February 5, 2015

Scope of Work

Assessment of Groundwater Movement, Recharge, and Water Quality
and Development of a Groundwater Monitoring System
for Key Cave
For
U. S. Fish and Wildlife Service
By the
Geological Survey of Alabama

Introduction and Purpose
Springs and cave pools originating from carbonate stratigraphy in Alabama provide habitat for a number of threatened and endangered species. Groundwater from this same stratigraphy also serves as sources of public, industrial, and agricultural water supply throughout the Tennessee Valley. A number of these important sources of groundwater are in the Tennessee River watershed in the northern part of the state. Key Cave is in the Tennessee River watershed in south-central Lauderdale County, about 5 miles southwest from the city of Florence. This cave provides habitat for the endangered Alabama Cavefish and gray bat, as well as the Key Caveshrimp, Southern Cavefish, and the Alabama Cave crayfish and Phantom Cave Crayfish.

Key Cave is in the recharge area of the Mississippian aged Tuscumbia Limestone aquifer. Groundwater flowing through the cave likely discharges into the Tennessee River, however no discharge points have been observed to date.

Protection of the groundwater recharge area for Key Cave is an essential part of plans for long-term protection of water quantity and quality that provides habitat for cave fauna. The Geological Survey of Alabama has prepared the following scope of work designed to assess the sources, movement, and quality of groundwater recharging the Key Cave ecosystem and to develop a groundwater monitoring system in the recharge area of Key Cave.

Scope of Work
This assessment will include evaluation of existing hydrogeologic data, collection of field data from on-site assessments to determine the hydrogeologic character of the cave, geographic extent of the recharge area for the cave discharge, and directions of groundwater movement through the recharge area. Project work elements will result in development and implementation of a groundwater
monitoring system to track changes in recharge water quantity and quality for the cave. The following deliverables will be prepared:

1. Hydrogeologic setting and detailed site geology. The occurrence of groundwater and the interaction of surface runoff and groundwater are the essential elements for maintenance and protection of habitat in the Key Cave recharge area. Work element 1 consists of information describing relationships of the geology of the area and origins and movement of groundwater that discharges at Key Cave.
2. Maps showing geologic structure and stratigraphy. These elements are the basis for groundwater movement and the interaction of surface and groundwater in the project area.
3. Geochemical characterization including water age dating (if possible), stable isotopic assessment, and ionic characterization of Key Cave groundwater.
4. Maps of groundwater levels, directions of groundwater movement, and information about the volume of water discharged through the cave (based on available data and collected field data) (dye tracing will be used, if necessary).
5. Delineation and mapping of the recharge area for Key Cave.
6. Design of a groundwater monitoring system for Key Cave, based on results from the hydrogeologic assessment. The monitoring system will use all available monitoring sites (available access to the Tuscumbia Limestone aquifer, utilizing existing wells (if available) and subsidence features (if available). Construction of monitoring wells is beyond the scope of this project but will be proposed to USFWS for consideration, if required).
7. Implementation of the groundwater monitoring system design (based on availability of adequate monitoring sites). The monitoring system will consist of two sites (one up-gradient and one in the cave), each outfitted with a EcoLog 800 pressure transducer, data logger, and data transmitter, and field laptop computer and a base station consisting of a desktop pc with appropriate, cellular receiving capability and data base and web software.

**Deliverables**

Deliverables will include text describing methods of investigation, acquired data, interpretations of data, conclusions, and graphics consisting of charts, graphs, and maps. An electronic version of the final report will be provided.

**Additional Work Elements**

If currently available and field collected data are not sufficient to adequately characterize the recharge area for Key Cave, a dye tracer survey will be recommended. A proposal will be provided if needed for this additional investigation. If an adequate number of groundwater monitoring sites are not available, a sufficient number of monitoring wells will be recommended for construction at a later date.

**Project Cost Estimate**

Hydrogeologic Assessment Cost Estimate
$28,117.00

Monitoring System Implementation
$26,356.00