

# Summary Report on Water Quality and Related Issues Concerning the Duck River near Only, Tennessee

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## Background:

In response to a request from property owners Victor and Holly Wooten, Subijoy Dutta, PE, environmental engineer and Dick Lahn, stormwater management consultant, of Rivers of the World Foundation, visited the 150 acre site on Duck River near Only, Tennessee on August 8, 2009. A general Location of the area is flagged below.



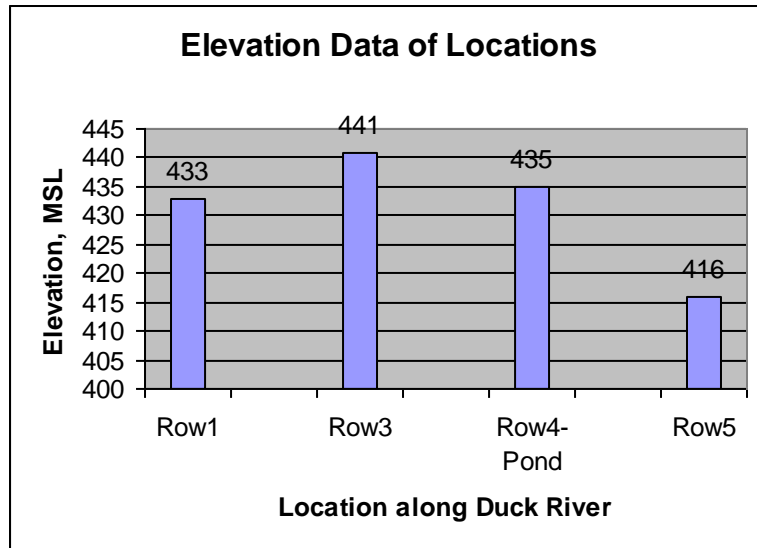
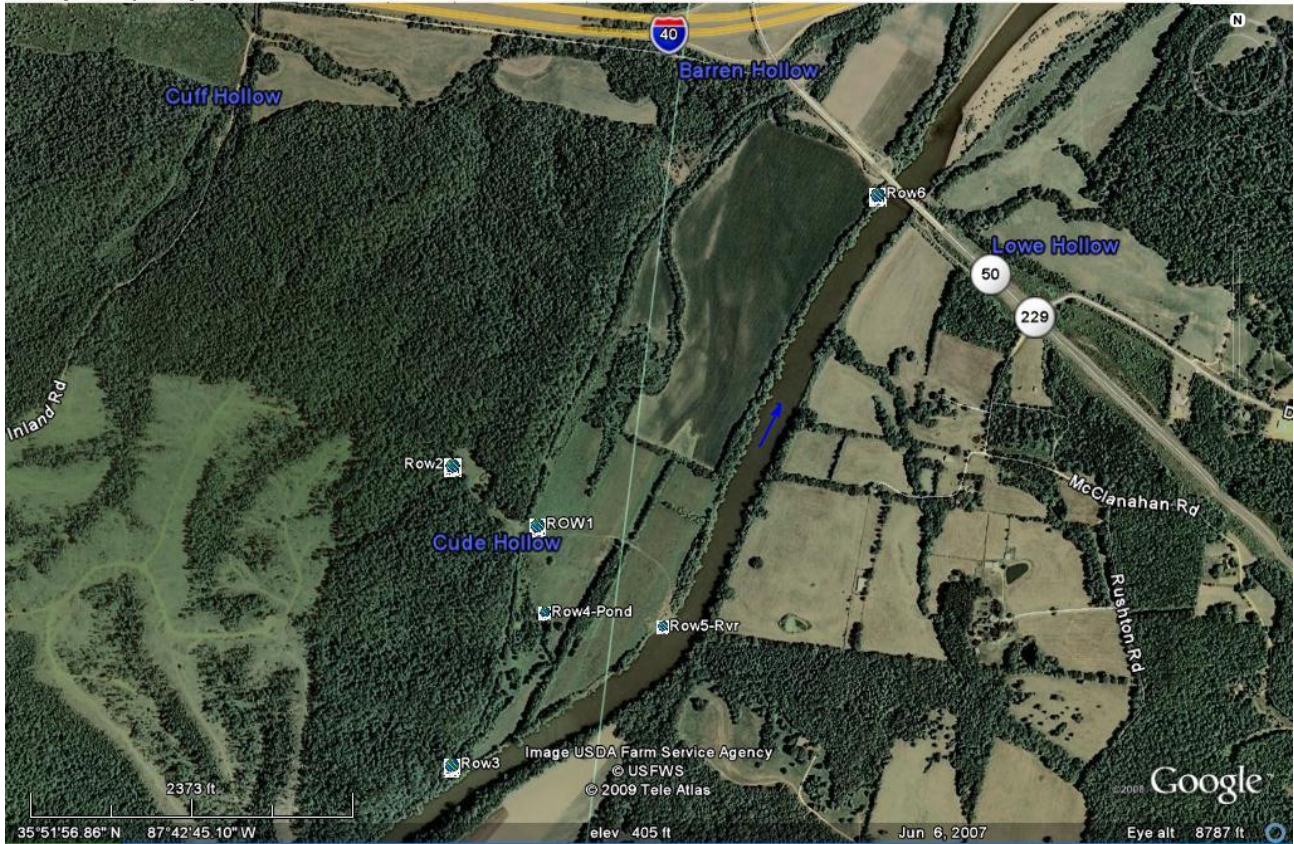
The site visit was made during a nature camp by Victor Wooten and other naturalists who believed in harmonizing the music with nature.

## Data Collections/Observations:

GPS data with elevations were collected for various areas along the Duck River. A location map showing the Data collection sites overlain on top of an aerial photo of the area is shown below. The elevation data for these locations - River house area (Row3), Fish Pond (Row4), Stony Beach (Row5), and River bank near Route 50 Bridge are depicted and labeled on a Chart below.

Duck River Site - Visit by Rivers of the World Foundation, Aug. 8, 2009

Base Map - Courtesy of Google Earth



Water temperature, Conductivity, and Dissolved Oxygen data for some of these areas are shown in the Table below.

**DUCK RIVER - WOOTEN WOODS AREA**

<b>Location</b>	<b>Elevation</b>	<b>Lat-Long</b>	<b>Date-Time</b>	<b>Temp. Deg. C</b>	<b>Conductivity µmho/cm</b>	<b>DO mg/L</b>
Row1	433	N35 51.818 W87 42.921	08-AUG-09 3:11:00PM			
Row3	441	N35 51.521 W87 43.052	08-AUG-09 3:56:03PM			
Row4- Pond	435	N35 51.712 W87 42.910	08-AUG-09 4:11:20PM	22	101.4	
Row5	416	N35 51.694 W87 42.730	08-AUG-09 4:24:06PM	29	229	8.0
Row6			08-AUG-09 4:54:08PM	29	220	

Water temperature at the fish pond is 7 °C cooler than the ones observed in the Duck River. The Fish pond is fed by water from the nearby spring off of the hillside.

Eroded bank near River House does not have an accessible slope to the river; rather it is a sheer drop off of about 15 feet. Spring water, drinkable by residents, is traceable underground up the hillside.

The site is being developed as a music/nature studies camp. Five different structures for the camp are estimated to be about a ½ mile from the Duck River. The only other building on the property is the “River House”, a wooden frame cottage some 30’ from the bank of the river. The River house is close to the Row3 location on the map and it is at about 25-30 feet above the water level during the site visit. The property is about half farmland in the flood plain of the Duck River and half forested. There is one pond and at least one spring on the property. Utilities are well water, septic, and electric. Plans are to let the land age naturally with the exception of the camp area and parking

lot which together are about 5 acres.



Serene Duck River – Full of Aquatic Life.

Photo: Subijoy Dutta

The Wooten's issues/concerns are erosion of the Duck River bank creating sediment and threatening the River House; the quality of the water in the river and possible impact from their property and other properties in the area; and impact, if any, on the endangered species in the River.

Duck River is only the second river named a State Scenic River since 1970, approximately 37 miles of the Duck River in Maury County received this designation, marking it as one of only 13 such rivers in Tennessee.

The Duck's scenic section, which begins at Iron Bridge Road near Columbia and extends upstream to the Maury and Marshall County line, features over 500 documented species including aquatic plants, fish and invertebrates. The river contains 39 mussel and 84 fish species; more species of fish than in all of Europe.

As the Duck River meanders its way across Middle Tennessee to the Tennessee River, it passes through some of the state's least populated counties and some of its most scenic rural and agricultural landscapes. As an important source of food, water and transportation, the Duck River has been a major influence on the history of this region from the earliest habitation by native Americans, through the early settlers and pioneers, to today's 21st century inhabitants. The river

and its surrounding landscape is rich with evidence of habitation from as far back as the Archaic period approximately 8,000 years ago. Reminders of early settlements, vast plantations, and Civil War battles can be found throughout the area. From its origin in the Eastern Highland Rim, the Duck crosses the Central Basin and continues west across the Western Highland Rim before flowing into the Tennessee River.

### **Biological Significance of Duck River:**

Although the Duck River is one of the most biologically rich and diverse rivers in North America, many of its species are in trouble and in need of help. The Duck River has already lost at least 35 species of mussels. In the designated scenic section of the river alone are at least 27 state and federally listed plant and animal species, including 13 listed plants; two listed mammals; five listed mussels; one listed salamander; and seven listed fish.

According to a 1998 publication by The Nature Conservancy entitled "Rivers of Life: Critical Watersheds for Protecting Freshwater Biological Diversity," the Upper Duck River watershed, including the designated scenic section, contains the second highest number (33) of at-risk fish and mussel species, as well as the second highest number (13) of federally endangered fish and mussel species in the nation. Many of these are imperiled because of impact from past land uses. Today, improved agricultural practices, stronger environmental regulations, and better land use planning are contributing to improvements in the water quality of the Duck River and thereby improving the habitat for these species.

One of many rare species that can be found in the Duck River is the federally and state endangered [Birdwing Pearly Mussel](http://www.fws.gov/asheville/photos/Birdwing_pearlymussel_large.jpg) (picture source: [http://www.fws.gov/asheville/photos/Birdwing\\_pearlymussel\\_large.jpg](http://www.fws.gov/asheville/photos/Birdwing_pearlymussel_large.jpg) ). While a small number of this rare mussel can be found in the Clinch, Powell, Elk and Tennessee Rivers, the only place in the world it exists in any great numbers is in the Duck River.



Due to its declining numbers and increasing threats, the Birdwing Pearly Mussel was listed as endangered by the USFWS in 1976 and was included on a 1980 list of the "10 most endangered" species.

Another federally and state endangered species that makes its home in the Duck River is the [Pygmy Madtom](http://www.conservationfisheries.org/fish_images/noturus_stanauli.JPG). (see picture, source:

[http://www.conservationfisheries.org/fish\\_images/noturus\\_stanauli.JPG](http://www.conservationfisheries.org/fish_images/noturus_stanauli.JPG) )

This small, two-inch long black and white catfish is one of the rarest fishes in the U.S., and was listed by the USFWS as endangered in 1993. It is found only in the Duck and Clinch rivers and nowhere else in the world. This fish is also an indicator species for river conditions, as it is very sensitive to toxic chemicals and increased sedimentation.



## **Conclusion/Recommendations:**

Conductivity readings on the three different locations in the area indicated that the water in the Fish-pond was having much less minerals and other contaminants. Since this is a spring-fed pond, it does not receive any sediment load or other contaminants. The slightly lower conductivity reading of the Duck river water downstream of the property, (Row6), in comparison to the upstream location (Row5) it only implies that no additional contaminants, minerals, or other waste products enter the River between these two sampling points. The dissolved oxygen level of 8 ppm at the River was quite supportive of aquatic life.

The spring coming out of the hillside behind the River House can be routed above ground, thereby allowing aeration of the water and improved water quality, and can flow as a waterfall, an additional amenity for the property.

The erosion of the bank threatening the River House poses a difficult problem. The river comes downstream straight to a slight bend at the beginning of the property and specifically at a point directly in front of the River House. The bank wall is vertical where it has eroded beyond a point where a rip rap solution is no longer feasible. Either rock would need to stand straight up which will be unstable against the strong current of the river or built out into the river to act as a foundation for additional rocks placed up against the bank.

A temporary and low-cost remedy is to sink rebar pilings along the shoreline in the eroded places then horizontally place fallen/cut trees behind the rebar next to the bank to create a buffer. This may prevent erosion for a short time while a more permanent solution could be looked into. Without this temporary protection against erosion the problem could get worse and threaten the River house.

Also, consideration should be given to creating a rain garden parallel to the front of the River House or in places where the downspouts from the roof direct rain water. The rain garden will capture the rain runoff from the roof and infiltrate the water into the ground. Otherwise, the water runs off the grass in front of the house and when reaches the bank of the river, it rolls around the edge of the bank and erodes the bank from the top (called a head cut).

It will also be good to participate in various programs where with the State, federal and local government agencies are working cooperatively with individual landowners and conservation organizations like The Nature Conservancy and the Tennessee Scenic Rivers Association to improve and protect the water quality of the Duck River. Public/private partnerships are emerging involving local school groups. These actions will help prevent other species, including mussels, from becoming endangered and possibly even extinct.

A final thought is to have a clay model of the Duck River watershed and display that right in front of the Duck River nature center which could be a part and parcel of the Wooten's Nature Camp. Rivers of the World Foundation will be happy to discuss implementation of these and any other options.