns Basin - New Madrid Floodway Project
HEP Analysis - Carolina Chickadee

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (miles)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (miles)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 6	0	10	0.00	0.00		10	0.00	0.00	
	1	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	5	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	15	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	25	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	50	10	0.00	0.00	0.00	10	0.00	0.00	0.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		0.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		0.00
								NET BENEFIT (AAHU)	
								0.00	

Benefits gained from mitigation zones of the St. Johns Basin - New Madrid Floodway Project
HEP Analysis - Pileated Woodpecker

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 1	0	1,800	0.00	0.00		1,800	0.00	0.00	
	1	1,800	0.00	0.00	0.00	1,800	0.00	0.00	0.00
	5	1,800	0.00	0.00	0.00	1,800	0.00	0.00	0.00
	15	1,800	0.00	0.00	0.00	1,800	0.00	0.00	0.00
	25	1,800	0.00	0.00	0.00	1,800	0.00	0.00	0.00
	50	1,800	0.00	0.00	0.00	1,800	0.00	0.00	0.00
		Cumulative Habitat Units			0.00	Cumulative Habitat Units			0.00
		Average Annual Habitat Units			0.00	Average Annual Habitat Units			0.00

NET BENEFIT (AAHU)
0.00

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 2	0	100	0.00	0.00		100	0.00	0.00	
	1	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	5	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	15	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	25	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	50	100	0.00	0.00	0.00	100	0.00	0.00	0.00
		Cumulative Habitat Units			0.00	Cumulative Habitat Units			0.00
		Average Annual Habitat Units			0.00	Average Annual Habitat Units			0.00

NET BENEFIT (AAHU)
0.00

Benefits gained from mitigation zones of the St. Johns Basin - New Madrid Floodway Project
HEP Analysis - Pileated Woodpecker

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zones 3 & 4	0	100	0.00	0.00		100	0.00	0.00	
	1	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	5	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	15	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	25	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	50	100	0.00	0.00	0.00	100	0.00	0.00	0.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		0.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		0.00

NET BENEFIT (AAHU)
0.00

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 5	0	100	0.00	0.00		100	0.00	0.00	
	1	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	5	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	15	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	25	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	50	100	0.00	0.00	0.00	100	0.24	24.00	300.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		300.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		6.00

NET BENEFIT (AAHU)
6.00

Benefits gained from mitigation zones of the St. Johns Basin - New Madrid Floodway Project
HEP Analysis - Pileated Woodpecker

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (miles)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (miles)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 6	0	10	0.00	0.00		10	0.00	0.00	
	1	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	5	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	15	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	25	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	50	10	0.00	0.00	0.00	10	0.00	0.00	0.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		0.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		0.00

NET BENEFIT (AAHU)
0.00

Benefits gained from mitigation zones of the St. Johns Basin - New Madrid Floodway Project
HEP Analysis - Mink

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 1	0	1,800	0.00	0.00		1,800	0.00	0.00	
	1	1,800	0.00	0.00	0.00	1,800	0.00	0.00	0.00
	5	1,800	0.00	0.00	0.00	1,800	0.10	180.00	360.00
	15	1,800	0.00	0.00	0.00	1,800	0.10	180.00	1,800.00
	25	1,800	0.00	0.00	0.00	1,800	0.10	180.00	1,800.00
	50	1,800	0.00	0.00	0.00	1,800	0.10	180.00	4,500.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		8,460.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		169.20
								NET BENEFIT (AAHU)	
								169.20	

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 2	0	100	0.00	0.00		100	0.00	0.00	
	1	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	5	100	0.00	0.00	0.00	100	0.15	15.00	30.00
	15	100	0.00	0.00	0.00	100	0.50	50.00	325.00
	25	100	0.00	0.00	0.00	100	0.50	50.00	500.00
	50	100	0.00	0.00	0.00	100	0.50	50.00	1750.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		2605.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		52.10
								NET BENEFIT (AAHU)	
								52.10	

Benefits gained from mitigation zones of the St. Johns Basin - New Madrid Floodway Project

HEP Analysis - Mink

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zones 3 & 4	0	100	0.00	0.00		100	0.00	0.00	
	1	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	5	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	15	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	25	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	50	100	0.00	0.00	0.00	100	0.00	0.00	0.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		0.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		0.00

NET BENEFIT (AAHU)
0.00

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (acres)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 5	0	100	0.00	0.00		100	0.00	0.00	
	1	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	5	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	15	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	25	100	0.00	0.00	0.00	100	0.00	0.00	0.00
	50	100	0.00	0.00	0.00	100	0.00	0.00	0.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		0.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		0.00

NET BENEFIT (AAHU)
0.00

Benefits gained from mitigation zones of the St. Johns Basin - New Madrid Floodway Project

HEP Analysis - Mink

		Without Project				With Project			
Mitigation Zone	TargetYear	Area of Habitat (miles)	Habitat Suitability Index	Habitat Units	Habitat Units between target years	Area of Habitat (miles)	Habitat Suitability Index	Habitat Units	Habitat Units between target years
Zone 6	0	10	0.00	0.00		10	0.00	0.00	
	1	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	5	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	15	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	25	10	0.00	0.00	0.00	10	0.00	0.00	0.00
	50	10	0.00	0.00	0.00	10	0.00	0.00	0.00
			Cumulative Habitat Units		0.00		Cumulative Habitat Units		0.00
			Average Annual Habitat Units		0.00		Average Annual Habitat Units		0.00

NET BENEFIT (AAHU)

0.00