

## **Blackboy Creek: Limestone Crossing (aka: Bigheart Creek)**

NW NW NE Section 36 – 20N – 11E

Osage County, Oklahoma

Latitude N 36° 10' 21.4"

Longitude W 96° 04' 57.3"

WBID# OK 120420-01-0140T

Blue Thumb Volunteer Monitoring Data Review – December 2, 2013

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The watershed of Blackboy Creek is approximately 1600 acres, roughly 40% of which is steep hillside, 30% flat to gently sloping ridges and, 30% is low hills and bottomland. The creek is a first order, intermittent stream located in southeast Osage County and just northwest of downtown Tulsa, Oklahoma. The monitoring location, at an elevation of 720 ft., is a mile from the headwaters, which are 950 ft. in elevation. From the monitoring site, Blackboy Creek flows south-southeast about 2-3 miles where Harlow Creek joins in just south of Sand Springs Expressway. Another mile south is where Blackboy Creek empties into the Arkansas River.

The creek and its watershed are in the Northern Cross Timbers ecoregion. Land use is typical of the ecoregion; primarily horse and cattle grazing, lots of wildlife and rural residential. In the past ten years 10 coal bed methane wells and a more urban type residential subdivision have been developed in the watershed. Additional rural residential subdivisions are planned for the area.

### Stream Condition and Habitat Overview

Most hillsides in the watershed are heavily wooded. Pasture/bottom land is well vegetated with both native and non-native grass species. Riparian vegetation along the creek plays a very important role in the health of an aquatic system. This area is thick with cottonwood, sycamore, black walnut, pecan, birch and other native tree and shrub species creating a good canopy cover. The canopy cover shades and helps maintain cooler water temperatures. Trees contribute woody & organic debris that creates riffles and pools and provides a food source and habitat for aquatic invertebrates. There has been no channel alteration; however, the creek tends to flow in a somewhat straight manner along the bottom of a hill, making just a few 90° turns. The monitoring site is a pool at one of these turns.

The stream substrate is generally flat rock, sandstone and limestone, cobble and gravel with minimal sand. Moderate sedimentation can be found in some areas as a result of previously mentioned drilling and residential development activities. Instream cover is high however bank vegetation stability is moderate due to long term drought conditions. There is good pool variability; pool substrate is mostly flat rock.

Due to the continuing drought, there has been little to no flow, hence no rocky runs or riffles. These stream features provide important habitat and oxygenated water for stream organisms.

The Habitat Assessment points totaled 90 on 6/13/2006 and increased to 112.5 on 6/21/2010, both excellent scores for the ecoregion; the average of high quality sites in the Cross Timbers (reference conditions) is 84. The 2010 assessment really increased in the presence of rocky runs and riffles and also instream cover.

### Fish

Fish were collected from pools on 6/13/2006 and 6/21/2010. The total number of species collected each time was 6, compared to 19 for the Cross Timbers reference conditions. There were only 2 sunfish species (green sunfish and bluegill sunfish) in 2006 and this increased to 4 species (green sunfish, bluegill sunfish, longear sunfish, largemouth bass) in 2010, but both still below reference conditions of 7 sunfish species. There were no sensitive benthic species and no intolerant species collected at Blackboy Creek, compared to 4 and 2 respectively collected from Cross Timbers reference conditions. The overall fish collection score when compared to reference conditions for Blackboy Creek in 2006 was 27%, an "E" grade which is the lowest grade on the scale, and in 2010 was 36% which is still an "E" grade. According to Karr's Index of Biotic Integrity, attributes of an "E" grade are "Few species and individuals present; tolerant species dominant; diseased fish frequent".

Prior to the fish collections, there had been only intermittent flow in the creek since January 2005 and there was no flow at the time of collections. Flow, runs and riffles are critical to sensitive species. Low water levels allow for easy predation of fish by birds, raccoons and other wildlife. Many of the fish remaining in the pools were catfish which also serve to reduce the numbers of other fish. The fish collection results are an indication of how serious the drought has been and that Blackboy Creek is a headwater creek that dries up or has no flow during much of the summertime.

### Benthic Macroinvertebrates

Benthic macroinvertebrates are aquatic bugs in the larval state that live on the stream bottom and on debris found in the stream. They are a link in the aquatic food chain as both consumers of nutrients and food for fish. Some are intolerant of pollution or poor quality water and as such are good indicators of stream condition. In general, the greater the diversity of the benthic macroinvertebrate population, the healthier the stream. EPT richness (the number of mayflies, caddisflies & stoneflies found) is important since these are some of the most sensitive to pollution, poor quality water and poor habitat.

Benthic macroinvertebrates were collected in the winter season: 2004, 2005, 2007, 2008, 2010, and in the summer season: 2010. Blackboy Creek has little to no flow in the summer so there have not been many collections in this season.

The summer 2010 collection scored 90% as good as reference conditions due to high counts of EPT taxa and diversity. This collection was just missing a few more different bug species.

The winter collections hit the lowest score in 2007 with a 46% due to only having 3 species and only 1 EPT specie, but that 1 specie was very abundant. The diversity was horrible. The previous collections in 2004 and 2005 scored better than reference conditions. The following collection in 2008 increased to 77% and the 2010 collection's score was back up to better than reference conditions and was the highest score of all the collections.

### Bacterial Testing

Total coliforms and E. Coli were screened for in the summers of 2003, 2004, 2005 and 2009. It is thought that the extremely high results in the thousands on 6/26/2006, 6/24/2004 and 9/23/2004 were due to the wildlife as the other samples were a lot lower.

### Chemical Testing

Chemical data were collected monthly between 5/29/2003 and 3/30/2012 except when there was neither flow nor water in pools from which to sample.

### Dissolved Oxygen Saturation

Dissolved Oxygen (DO) Saturation can indicate when there is too little or too much oxygen available to support aquatic life. Chemical data show DO saturation to be low for the ecoregion, but it is increasing. From 2003-2007 the average was 62.5% which increased to 77% from 2008-2012. Normal DO saturation is above 80%. Since the concentration of DO is affected by both temperature and flow among other factors, lack of flow over an extended period of time can explain low DO saturation levels.

### pH

pH is the measure of acidity or alkalinity of a solution. pH is a critical chemical factor for aquatic life and can also make other factors like ammonia and metals toxic if it is out of range or has drastic changes. Macroinvertebrates and fish are sensitive to pH with an optimal range for life of 6.5 – 9.0. Data show the pH of Blackboy Creek ranges from 6.30 – 7.9 with a median value of 7.2.

### Nitrogen

An estimate of soluble Nitrogen is made by adding the amounts of Ammonia-Nitrogen and Nitrate/Nitrite-Nitrogen found in the water. Levels of soluble Nitrogen are very low, with many results below detection limits. Blackboy Creek averages 0.7mg/L N which is within the normal range, below 0.8mg/L N. A one-time high, above normal range, of 1.0mg/L N on 11/17/2005 could have been the result of wildlife waste in the creek.

## Phosphorus

Like Nitrogen, Phosphorus is a nutrient required by living organisms for life. In excess amounts growth of aquatic plants and algae can clog the stream. When the vegetation dies and begins to decompose, DO levels can drop to very low levels. Orthophosphate phosphorous data for Blackboy Creek show below detection limits.

## Chloride

Typically, in Northeastern Oklahoma, chloride is naturally present in water at less than 20mg/L. Chloride pollution can occur as a result of petroleum production and from street de-icing activities. Some sensitive aquatic species can be affected at levels of 100 – 200mg/L but most species won't be affected until concentrations are greater than 300 – 400mg/L. Monitoring data show chloride typically at 5 – 15mg/L with a one-time high of 40mg/L on 10/30/2008.

Overall, with the exception of lower than optimum DO saturation, the chemistry of the stream is excellent.

## Synopsis

Chemical data collected show there is very little to no pollution from sources such as fertilizer runoff, septic tank overflow, street de-icing, etc. Animal waste is likely the sole source of nutrients in the stream.

Drought and lack of flow appears to be the most significant detriment to a healthy fish population, resulting in low/no flow and consequently low dissolved oxygen levels. Habitat is good and would be much better if there was consistent rain to feed the stream.

At the present time, Blackboy Creek is healthy with good physical habitat, water chemistry, and macroinvertebrate collections. Fish have been affected by recent drought conditions. Future water quality status is uncertain due to the presence of a salt water line, related to the coal bed methane wells, which intersects the creek. The integrity of the line is questionable since it has broken in two different spots, one spill contaminating a nearby pond.