

# STATE WILDLIFE GRANT

State of Illinois

## GRANT PROPOSAL Amendment #1

by  
The Center for Watershed Science  
Illinois State Water Survey  
Champaign, IL 61820

**PROJECT TITLE:** Hydrologic and Hydraulic Modeling and Analyses for the Cache River:  
For the Purpose of Evaluating Restoration Measures Recommended  
for Implementation as Part of the Cache River Basin Study

**PROJECT NUMBER:** T-18-P Amendment #1

**NEED:** The Cache River basin is located in an extreme southern part of Illinois, just north of the confluence of the Ohio and Mississippi Rivers. The basin covers parts of the six southern Illinois counties of Union, Johnson, Alexander, Pulaski, Massac, and Pope. The total drainage area of the watershed is 737 square miles. Since the construction of the Post Creek Cutoff in 1915, the Cache River basin has been divided into two subwatersheds: the Upper and Lower Cache River watersheds (as shown in figure 1.) The Upper Cache River watershed consists of the eastern part of the Cache River basin with a drainage area of 368 square miles; it drains directly to the Ohio River through the Post Creek Cutoff. The Lower Cache River watershed consists of the western part of the Cache River basin with a drainage area of 358 square miles; it drains to the Mississippi River through a diversion channel at the downstream end of the river. Elevens square miles of the Lower Cache River watershed continue to drain into the Ohio River through the original channel.

Because of its unique location at a junction of major rivers and at the confluence of different topographic and physiographic regions, the Cache River basin exhibits diverse physical, chemical and biological features to produce a great diversity of natural communities, many of which are on the edge of their species range. In addition, many of the natural communities within the basin are relatively undisturbed and still support the full range of species and natural character they displayed prior to human disturbance. As a result, the Cache River basin contains some of the most nationally and internationally significant habitats that need protection and restoration. Changes in land use practices and hydrologic modifications over the last century have significantly threatened the ecological integrity of some of the valuable habitats and wetlands in the basin.

Concerned citizens, non-governmental organizations and state and federal agencies have been working together over the last 30 years to protect and restore these valuable natural resources. Because of the scale and complexity associated with successful restoration, preservation and management of natural resources within the Cache River basin, a partnership was formed bringing together the most prominent conservation organizations in the state. The Illinois Department of Natural Resources, The Nature Conservancy, The U.S. Fish and Wildlife Service, and Ducks Unlimited have united to form the nucleus of the Cache River Joint Venture Partnership (JVP). The JVP is committed to the preservation, restoration, and management of

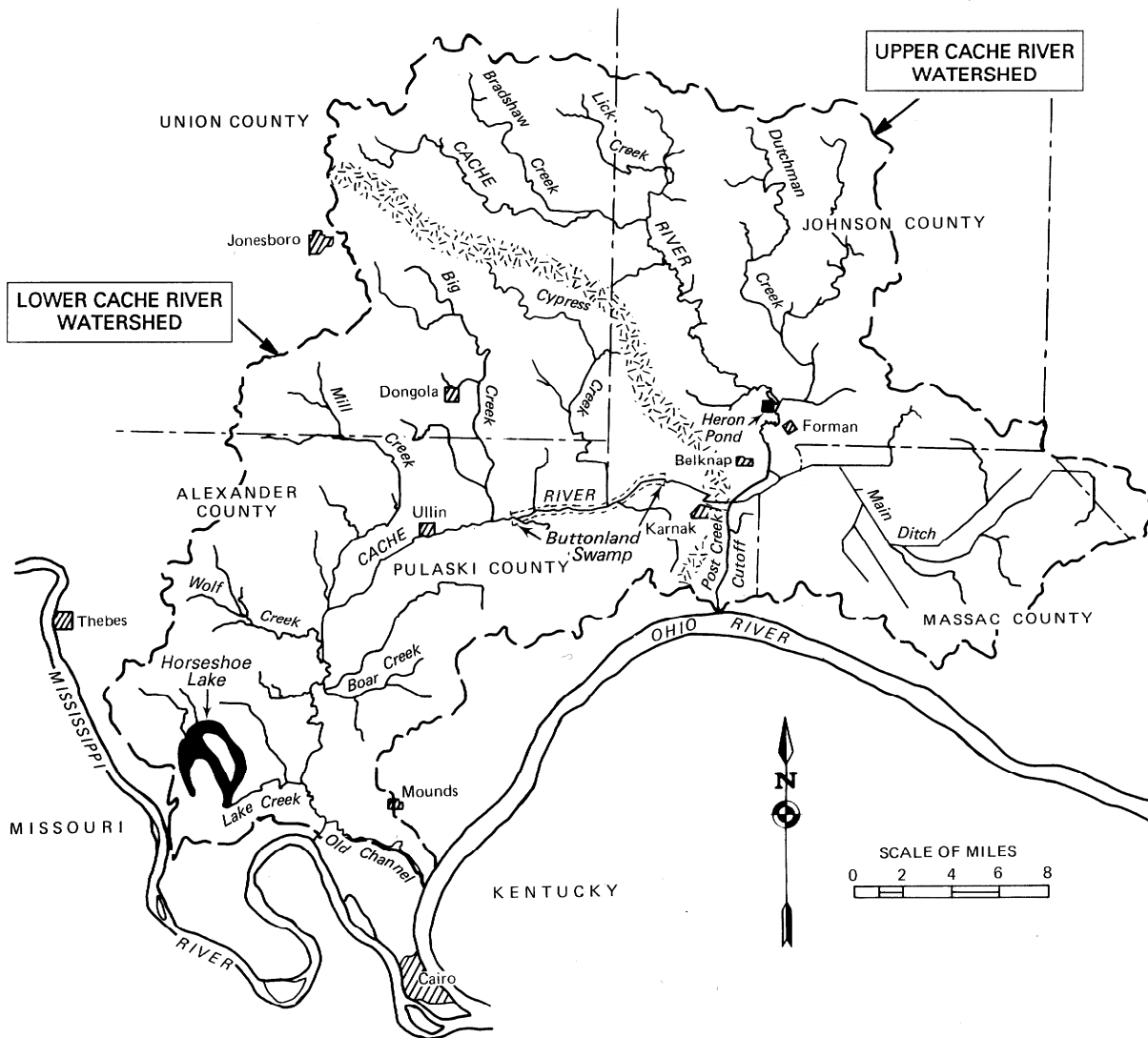


Figure 1. The Upper and Lower Cache River

natural resources within the Cache River basin with emphasis on bottomland hardwood forests, wetlands, migratory waterfowl, shorebirds, and neotropical migratory songbirds. Together, the JVP partners own and manage nearly 35,000 acres of land in the Cache River watershed including the Cache River State Natural Area, Cypress Creek National Wildlife Refuge, and Grassy Slough Preserve, with in a purchase boundary of over 60,000 acres. Other prominent contributors to this effort include the U.S. Army Corps of Engineers, St. Louis District, the Natural Resources Conservation Service, local Soil and Water Conservation Districts, students and scientists from Southern Illinois University, a collection of local farmers and conservation professionals who banded together to form the Cache River Watershed Resource Planning Committee, the Friends of the Cache River Watershed, and numerous other organizations and individuals representing a diverse collection of background and interests.

These conservation groups and local stakeholders have come together with a goal of restoring a degree of the Cache River system's natural hydrology. This restoration vision includes placing two structures in the river channel (hereafter referred as east and west swamp structures) and creating a managed reconnection of the Upper and Lower Cache River segments.

An essential component of this restoration effort is detailed hydrologic and hydraulic modeling to determine water levels associated with the proposed restoration measures. Hydrologic and hydraulic modeling will allow the JVP to satisfy all regulatory requirements and assure that natural, agricultural and social resources are not damaged by flooding induced by structural modifications to the river system.

Table 1 lists the conservation status (Federal/State threatened, endangered, or a species of special concern) of imperiled species found within the project area. These species are dependent on floodplain processes for the long-term sustainability of the natural communities where they are found. The restoration alternatives proposed by the JVP are intended to restore those processes, allowing for sustainable site-specific management to benefit individual natural communities and/or species.

**Table 1.** Threatened, Endangered and rare species and species of special concern found in the floodplain of the Cache River watershed (Cache River State Natural Area, USFWS - Cypress Creek NWR, The Nature Conservancy - Grassy Slough Preserve) Union, Alexander, Pulaski, and Johnson Counties in extreme southern Illinois.

<b>Common Name</b>	<b>Scientific Name</b>	<b>Status (SE,ST, FE, FT, SSC)*</b>
American Strawberry Bush	<i>Euonymus americanus</i>	SE
Bald Eagle	<i>Haliaeetus leucocephalus</i>	ST, FT
Bewick's Wren	<i>Thryomanes bewickii</i>	SE
Bird-voiced treefrog	<i>Hyla avivoca</i>	ST
Copperbelly Water Snake	<i>Nerodia erythrogaster var. neglecta</i>	SSC
Creeping Loosestrife	<i>Lysimachia radicans</i>	SE
Cypress Knee Sedge	<i>Carex decomposita</i>	SE
Eastern Ribbon Snake	<i>Thamnophis sauritus</i>	SE
Eryngo	<i>Eryngium prostratum</i>	SE
Grass-leaved Lilly	<i>Stenanthium gramineum</i>	SE
Gray Bat	<i>Myotis grisescens</i>	SE, FE
Indiana Bat	<i>Myotis sodalis</i>	SE, FE
Large Sedge	<i>Carex gigantea</i>	SE
Leatherflower	<i>Clematis viorna</i>	SE
Log Fern	<i>Dryopteris celsa</i>	SE
Nuttall's Oak	<i>Quercus nuttallii</i>	SE
One-flowered Hydrolea	<i>Hydrolea uniflora</i>	SE
Panic Grass	<i>Panicum jooi</i>	SE
Pink Thoroughwort	<i>Eupatorium incarnatum</i>	ST
Powdery Thalia	<i>Thalia dealbata</i>	SE
Rafinesque's Big-eared Bat	<i>Coryrhinus rafinesquii</i>	SE
Red-shouldered Hawk	<i>Buteo lineatus</i>	ST
Reniform Sedge	<i>Carex reniformis</i>	SE
Sharp-scaled Sedge	<i>Carex oxylepis</i>	ST
Storax	<i>Styrax americana</i>	ST

Swainson's Warbler	<i>Limnothlypis swainsonii</i>	SE
Swollen Sedge	<i>Carex intumescens</i>	ST
Timber Rattlesnake	<i>Crotalus horridus</i>	ST
Tuberclad Orchid	<i>Platanthera flava var. flava</i>	SE
Virginia Snakeroot	<i>Aristolochia serpentaria var. hastata</i>	ST
Water Elm	<i>Planera aquatica</i>	ST
Water Pennywort	<i>Hydrocotyl ranunculoides</i>	SE
Water Willow	<i>Justicia ovata</i>	SE
Willow Oak	<i>Quercus phellos</i>	ST

\*SE=State Endangered, ST=State Threatened, FE=Federally Endangered, FT=Federally Threatened, SSC=Species of Special Concern.

**OBJECTIVES:** Between September 1, 2005 and March 31, 2007 the objectives of this study are to:

- a) interpret the hydrologic and hydraulic modeling work started by the U.S. Army Corps of Engineers - St. Louis District as part of the Cache River Basin Study
- b) complete the modeling necessary to assess the JVPs proposed water level management alternatives. This process will provide the JVP with the information necessary to satisfy all regulatory requirements and assess the impacts on natural, agricultural, and social resources from any flooding induced by structural modifications to the river system.

**EXPECTED BENEFITS AND RESULTS:** The main benefit that will result from this project is the development of tools that will provide a better understanding of the complex hydrology and hydraulics of the Cache River System that has been significantly altered over the years. The main goal of the JVP is the preservation, restoration, and management of natural resources within the Cache River basin with emphasis on bottomland hardwood forests, wetlands, migratory waterfowl, shorebirds, and neo tropical migratory songbirds. To achieve this goal, the hydrology of the Cache River has to be restored closer to its natural state. At the present, the JVP is considering different management alternatives to restore the hydrology. However, it would be impossible to evaluate if any of the alternatives are feasible and what their impacts would be on other parts of the river system without developing the necessary hydrologic and hydraulic models. Some of the alternatives under consideration include constructing water level control and flow diversion structures that could significantly alter the current hydrology and hydraulics of the Cache River. The models that will be prepared for this project will enable the JVP to objectively evaluate the benefits and potential impacts of the different alternatives before deciding to implement any of the alternatives. The results of the models will also be presented by using GIS maps and 3-D visualization products that could easily be understood by resource managers and stakeholders within the watershed. This will help in effectively communicating the project objectives and potential outcomes to a wide range of audiences in the Cache River basin.

**APPROACH:** To accomplish the project objective, the Water Survey will perform the following tasks. It should be noted that this project is jointly funded by the Illinois Department of Natural Resources and The Nature Conservancy of Illinois. The funding request from IDNR is for a total of \$52,000 from the State Wildlife Grant. The Nature Conservancy will provide the non-federal aid match of \$52,000. The Nature Conservancy is one of the main partners of the JVP and owns and manages critical restoration areas in the Cache River. As one of the partners in JVP, they are interested in developing the necessary tools to develop the appropriate restoration projects for the Cache River. Development of the hydrologic and hydraulic models is one of the important tools needed to implement any major restoration project in the Cache River watershed.

**Task 1.** Collect all documents including maps, modeling data, and associated software used by the U.S. Army Corps of Engineers, St. Louis District for the Cache River Basin Study.

**Task 2.** Work closely with the JVP and the St. Louis District to evaluate and interpret the information received from the Corps of Engineers.

**Task 3.** Re-establish and run the hydrologic and hydraulic models used by the St. Louis District for the Cache River Basin Study. Evaluate the accuracy of the models by comparing the model results to observed data in the Cache River. Make necessary adjustments including the changes in the Big Creek watershed in the models as needed to improve the overall accuracy of hydrologic and hydraulic models.

**Task 4.** Prepare landscape and hydrologic visualization products to illustrate the changes in land use and hydrologic modifications over time and under future alternative restoration plans.

**Task 5.** Based on the results of the hydrologic and hydraulic modeling efforts, identify to the greatest level of accuracy possible all acreages and landowners affected by the implementation of all the restoration measures recommended by JVP. The major restoration measure includes the management of water levels between the proposed East and West Swamp structures by partially reconnecting the Upper Cache River with the Lower Cache River as shown in figure 2. The U.S. Army Corps of Engineers has already evaluated re-diverting flows from the Upper Cache River to the Lower Cache River in the range of 200 to 500 cubic feet per second. For this study, the range of flow diversion will be increased based on discussions with the JVP. The four alternative combinations of elevations that were considered by the U.S. Army Corps of Engineers are given in the table below. In this study, the impact of each of the structural modifications: re-diverting water from the Upper Cache River to the Lower Cache River; the East Swamp Structure; and the West Swamp structure will be evaluated separately and compared to existing conditions and to the four alternatives evaluated by the U.S. Army Corps of Engineers.

**Table 1. Water Level Management Alternatives that will be Evaluated Using the Hydraulic Model for the Lower Cache River**

<i>Alternative</i>	<i>Elevation of East Swamp Structure (feet above mean sea level)</i>	<i>Elevation of West Swamp Structure (feet above mean sea level)</i>
1	328.4	327.4
2	328.4	326.4
3	330.4	327.4
4	330.4	326.4

**Task 6.** Prepare a project report and submit to the JVP. The report will include all the relevant model results, GIS maps, and aerial photographs collected and used for the project.

# State Wildlife Grant Proposal Project Area

Cache River Watershed Ecosystem Restoration

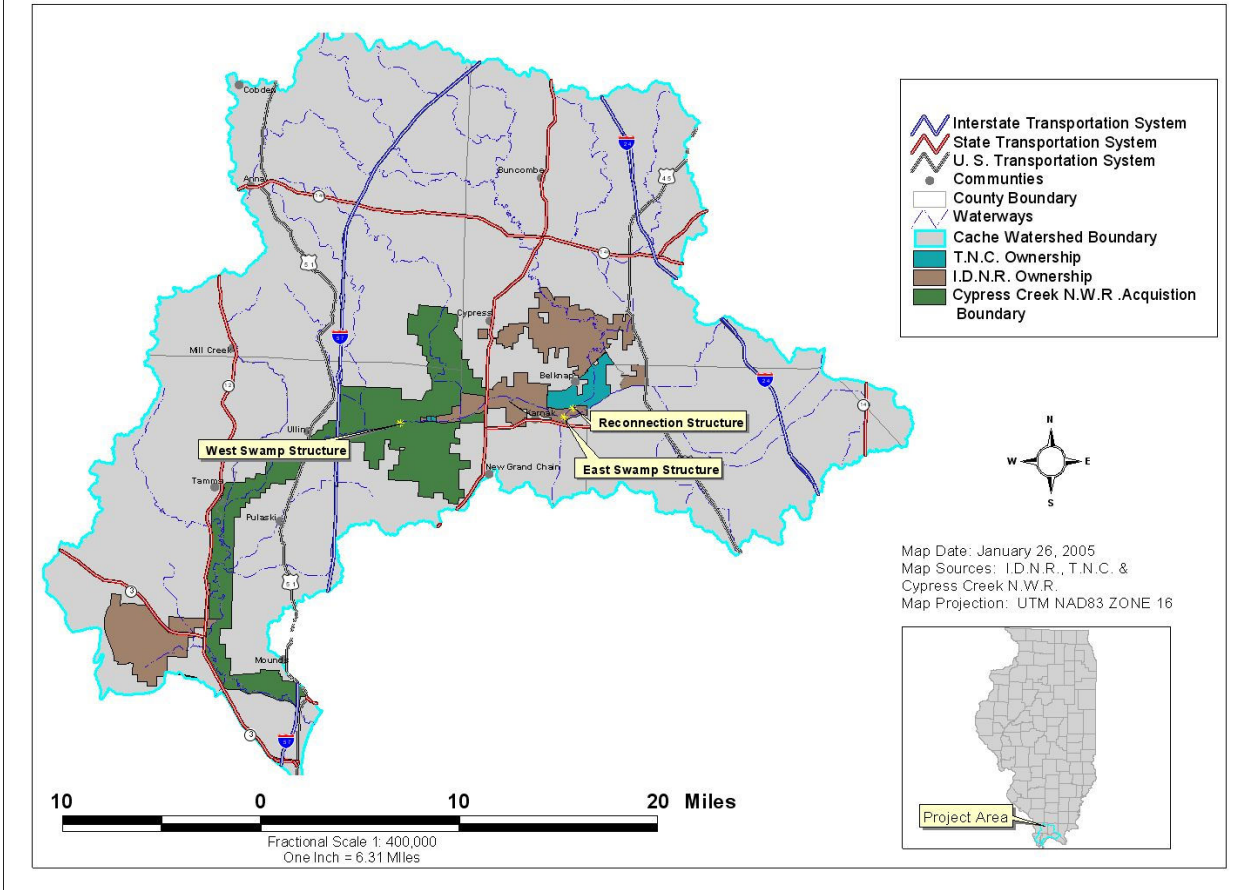


Figure 2. Location of the Reconnection and the East and West Swamp Structures along the Cache River

**DELIVERABLES:** The deliverables for the project include the final project report and landscape and flow visualization products. The final project report will include the results of the hydrologic and hydraulic modeling effort used to evaluate the impacts of the different water level management scenarios proposed by the JVP. The water level management alternatives assume partial reconnection of the Upper Cache River with the Lower Cache River with flows ranging from 200-500 cfs and variable elevations for the east and west structures as discussed earlier in the proposal. The report will include GIS maps of the area showing areas that will be affected by the implementation of the water level management alternatives.

The visualization products will include: three-dimensional flyovers of the Cache River Valley at different times including potential future conditions envisioned under the proposed management scenarios. Other products will include an overview of the area under different water levels. These products will be produced in consultation with the JVP.

**SCHEDULE:** The schedule for accomplishing the six tasks outlines in the Approach section are provided below:

Tasks	2005				2006												2007			
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	
1																				
2																				
3																				
4																				
5																				
6																				

**LOCATION:** (See Figure 1) The Project Area is located in extreme southern Illinois within all or parts of Union, Johnson, Alexander, Pulaski and Massac Counties. See the attached map for an illustration of the project area and structural restoration measures.

- Topographic Maps: Karnak, Vienna, and Cypress
- Location: 13S02E; 13S03E; 14S01E; 14S02E
- Sections: 14, 15, 21-30, 34-36; 19, 20, 21, 28-31; 11-16, 21-24; 7-11, 14-18
- Natural Divisions: 013B-Shawnee Hills Div., Lesser Shawnee Hills
- Section: 014B-Coastal Plain Division, Cretaceous Hill Section
- Legislative Districts: S59; R118

**PERSONNEL:** The following personnel from the Division of Habitat Resources, Office of Resource Conservation will be managing this project:

Jody Shimp

Illinois Dept. of Natural Resources-Region 5 Office

Districts 21-26

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**RELATED PROJECTS:**

Title: "Project Administrator-Cache River Watershed Scale Restoration Project, Union, Johnson, Alexander and Pulaski Counties, IL." (SWG '04 Project – Effective 5/1/05).