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Application  
Forms

**APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT**  
(33 CFR 325)

**OMB APPROVAL NO. 0710-0003**  
**EXPIRES: 31 August 2012**

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**PRIVACY ACT STATEMENT**

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

**(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)**

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE
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**(ITEMS BELOW TO BE FILLED BY APPLICANT)**

<p>5. APPLICANT'S NAME:</p> <p>First - John                      Middle -                      Last - Baugues, Jr.</p> <p>Company - Carbonado Coal Mining, LLC</p> <p>E-mail Address -</p>	<p>8. AUTHORIZED AGENT'S NAME AND TITLE (an agent is not required)</p> <p>First - David                      Middle -                      Last - Lamb, P.E.</p> <p>Company - Associated Engineers, Inc.</p> <p>E-mail Address - DLamb@associatedengineers.com</p>
<p>6. APPLICANT'S ADDRESS:</p> <p>Address - 1205 Nebo Road</p> <p>City - Madisonville      State - KY      Zip - 42431      Country - USA</p>	<p>9. AGENT'S ADDRESS</p> <p>Address - 2740 North Main Street</p> <p>City - Madisonville      State - KY      Zip - 42431      Country -</p>
<p>7. APPLICANT'S PHONE NOS. W/AREA CODE.</p> <p>a. Residence                      b. Business                      c. Fax</p> <p>(270) 326-2002</p>	<p>10. AGENT'S PHONE NOS. W/AREA CODE</p> <p>a. Residence                      b. Business                      c. Fax</p>

**STATEMENT OF AUTHORIZATION**

11. I hereby authorize, \_\_\_\_\_ to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

\_\_\_\_\_  
APPLICANT'S SIGNATURE

\_\_\_\_\_  
DATE

**NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY**

<p>12. PROJECT NAME OR TITLE (see instructions)</p> <p>Doc Cole Mine #1</p>	
<p>13. NAME OF WATERBODY, IF KNOWN (if applicable)</p> <p>UT's of Jackson Ditch</p>	<p>14. PROJECT STREET ADDRESS (if applicable)</p> <p>Address N/A</p> <p>City -                      State -                      Zip -</p>
<p>15. LOCATION OF PROJECT</p> <p>Latitude: °N 37.555693</p> <p>Longitude: °W 87.621624</p>	
<p>16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)</p> <p>State Tax Parcel ID                      Municipality</p> <p>Section -                      Township -                      Range -</p>	

17. DIRECTIONS TO THE SITE

From KY132/US41A intersection in Dixon, travel northeast for 5.2 miles on KY132. The project area lies on the left side of the roadway (immediately north of KY132).

18. Nature of Activity (Description of project, include all features)

Development of surface facilities for an underground mine operation, involving impacts to 2730' of intermittent and 2241' of ephemeral stream. In addition, there will be impacts to 0.292 acres of wetlands and 0.085 acres of open waters.

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

Development of a 66-acre surface facility to support an underground mining operation.

**USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED**

20. Reason(s) for Discharge

To necessitate the underground mining operation, surface facilities are required to access the coal reserves. Development of these facilities require impacts to streams and wetlands.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards:

Type Amount in Cubic Yards	Type Amount in Cubic Yards	Type Amount in Cubic Yards
1070 CY total (common fill generated on site)		

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Acres 0.692 ac. total (Intermittent= 0.221 ac., Ephemeral= 0.094 ac., Ponds= 0.085 ac. & Wetlands= 0.292 ac.)  
Or  
Liner Feet

23. Description of Avoidance, Minimization, and Compensation (see instructions)

See PCN, Section 2B,(3)

24. Is Any Portion of the Work Already Complete? Yes  No  IF YES, DESCRIBE THE COMPLETED WORK

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (If more than can be entered here, please attach a supplemental list).

Address - See Attachment  
City - State - Zip -

26. List of Other Certifications or Approvals/Denials Received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED
KDNR-Div. of Permits	WQC	Pending			

\* Would include but is not restricted to zoning, building, and flood plain permits

27. Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

\_\_\_\_\_  
SIGNATURE OF APPLICANT

\_\_\_\_\_  
DATE

\_\_\_\_\_  
SIGNATURE OF AGENT

\_\_\_\_\_  
DATE

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than \$10,000 or imprisoned not more than five years or both.

ATTACHMENT

Block 25

Adjoining Property Owners

Maurice & Annette Floyd  
5767 State Route 132E  
Sebree, KY 42455

Norman & Dorcis Dorntrager  
7851 State Route 132E  
Dixon, KY 42409

Allen & Katherine Jones  
7117 Olive Strett  
Evansville, IN 47715

Webster County Fiscal Court  
Honorable Jim Townsend, Judge/Executive  
Webster County Courthouse  
P.O. Box 155  
Dixon, KY 42409

**DOC COLE SITE  
SUMMARY OF IMPACTS**

Site number	Latitude	Longitude	Cowardin Class or Flow Regime	Drainage Area (ac.)	Impact Length or Acreage
INT-1	37°33'14" N	87°37'25" W	Intermittent	20.3	417 linear feet
INT-2	37°33'21" N	87°37'05" W	Intermittent	72.8	1775 linear feet
INT-3	37°33'23" N	87°37'09" W	Intermittent	27.2	538 linear feet
E-1	37°33'15" N	87°37'23" W	Ephemeral	1.4	294 linear feet
E-2	37°33'15" N	87°37'24" W	Ephemeral	2.0	247 linear feet
E-3	37°33'19" N	87°37'25" W	Ephemeral	9.7	685 linear feet
E-4	37°33'23" N	87°37'08" W	Ephemeral	4.4	214 linear feet
E-5	37°33'22" N	87°37'07" W	Ephemeral	3.3	297 linear feet
E-6	37°33'12" N	87°37'16" W	Ephemeral	4.3	177 linear feet
E-7	37°33'14" N	87°37'12" W	Ephemeral	4.1	219 linear feet
E-8	37°33'24" N	87°37'17" W	Ephemeral	0.8	108 linear feet
Pond 1*	37°33'19" N	87°37'12" W	Open water		0.085 acres
Wet A	37°33'14" N	87°37'25" W	PF01B		0.210 acres
Wet B*	37°33'19" N	87°37'12" W	PEM1B		0.040 acres
Wet C	37°33'25" N	87°37'19" W	PEM1B		0.042 acres

\* Pond 1/Wetland B appears to be isolated waters

\*\* Total for wetlands include Wetland B

Totals:

Intermittent = 2730 ft.  
 Ephemeral = 2241 ft.  
 Wetlands = 0.292 ac.\*\*  
 Open waters = 0.085 ac.\*



# **Stream Habitat Assessment and Wetland Delineation Report**

**Doc Cole No. 1 Mine Site  
Webster County, Kentucky**

Prepared by:

**T.H.E. T-E Engineers, Inc.**

2331 Fortune Drive, Suite 295  
Lexington, Kentucky 40509  
(859) 263-0009

In Association With:



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Madisonville, Kentucky 42431  
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March 24, 2011  
(Revised May 9, 2012)

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## I. INTRODUCTION

### **Introduction**

This report is a description of streams and wetlands located within a 65.6 acre study area in Webster County, Kentucky. Information contained within this document was compiled for the purpose of identifying potential environmental impacts that may be associated with a future surface facility for an underground coal mining operation. The report will focus on the physical assessment of streams and wetlands. The documentation of existing conditions will aid in determination of the amount of mitigation that will be required for potential impacts on jurisdictional waters of the United States.

The data presented in this report is based upon field investigation, general research, and information supplied by Associated Engineers, Inc. on behalf of Carbonado Coal Mining, LLC. The text body is limited to analyses, which may be further summarized, supported or illustrated by tables and exhibits. The exhibits and appendix include the following: project vicinity map, aerial map, National Wetlands Inventory map, soils map, USGS topographic quadrangle, floodplain map, stream habitat assessment forms, wetland delineation forms, and photographic documentation.

### **Location**

The study area is located approximately 5.2 miles northeast of Dixon, Kentucky, in Webster County (Sebree USGS 7.5 minute topographic quadrangle), Latitude: 37° 33' 20" N, Longitude: 87° 37' 17" W. The site is between KY 132 and Starl Shelton Road, and can be accessed from KY 132 (see Exhibit 1).

### **Background and Description**

The study area is a nearly equal mix of agricultural land and forest. Forested areas are found throughout the study area, but a large block exists in the northeast quadrant of the site. Forest accounts for approximately 32 acres, and is generally a mixed stand of second-growth or younger trees. There is evidence that logging has occurred within the past several years. There is also some evidence, from geological mapping and the water quality/color of one of the intermittent streams, that some degree of underground mining that occurred in the past. The topography generally consists of gently rolling terrain, with a ridgeline running diagonally through the site. Land features in the area include a pond, wetlands, a spring, and sinkhole. Dominant tree species within the permit boundary include sycamore, white oak, tulip poplar, shagbark hickory, and red maple. It should also be noted that, although Webster County is not

mapped for floodplains under FEMA, the study area should not be considered within the 100-year floodplain based on the site being a minimum of fifty feet above Jackson Ditch and Deer Creek.

### **Purpose of Project**

The purpose of the project is for Carbonado Coal Company, LLC to establish a surface facilities for an underground coal mine.

## **II. STREAM ASSESSMENT AND WETLAND DELINEATION METHODS**

### **Streams**

The Environmental Protection Agency's (EPA) *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers* (1999) was used to assess intermittent and ephemeral streams in the permit area. High gradient or low gradient field data sheets were completed for each stream. Documentation includes photographs, location, and total length. The protocol matrix used to assess habitat quality is based on key physical characteristics of the water-body and surrounding land, particularly the catchment of the site under investigation. Habitat is defined as the quality of in-stream and riparian habitat that influences the structure and function of the aquatic community in a stream. This matrix provides an effective means of evaluating and documenting habitat quality at each site. Habitat parameters evaluated are related to overall aquatic life use and are a potential source of limitation to aquatic biota. Site selection for assessment was based upon a probabilistic approach to provide information about the overall status or condition of each site (Barbour, et al. 1999).

For this report, assessments focus on the matrix in which physical characteristics of each stream are evaluated on 10 parameters with scales from 0 to 20, in which 20 represents a pristine situation. Parameters address characteristics including substrate, flow regime, sediment deposition, and riparian zone quality, among others. The potential score for a pristine evaluation is 200 total, but a high habitat assessment score can still represent a poor stream when taking into account conductivity, which contributes to overall ecological integrity. To describe water quality within the assessed reach, habitat criteria provided by the Newburgh Regulatory Office of the Louisville District Corps of Engineers was used. This habitat criteria provides ranges of habitat scores and corresponding descriptive scores (poor, marginal, suboptimal and optimal) for stream quality.

In addition, each stream was classified by "type", according to the Rosgen methodology, based on various geomorphic parameters (entrenchment ratios, width to depth ratios, slope, etc.) taken from cross-section and contour information.

Stream lengths, channel locations and limits were determined in the field utilizing manual measuring techniques including chaining, range finding, pacing, global positioning, and verification of mapping. Stream flow was determined in the field based upon stream status at the time of visit. Final determination of stream quantity and jurisdiction will be decided by USACE. Due to low relief and available contour information, drainage areas for each stream are approximate.

See Sections VII, VIII, and IX for a list of tables, exhibits, and items in the appendix that.

### **Wetlands**

Potential wetlands within the study boundary were evaluated for the presence of wetland characteristics during January and February 2011. See Table 2 for a summary of identified wetlands and their sizes. On-site wetland determinations were conducted using criteria outlined in the 2010 U.S. Army Corps of Engineers' *Draft Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region*. Hydrology, vegetation, and soils were evaluated. Soil characteristics were identified using soil borings, dug pits, and a Munsell soil color chart. Wetland boundaries were defined in the field, surveyed using a hand-held global positioning unit and transferred to project mapping in order to determine approximate wetland areas. Data on soils were taken from the Natural Resources Conservation Service's Web Soil Survey (NRCS 2009). The National Wetland Inventory (NWI) map for the Sebree Quadrangle was examined for existing Cowardin classifications (Cowardin, et. al 1979). A Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map was unavailable for floodplain boundaries (Webster County does not participate in the flood insurance program and is not mapped). Refer to Exhibits 2 and 3 for locations of delineated wetlands on project mapping. See Appendix for copies of wetland delineation forms and photographs.

## **III. EXISTING CONDITIONS: STREAMS**

There are three intermittent, and eight ephemeral streams located within, or immediately adjacent to, the study area boundary. All assessed streams are identified on Exhibits 2 and 3. The streams are unnamed tributaries to Jackson Ditch; which is a tributary to Deer Creek.

### **Stream Assessments**

**Intermittent Stream 1 (INT-1)** is located near the western study boundary. It is an unnamed tributary to Jackson Ditch, and appears to originate from a spring. The water exhibited an orange color throughout most of its length. Within the study boundary, INT-1 flows for

approximately 417 feet southward from the spring, through Wetland A, to the boundary. The stream has a drainage area of approximately 20.3 acres at the boundary. The stream has an average bottom width of 3.0 feet and an average bankfull width of 4.3 feet.

The EPA stream habitat assessment (Low Gradient) for INT-1 indicates a marginal substrate/available cover. The streambed morphology consists of very short riffles, long runs, and short shallow pools. The substrate appears to consist of predominantly silt/clay size particles, with minor amounts of sand and gravel size material. There is evidence of heavy sediment deposition affecting at least 80 percent of the channel bottom. Signs of some past channelization are present, with sinuosity scoring in the marginal range. Banks are moderately stable, with infrequent signs of erosion. Vegetative protection scored marginal, with 50 to 70 percent of both banks covered. The riparian zone is marginal to poor, having been affected by agricultural practices at the site.

INT-1 has a total habitat score of 95, which indicates that stream quality is in the marginal range. Conductivity measured at 1236  $\mu$ S. INT-1 is classified, according to Rosgen methodology, as an "Eb" type stream.

**Intermittent Stream 2 (INT-2)** is located in the northeastern section of the study boundary. Within the study area, INT-2 flows approximately 1775 feet southeastward to the boundary. The stream flows through Wetland C in its headwaters. The channel has shifted more northerly from its original alignment, creating a remnant channel that appears to flow only during high flow conditions. The stream has a drainage area of approximately 72.8 acres at the boundary limit. INT-2 has an average bottom width of 1.5 feet and a bankfull average width of 3 feet. Due to its length and confluence with another intermittent stream (INT-3) three segments were assessed (upstream, midstream, and downstream)

The EPA stream habitat assessment (High Gradient) for INT-2 US (upstream) indicates a marginal epifaunal substrate/available cover, with a 20 to 40 percent mix of stable habitat. The streambed morphology consists of only runs. The substrate appears to consist predominantly of silt/clay size particles, with a lesser amount of sand material present. Only 1 of 4 velocity/depth flow regimes is present. There is evidence of some sediment deposition affecting the channel bottom. There are some signs of past channelization, but no recent alterations. Banks are stable, with minimal signs of erosion or bank failure. Vegetative protection scored optimal, with more than 90 percent of both banks covered. However, the riparian zone is poor to marginal, being less than 6 meters in width along the left bank, and 6 to 12 meters wide along the right.

The stream habitat assessment (High Gradient) for INT-2 MS (midstream) indicates a suboptimal epifaunal substrate/available cover, with a 40 to 70 percent mix of stable habitat. The streambed morphology consists of nearly equal runs and shallow pools, with short riffle

sections. The substrate is a good mix of silt/clay, sand, and gravel size particles. Two of four velocity/depth flow regimes is present. Again, there is evidence of some sediment deposition affecting the channel bottom. There are no signs of channelization or stream alteration. Bank stability scored poor (unstable), with many signs of erosion and bank failure. Vegetative protection scored suboptimal, with 70 to 90 percent of both banks covered. The riparian zone scored suboptimal, being 12 to 18 meters in width along both banks.

The stream habitat assessment (High Gradient) for INT-2 DS (downstream) also indicates a suboptimal epifaunal substrate/available cover. The streambed morphology consists of equal riffles and shallow pools, with shorter run sections. The substrate material ranged from silt/clay to bedrock, but had sand size particles only in pools. Two of four velocity/depth flow regimes is present. Again, there is evidence of some sediment deposition affecting the channel bottom and no signs of channelization or stream alteration. Bank stability was found to be moderately unstable (left bank) to moderately stable (right bank), with areas having signs of erosion. Vegetative protection again scored suboptimal, with 70 to 90 percent of both banks covered; and the riparian zone scored suboptimal, being 12 to 18 meters in width along both banks.

INT-2 has an average total habitat score of 119, which indicates that stream quality is in the suboptimal range. Conductivity averaged 146  $\mu$ S. This stream classified as a type "Eb" for the upstream and midstream reaches, but was found to be a "B" type stream in the downstream reach.

**Intermittent Stream 3 (INT-3)** is also located in the northeastern section of the study boundary, and is a tributary to INT-2. INT-3 flows approximately 538 feet southeasterly before its confluence with INT-2. The stream has a drainage area of approximately 27.2 acres at the confluence. The stream has an average bottom width of 2 feet and an average bankfull width of 4.5 feet.

The stream habitat assessment (High Gradient) for INT-3 indicates suboptimal epifaunal substrate/available cover. The streambed morphology consists of long riffles, with short runs and shallow pools. The substrate consists of a good mix of silt/clay size to boulder size particles in the riffles and runs. Pools appear to be predominantly silt/clay. Two of four velocity/depth flow regimes are present. There is some sediment deposition affecting the channel bottom. Signs of channelization are absent in this reach. Banks are moderately stable to stable, with small infrequent areas of erosion. Vegetative protection and riparian zone scored suboptimal, with 70 to 90 percent of both banks covered and a riparian zone being 12 to 18 meters in width.

INT-3 has a total habitat score of 134, which indicates that the stream quality is in the suboptimal range. Conductivity measured at 83  $\mu$ S. INT-3 was found to be a "Ba" type stream under the Rosgen methodology.

**Ephemeral Streams (E-1 to E-8)** are located throughout the study boundary. For purposes of this discussion, ephemeral streams with similar conditions and/or functions have been grouped together. One ephemeral is discussed separately due to its connection to a sinkhole.

**E-1, 2, 6 and 7** - These streams have drainage areas ranging from 1.4 to 4.3 acres, and serve to provide drainage away from agricultural fields. The average length of channel studied is approximately 234 feet. They have an average bottom width of 1.4 feet, and an average bankfull width of 1.9 feet. In general, the EPA stream habitat assessments (High Gradient) indicate a marginal epifaunal substrate/available cover, due to unstable substrates. With one exception, the streambed morphology consists of riffles, runs, and short shallow pools. The typical substrate is predominantly silt/clay size material, with lesser amounts of larger sizes present. There is moderate deposition of new material, with 50 to 80 percent of the bottom affected. In nearly all cases, the streams have evidence of some past channelization (but not recent), with poor sinuosity. Bank stability does vary; in the stable to moderately unstable range. Vegetative protection scores in the suboptimal range. Generally, the riparian zone is suboptimal, being 12 to 18 meters in width; one stream scored marginal. The dominant vegetation consisted of trees with either grasses or herbaceous species present.

These streams have a typical habitat score of 93, which indicates that stream quality is marginal. Conductivity readings are usually not available for ephemeral streams due to their dry conditions. However, two had pools available suitable for testing; yielding an average conductivity of 82  $\mu$ S. Ephemeral streams E-1 and E-2 were classified as "A" type streams, while E-6 and E-7 were "Ba" type streams.

**E-4, 5 and 8** are all located in the northeastern section of the study boundary, within a forested area. These ephemeral streams flow for an average length of approximately 206 feet within the study boundary. The drainage areas range from 0.8 to 4.4 acres. They have average bottom widths of 0.4 feet and average bankfull widths of 1.3 feet.

The stream habitat assessments indicate marginal to suboptimal epifaunal substrate/available cover. Pool substrate characterization consisted of either a silt/clay sized material or a good mix of materials from silt/clay to boulder sizes. Streambed morphology varied from riffle-pool, run-pool, to runs only. Pools were consistently short and shallow when present. There is some deposition of new material. Evidence of past channelization is largely absent. Bank stability is in the suboptimal range, with infrequent areas of erosion present.

Vegetative protection ranks in the high marginal to suboptimal range, indicating a low potential for erosion problems. Riparian zone width is also in the suboptimal range, with slight impacts from human activities. The dominant riparian vegetation consists of trees and herbaceous species.

These streams have an average habitat score of 103, which indicates that stream quality is in the low suboptimal range. Again, only a few conductivity readings were available due to dry channel conditions. They indicated an average reading of 70  $\mu$ S. Ephemeral stream E-4 was classified as a type "Ba" stream, while E-5 and E-8 were found to be "A" type streams.

**E-3** – This ephemeral is discussed individually due to its drainage to a sinkhole and lack of visible connection to a receiving stream. It has the largest drainage area of the ephemeral streams; being 9.7 acres in size. The channel starts in a pasture and runs into a narrow forested corridor above INT-1 before disappearing. The channel is 685 feet in length, with a bottom width of 1 foot and a bankfull width of 1.5 feet.

The stream habitat assessment indicates a marginal epifaunal substrate/available cover. Pool substrate characterization consisted of predominantly silt/clay size material, with lesser amounts of sand and gravel. Streambed morphology consisted of short riffles and long runs. There moderate deposition of new material. Some evidence of past channelization is present. Bank stability is in the suboptimal range, with infrequent areas of erosion present. Vegetative protection also ranks in the suboptimal range, indicating a low potential for erosion. Riparian zone width is also in the suboptimal range, with the dominant riparian vegetation consisting of trees, grasses and herbaceous species.

The stream has a total habitat score of 89, which indicates that stream quality is in the marginal range. No conductivity reading was available due to dry channel conditions. E-3 was classified as a Rosgen "Ba" type stream.

#### **IV. EXISTING CONDITIONS: WETLANDS**

Three wetlands are located within the permit boundary. The wetlands have a combined total area of 0.292 acres, all occurring within the permit area. None of the wetlands would be considered within the 100-year floodplain (there is at least sixty feet of elevation difference between their locations and Jackson Ditch). Refer to Exhibits 2 and 3 for locations of delineated wetlands, and the appendix for photographs of each wetland. Table 3 is a summary of wetland information, including wetland impacts for the project. Descriptions of the delineated wetlands follow. It should be noted that although the areas are referred to as wetlands, these determinations are assigned pending final USACE verifications.

**Wetland A** is located along INT-1 and has a total area of 0.210 acres. The Cowardin classification is palustrine forested wetland that is saturated (PFO1B). Dominant vegetation consists of river birch (*Betula nigra*), red maple (*Acer rubrum*), and sweetgum (*Liquidambar styraciflua*) in the tree stratum and river birch and red maple in the sapling stratum. Hydrophytic vegetation is established by the dominance test, which was 100 percent. Red-orange soil and stream water indicate acid mine drainage from past mining is infiltrating the soil. The upper four inches of soil contain abundant organic matter and are a mix of red and gray colors. Below this the soil profile contains approximately 30 percent 2.5Y 5/1 with the remainder a 7.5YR 5/8. Coal and fill material are present. The soil belongs to the Wellston silty clay loam series, 12 to 20 percent slopes, severely eroded (WpD3). Soil saturation, water marks, and water-stained leaves are indicators of wetland hydrology. Because the wetland soil is problematic, the wetland determination will be based on vegetation and hydrology.

**Wetland B** is the wetland fringe of a pond located on a bench on the hillside. Total wetland area is 0.040 acres. The pond and wetland do not have a clearly defined outflow and appear to be isolated. The Cowardin classification is palustrine emergent wetland that is saturated (PEM1B). Vegetation was largely unidentifiable due to the winter season but was dominated by a sedge sp. (*Carex* species) and a grass sp. A species of bulrush (*Scirpus* sp.) and soft rush (*Juncus effusus*) were also noted, so it is likely that hydrophytic vegetation is present. The soil has a matrix color of 10YR 5/2 and mottle color of 7.5YR 4/6. Soil texture is loamy sand. The soil belongs to the Memphis silt loam series, 2 to 6 percent slopes (MoB). The upper 7 inches of soil are saturated, therefore, wetland hydrology is present.

**Wetland C** is located along INT-2 where the stream spreads out across part of the valley. Total wetland area is 0.042 acres. The Cowardin classification is palustrine emergent wetland that is saturated (PEM1B). Complete species-level identification of the remnant plants could not be achieved, but vegetation included *Carex* sp., goldenrod sp. (*Solidago* species), soft rush, and false nettle (*Boehmeria cylindrica*). It is likely that vegetation would pass the dominance test. The soil has a matrix color of 10YR 6/2 and mottle color of 7.5YR 4/6. Soil texture is silt loam. The soil belongs to the Frondorf silt loam series, 20 to 30 percent slopes (FdE). The presence of soil saturation within the upper 2 inches indicates wetland hydrology is present.

### **Ponds**

One pond is located in the study area. This open water area is associated with Wetland B discussed previously (see Exhibits 2 and 3 for the location). The total area of open water is 0.085 acres. The pond, and the associated wetland, appears to be isolated (no outlet or connectivity found).

## VI. REFERENCES

- Barbour, M. T.; J. Gerritsen; B. D. Snyder; J. B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water, Washington, D.C.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31, U.S. Fish and Wildlife Service, Washington, D.C.
- Environmental Laboratory. 1987. Army Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1, U.S. Army Engineer Waterways Experimentation Station, Vicksburg, Miss.
- Jones, R. L. 2005. Plant Life of Kentucky. The University Press of Kentucky, Lexington, KY.
- Kentucky Natural Resources and Environmental Protection Cabinet. 2002. Methods for Assessing Biological Integrity of Surface Waters in Kentucky. Division of Water-Water Quality Branch, Frankfort, KY.
- U.S. Army Corps of Engineers. 2010. Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region, ed. J.S. Wakeley, R.W. Lichvar, and C.V. Noble. ERDC/EL TR-10-XX. Vicksburg, MS: U.S. Army Engineer Research and Development Center.
- U.S. Department of Agriculture, Natural Resource Conservation Service. 1981. Soil Survey of Union and Webster Counties, Kentucky.

## VII. TABLES

Table 1. Summary of Stream Information

Table 2. Summary of Wetland Information

Table 3. Summary of Ponds and Open Water

**Table 1: Summary of Stream Information**

Stream	Latitude	Longitude	Habitat Score	Conductivity ( $\mu$ S)	Stream Type	Study Length (ft)	Drainage Area (ac)	Dates Assessed
INT-1	37°33'14" N	87°37'25" W	95	1236.0	Intermittent	417	20.3	1/25/11
INT-2	37°33'21" N	87°37'05" W	119 av.	146 av.	Intermittent	1775	72.8	2/15,16/11
INT-3	37°33'23" N	87°37'09" W	134	82.9	Intermittent	538	27.2	2/15/11
E-1	37°33'15" N	87°37'23" W	87	-----	Ephemeral	294	1.4	1/25/11
E-2	37°33'15" N	87°37'24" W	91	-----	Ephemeral	247	2.0	1/25/11
E-3	37°33'19" N	87°37'25" W	89	-----	Ephemeral	685	9.7	1/25/11
E-4	37°33'23" N	87°37'08" W	122	71.8	Ephemeral	214	4.4	2/15/11
E-5	37°33'22" N	87°37'07" W	91	67.3	Ephemeral	297	3.3	2/15/11
E-6	37°33'12" N	87°37'16" W	98	94.4	Ephemeral	177	4.3	2/16/11
E-7	37°33'14" N	87°37'12" W	96	69.6	Ephemeral	219	4.1	2/16/11
E-8	37°33'24" N	87°37'17" W	96	-----	Ephemeral	108	0.8	2/16/11
Intermittent				Cumulative Total		<b>2730</b>		
Ephemeral				Cumulative Total		<b>2241</b>		

- 1) Streams with multiple assessments have averages shown for habitat score and conductivity readings.
- 2) Data provided in this table is for baseline purposes only. **The amount of stream studied does not reflect future impact lengths.**

**Table 2. Summary of Wetlands**

<b>Wetland</b>	<b>Classification</b>	<b>Connectivity (Yes/No)</b>	<b>Total Area (acres)</b>	<b>Total Acreage within Study Area</b>
A	PFO1B	Yes	0.210	0.210
B*	PEM1B	No	0.040	0.040
C	PEM1B	Yes	0.042	0.042
<b>Site Total</b>			0.292	0.292

**Table 3. Summary of Ponds and Open Water**

	<b>Feature Associated With</b>	<b>Open Water Acreage in Study Area</b>
Pond 1*	Wetland B	0.085 acres
	<b>Total Acreage in Study Area</b>	<b>0.085 acres</b>

\* Resources appear to be "isolated waters".

## **VIII. EXHIBITS**

- Exhibit 1: Vicinity Map
- Exhibit 2: USGS Topographic Map
- Exhibit 3: Aerial Photograph
- Exhibit 4: National Wetlands Inventory (NWI) Map
- Exhibit 5: Soil Map

# Vicinity Map Doc Cole Site



**Permit Boundary**

SCALE 1"=4000'

**T.H.E.  
Engineers, Inc.**

PROJECT: DOC COLE SITE - PERMIT BOUNDARY

STREAMS: UT'S TO JACKSON DITCH

COUNTY: WEBSTER

STATE: KY

NEAR: ORTIZ

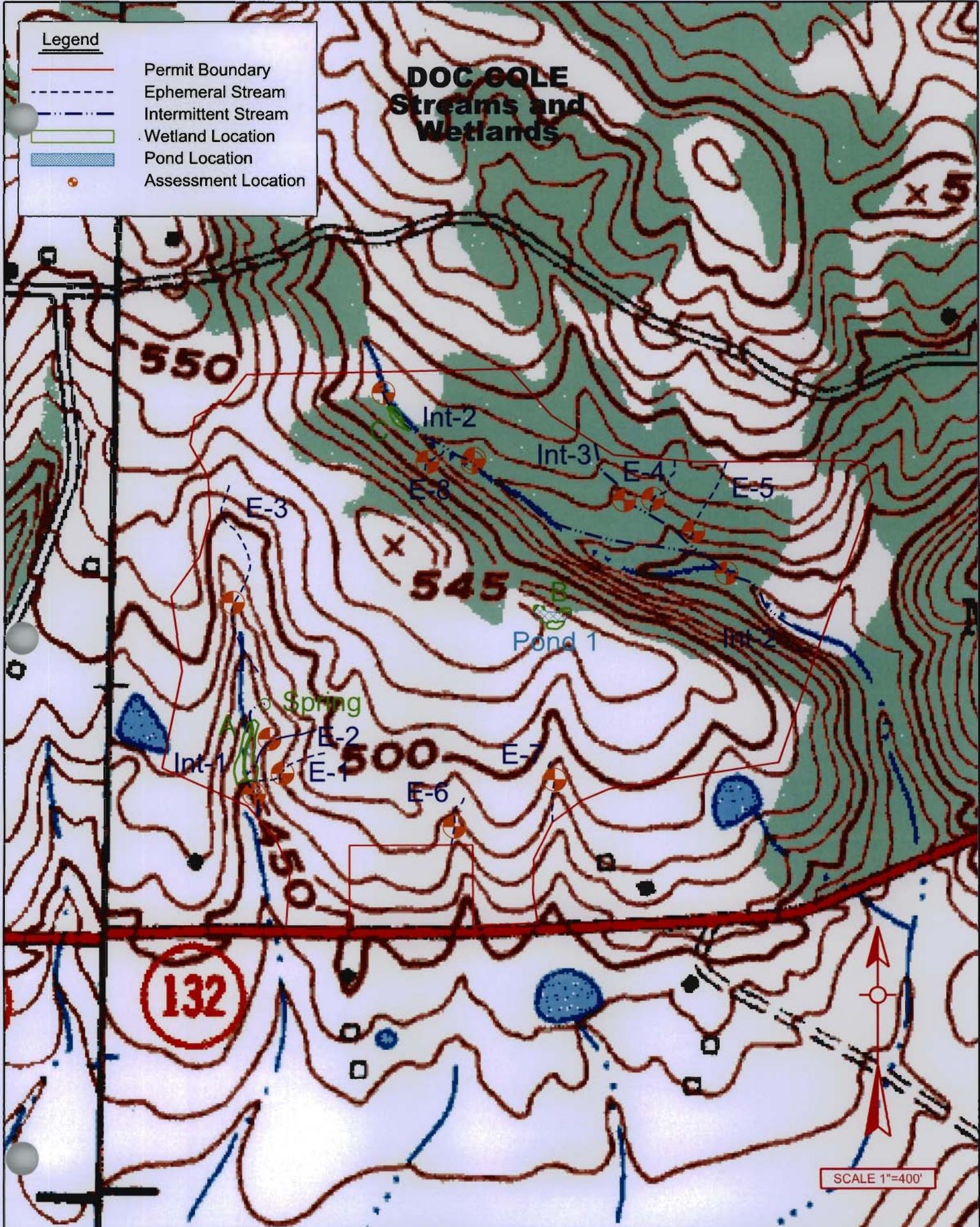
ITEM: VICINITY MAP

EXHIBIT I

# DOC COLE Streams and Wetlands

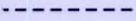
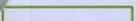
**Legend**

-  Permit Boundary
-  Ephemeral Stream
-  Intermittent Stream
-  Wetland Location
-  Pond Location
-  Assessment Location

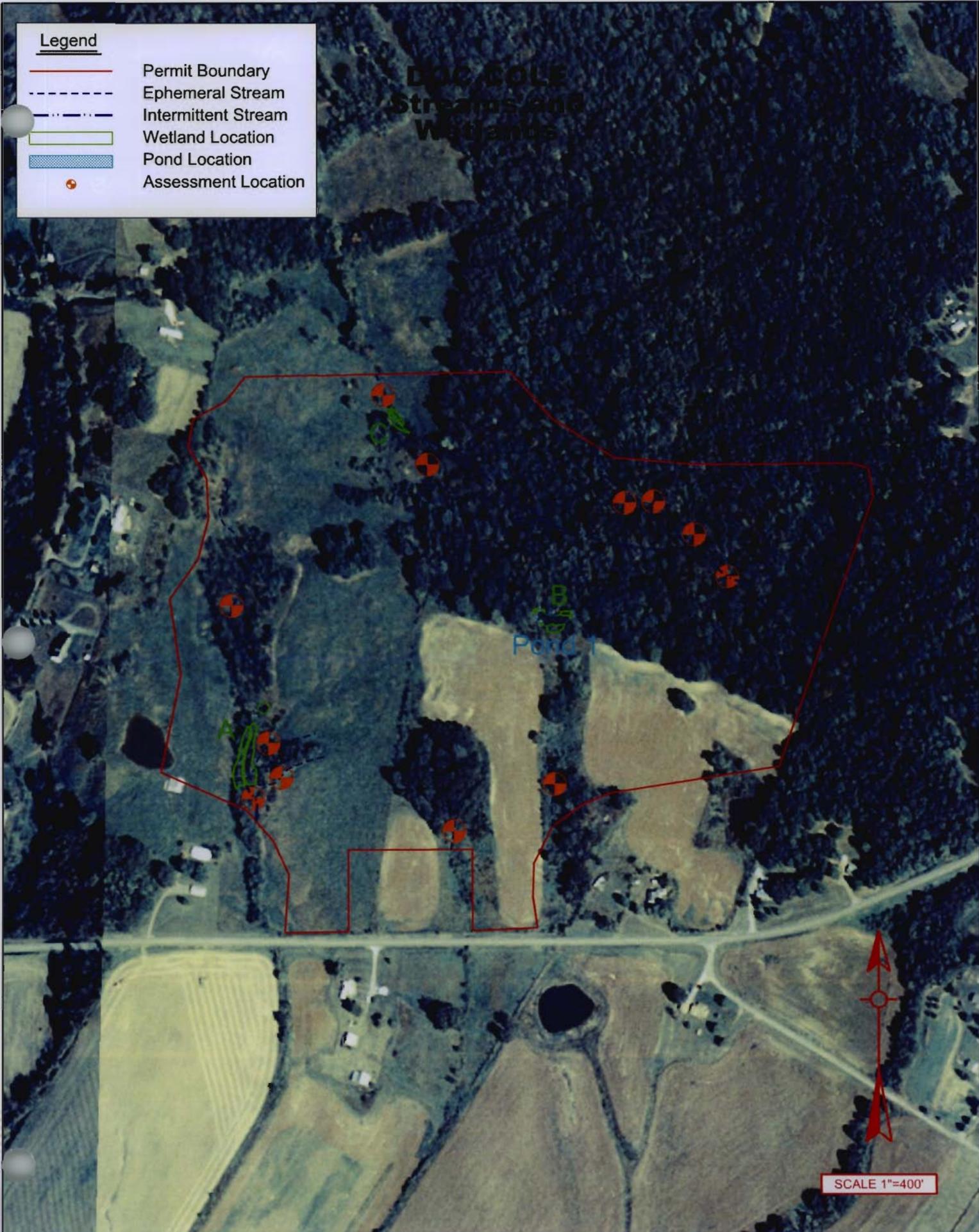


<p><b>T.H.E.</b> Engineers, Inc.</p>	<p>PROJECT: DOC COLE SITE - JURISDICTIONAL WATERS DELINEATION</p> <p>COUNTY: WEBSTER      STATE: KY      NEAR: ORTIZ</p>	<p>STREAMS: UT'S TO JACKSON DITCH</p> <p>ITEM: QUAD MAP      EXHIBIT 2</p>
--	--	--

Legend

-  Permit Boundary
-  Ephemeral Stream
-  Intermittent Stream
-  Wetland Location
-  Pond Location
-  Assessment Location

# DOC COLE Streams and Wetlands



SCALE 1"=400'

**T.H.E.  
Engineers, Inc.**

PROJECT: DOC COLE SITE - JURISDICTIONAL WATERS DELINEATION

STREAMS: UT'S TO JACKSON DITCH

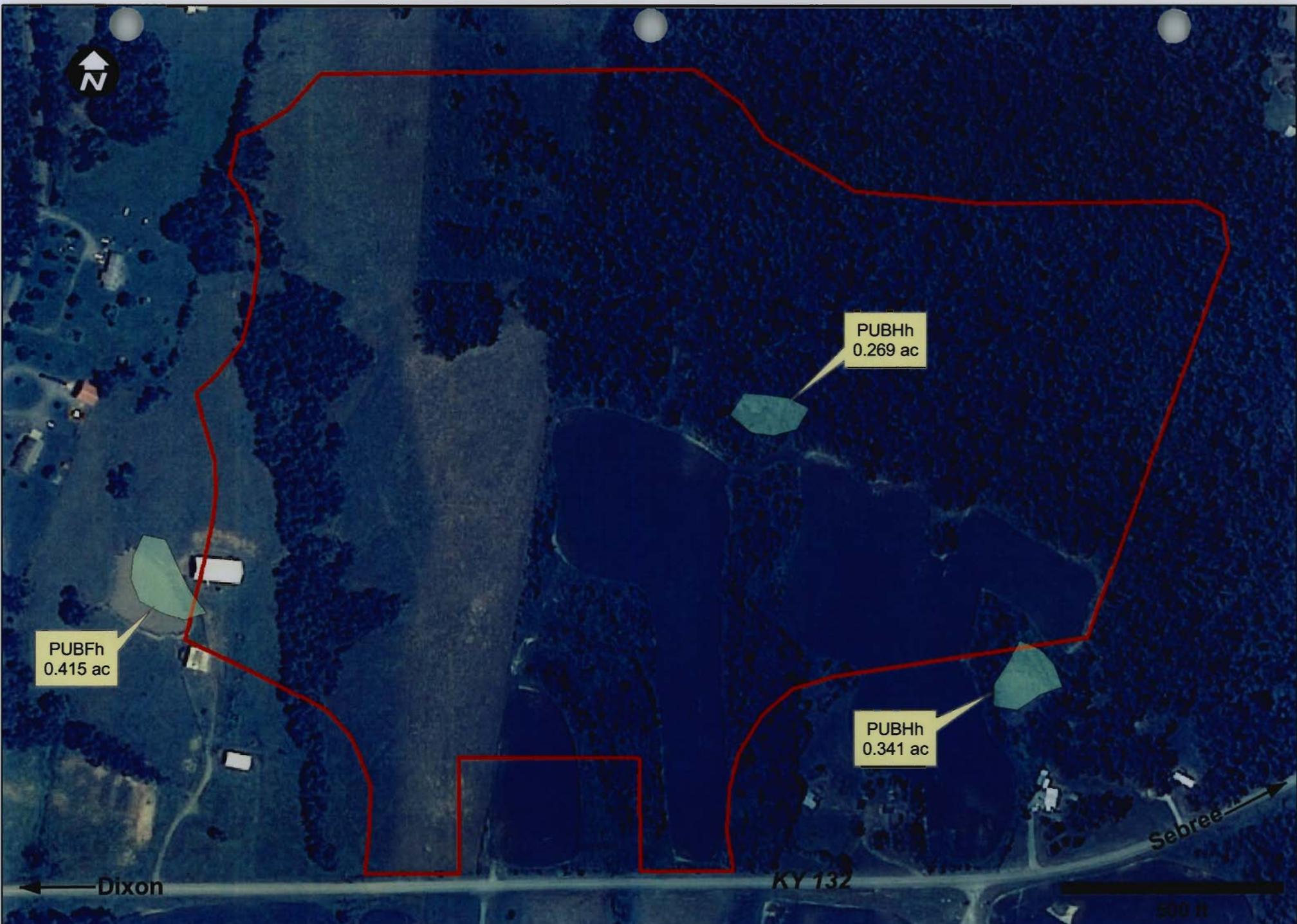
COUNTY: WEBSTER

STATE: KY

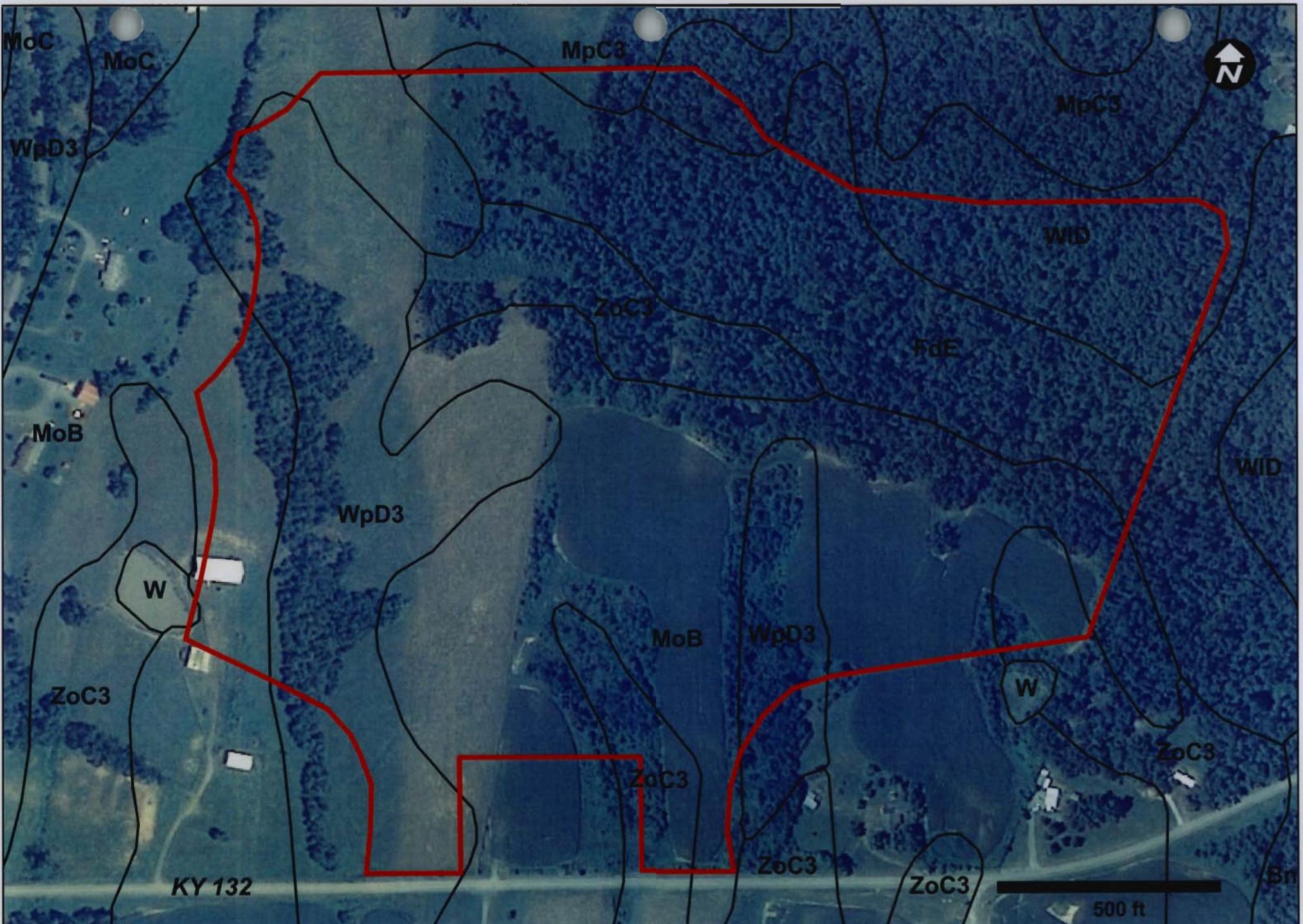
NEAR: ORTIZ

ITEM: AERIAL MAP

EXHIBIT 3



	PROJECT: Dock-Cole Mine		Digital NWI Data over 2010 NAIP Imagery	
	COUNTY: Webster	STATE: KY	NEAR: Ortiz	EXHIBIT 4



	PROJECT: Dock-Cole Mine		Digital NRCS Soils Data Over 2010 NAIP Imagery	
	COUNTY: Webster	STATE: KY	NEAR: Ortiz	EXHIBIT 5

## **IX. APPENDIX**

### **Site Assessment Data Forms:**

- 1. EPA Rapid Bioassessment Protocol Field Data Sheets  
Photographs**
- 2. Wetland Delineation Forms  
Photographs**

## Low Gradient Stream Data Sheet

STREAM NAME: <i>INT 1</i>				LOCATION: <i>Doc Cole</i>					
STATION: <i>WP</i>		DRAINAGE AREA (AC)		BASIN/WATERSHED: <i>Green River</i>					
LAT: <i>37-33-13.7</i>		LONG: <i>87-37-24.5</i>		COUNTY: <i>Webster</i> USGS 7.5 TOPO:					
DATE: <i>1-25-11</i>		TIME: <i>3:40 CT</i> <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM		INVESTIGATORS: <i>Rick Heil, Julie Clark</i>					
TYPE SAMPLE: <input type="checkbox"/> P-CHEM <input type="checkbox"/> Macroinvertebrate <input type="checkbox"/> FISH <input type="checkbox"/> BACT.									
WEATHER: Now <input type="checkbox"/> Past 24 hours <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input type="checkbox"/> Clear/sunny									
Has there been a heavy rain in the last 7 days? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Air temperature <u>35</u> °F. Inches rainfall in past 24 hours <u>.01</u> in <u>100</u> % Cloud Cover									
P-Chem: Temp (°F) <u>42.6</u> D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. <u>1236</u> <input type="checkbox"/> Grab									
<b>INSTREAM WATERSHED FEATURES</b>				<b>LOCAL WATERSHED FEATURES:</b>					
Stream Width BW <u>3.0</u> ft Stream Width BF <u>4.3</u> ft Range of Depth <u>.1-.6</u> ft Bankfull Depth <u>0.45</u> ft Est. Reach Length _____ ft				Predominant Surrounding Land Use: <input type="checkbox"/> Surface Mining <input type="checkbox"/> Construction <input type="checkbox"/> Forest <input type="checkbox"/> Deep Mining <input type="checkbox"/> Commercial <input checked="" type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Oil Wells <input type="checkbox"/> Industrial <input type="checkbox"/> Silviculture <input type="checkbox"/> Land Disposal <input type="checkbox"/> Row Crops <input type="checkbox"/> Urban Runoff/Storm Sewers					
Hydraulic Structures:		Stream Flow:			Stream Type:				
<input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input type="checkbox"/> Waterfalls <input type="checkbox"/> Other <input type="checkbox"/> Island <input type="checkbox"/> Culverts		<input type="checkbox"/> Dry <input type="checkbox"/> Pooled <input type="checkbox"/> Low <input checked="" type="checkbox"/> Normal <input type="checkbox"/> High <input type="checkbox"/> Very Rapid or Torrential			<input type="checkbox"/> Perennial <input checked="" type="checkbox"/> Intermittent <input type="checkbox"/> Ephemeral <input type="checkbox"/> Seep				
Riparian Vegetation:		Dom. Tree/Shrub Taxa		Canopy Cover:		Channel Alterations:			
Dominate Type: <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses Number of Strata <u>2</u>		<i>River Birch</i> <i>Red Maple</i> <i>Black Willow</i>		<input type="checkbox"/> Fully Exposed (0-25%) <input type="checkbox"/> Partially Exposed (25-50%) <input checked="" type="checkbox"/> Partially Shaded (50-75%) <input type="checkbox"/> Fully Shaded (75-100%)		<input type="checkbox"/> Dredging <input type="checkbox"/> Channelization ( <input type="checkbox"/> Full <input type="checkbox"/> Partial)			
Substrate <input checked="" type="checkbox"/> Est. <input type="checkbox"/> P.C.		Riffle <u>15</u> %		Run: <u>50</u> %		Pool <u>35</u> %			
Silt/Clay (<0.06 mm)		<u>90</u>		<u>90</u>		<u>100</u>			
Sand (0.06-2 mm)		<u>5</u>		<u>5</u>					
Gravel (2-64 mm)		<u>5</u>		<u>5</u>					
Cobble (64-256 mm)									
Boulders (>256 mm)									
Bedrock									
<b>Habitat</b>		<b>Condition Category</b>							
<b>Parameter</b>		<b>Optimal</b>		<b>Suboptimal</b>		<b>Marginal</b>		<b>Poor</b>	
1. Epifaunal Substrate/ Available Cover		Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).		30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).		10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.		Less than 10% stable habitat* lack of habitat is obvious; substrate unstable or lacking.	
<b>SCORE</b>		<b>20 19 18 17 16</b>		<b>15 14 13 12 11</b>		<b>10 9 8 7 6</b>		<b>5 4 3 2 1 0</b>	
2. Pool Substrate/ Characterization		Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.		Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.		All mud or clay or sand bottom; little or no root mat; no submerged vegetation.		Hard-pan clay or bedrock; no root mat or vegetation.	
<b>SCORE</b>		<b>20 19 18 17 16</b>		<b>15 14 13 12 11</b>		<b>10 9 8 7 6</b>		<b>5 4 3 2 1 0</b>	
3. Pool Availability		Even mix of large shallow, large-deep, small-shallow, small-deep pools present.		Majority of pools large-deep; very few shallow.		Shallow pools much more prevalent than deep pools.		Majority of pools small-shallow or pools absent.	
<b>SCORE</b>		<b>20 19 18 17 16</b>		<b>15 14 13 12 11</b>		<b>10 8 7 6</b>		<b>5 4 3 2 1 0</b>	

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score

95

NOTES/COMMENTS:

### High Gradient Stream Data Sheet

STREAM NAME: <i>INT 2 (US)</i>		LOCATION: <i>Doc Cole</i>	
STATION: <i>WP229</i>	DRAINAGE AREA (AC)	BASIN/WATERSHED	
LAT: <i>37-33-25.4</i>	LONG: <i>87-37-18.6</i>	COUNTY: <i>Webster</i>	USGS 7.5 TOPO:
DATE: <i>2-16-11</i>	TIME: <i>11:00 CT</i> <input checked="" type="checkbox"/> AM <input type="checkbox"/> PM	INVESTIGATORS: <i>Rick Heil / Julie Clark</i>	
TYPE SAMPLE: <input type="checkbox"/> P-CHEM <input type="checkbox"/> Macroinvertebrate <input type="checkbox"/> FISH <input type="checkbox"/> BACT.			
WEATHER: Now		Past 24 hours	
<input type="checkbox"/>		<input type="checkbox"/> Heavy rain	
<input type="checkbox"/>		<input type="checkbox"/> Steady rain	
<input type="checkbox"/>		<input type="checkbox"/> Intermittent showers	
<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/> Clear/sunny	
		Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
		Air temperature <i>62</i> °F. Inches rainfall in past 24 hours <i>0</i> in	
		<i>0</i> % Cloud Cover	
P-Chem: Temp (°F) <i>46.4</i> D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond.µs <i>110.7</i> <input type="checkbox"/> Grab			

<b>INSTREAM WATERSHED FEATURES</b>		<b>LOCAL WATERSHED FEATURES:</b>	
Stream BW <i>1.5</i> ft	Stream Width BF <i>2.1</i> ft	Predominant Surrounding Land Use:	
BF Max Depth <i>.15</i> ft	Discharge _____ cfs	<input type="checkbox"/> Surface Mining	<input type="checkbox"/> Construction <input checked="" type="checkbox"/> Forest
Est. Reach Length <i>200</i> ft		<input type="checkbox"/> Deep Mining	<input type="checkbox"/> Commercial <input checked="" type="checkbox"/> Pasture/Grazing
		<input type="checkbox"/> Oil Wells	<input type="checkbox"/> Industrial <input type="checkbox"/> Silviculture
		<input type="checkbox"/> Land Disposal	<input type="checkbox"/> Row Crops <input type="checkbox"/> Urban Runoff/Storm Sewers

Hydraulic Structures:		Stream Flow:		Stream Type:	
<input type="checkbox"/> Dams	<input type="checkbox"/> Bridge Abutments	<input type="checkbox"/> Dry	<input checked="" type="checkbox"/> Pooled	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Normal
<input type="checkbox"/> Island	<input type="checkbox"/> Waterfalls	<input type="checkbox"/> High	<input type="checkbox"/> Very Rapid or Torrential	<input type="checkbox"/> Perennial	<input checked="" type="checkbox"/> Intermittent
<input type="checkbox"/> Other	<input type="checkbox"/> Culverts			<input type="checkbox"/> Ephemeral	<input type="checkbox"/> Seep

Riparian Vegetation:		Dom. Tree/Shrub Taxa		Canopy Cover:		Channel Alterations:	
Dominate Type:		<i>Sycamore</i>		<input type="checkbox"/> Fully Exposed (0-25%)		Dredging	
<input checked="" type="checkbox"/> Trees	<input checked="" type="checkbox"/> Shrubs	<i>Black Willow</i>		<input checked="" type="checkbox"/> Partially Exposed (25-50%)		<input type="checkbox"/> Channelization	
<input type="checkbox"/> Grasses	<input checked="" type="checkbox"/> Herbaceous	<i>Sweetgum</i>		<input type="checkbox"/> Partially Shaded (50-75%)		<input type="checkbox"/> Full <input type="checkbox"/> Partial	
Number of Strata <i>3</i>				<input type="checkbox"/> Fully Shaded (75-100%)			

Substrate <input checked="" type="checkbox"/> Est. <input type="checkbox"/> P.C	Riffle _____ %	Run; <i>100</i> %	Pool _____ %
Silt/Clay (<0.06 mm)		<i>80</i>	
Sand (0.06-2 mm)		<i>20</i>	
Gravel (2-64 mm)			
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Condition Category																				
	Optimal					Suboptimal					Marginal					Poor					
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient.					40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).					20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 20% stable habitat" lack of habitat is obvious; substrate unstable or lacking.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow. Deep > 1.5 feet.					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)					Only 2 of the 4 habitat regimes present (if fast-shallow or slow shallow are missing, score low)					Dominated by 1 velocity/depth regime.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
7. Frequency of Riffles	Occurrence of riffles relatively frequent; spacing between riffles 5 to 7 stream widths. Variety of habitat is key. In streams where riffles are continuous, boulders or logs are important.	Occurrence of riffles infrequent; distance between riffles divided by stream width is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by stream width is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by stream width is > than 25.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>

**Total Score**

**108**

**NOTES/COMMENTS:**

## High Gradient Stream Data Sheet

STREAM NAME: <i>INT 2 (MS)</i>			LOCATION: <i>Doc Cole</i>		
STATION: <i>WP220</i>		DRAINAGE AREA (AC)	BASIN/WATERSHED		
LAT: <i>37-33-24.2</i>		LONG: <i>87-37-15.3</i>	COUNTY: <i>Webster</i> USGS 7.5 TOPO:		
DATE: <i>2-15-11</i>		TIME: <i>4:45 CT</i> <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM	INVESTIGATORS: <i>Rick Heil /Julie Clark</i>		
TYPE SAMPLE: <input type="checkbox"/> P-CHEM <input type="checkbox"/> Macroinvertebrate <input type="checkbox"/> FISH <input type="checkbox"/> BACT.					
WEATHER: Now <input type="checkbox"/> Past 24 hours <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input checked="" type="checkbox"/> Clear/sunny					
Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
Air temperature <i>48</i> °F. Inches rainfall in past 24 hours <i>0</i> in					
% Cloud Cover <i>60</i>					
P-Chem: Temp (°F) <i>41.9</i> D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond.µs <i>173</i> <input type="checkbox"/> Grab					
<b>INSTREAM WATERSHED FEATURES</b>			<b>LOCAL WATERSHED FEATURES:</b>		
Stream BW <i>1.0</i> ft			Predominant Surrounding Land Use:		
Stream Width BF <i>3.5</i> ft			<input type="checkbox"/> Surface Mining <input type="checkbox"/> Construction <input checked="" type="checkbox"/> Forest		
BF Max Depth <i>.40</i> ft			<input type="checkbox"/> Deep Mining <input type="checkbox"/> Commercial <input type="checkbox"/> Pasture/Grazing		
Discharge _____ cfs			<input type="checkbox"/> Oil Wells <input type="checkbox"/> Industrial <input type="checkbox"/> Silviculture		
Est. Reach Length _____ ft			<input type="checkbox"/> Land Disposal <input type="checkbox"/> Row Crops <input type="checkbox"/> Urban Runoff/Storm Sewers		
Hydraulic Structures:		Stream Flow:		Stream Type:	
<input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input type="checkbox"/> Other <input type="checkbox"/> Culverts		<input type="checkbox"/> Dry <input type="checkbox"/> Pooled <input type="checkbox"/> Low <input checked="" type="checkbox"/> Normal <input type="checkbox"/> High <input type="checkbox"/> Very Rapid or Torrential		<input type="checkbox"/> Perennial <input checked="" type="checkbox"/> Intermittent <input type="checkbox"/> Ephemeral <input type="checkbox"/> Seep	
Riparian Vegetation:		Dom. Tree/Shrub Taxa		Channel Alterations:	
Dominate Type:		<i>Tulip Poplar</i>		Dredging	
<input checked="" type="checkbox"/> Trees <input checked="" type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input checked="" type="checkbox"/> Herbaceous		<i>Cherry</i>		<input type="checkbox"/> Channelization	
Number of Strata <i>3</i>		<i>Spicebush</i>		<input type="checkbox"/> Full <input type="checkbox"/> Partial	
Canopy Cover:					
<input type="checkbox"/> Fully Exposed (0-25%)					
<input type="checkbox"/> Partially Exposed (25-50%)					
<input checked="" type="checkbox"/> Partially Shaded (50-75%)					
<input type="checkbox"/> Fully Shaded (75-100%)					
Substrate <input checked="" type="checkbox"/> Est. <input type="checkbox"/> P.C.		Riffle <i>10</i> %		Run; <i>40</i> %	
				Pool <i>50</i> %	
Silt/Clay (<0.06 mm)		<i>40</i>		<i>40</i>	
Sand (0.06-2 mm)		<i>30</i>		<i>30</i>	
Gravel (2-64 mm)		<i>30</i>		<i>30</i>	
Cobble (64-256 mm)					
Boulders (>256 mm)					
Bedrock					
<b>Habitat</b>		<b>Condition Category</b>			
<b>Parameter</b>		<b>Optimal</b>	<b>Suboptimal</b>	<b>Marginal</b>	<b>Poor</b>
1. Epifaunal Substrate/ Available Cover		Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient.	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
2. Embeddedness		Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
3. Velocity/Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow. Deep > 1.5 feet.	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)	Only 2 of the 4 habitat regimes present (if fast-shallow or slow shallow are missing, score low)	Dominated by 1 velocity/depth regime.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
7. Frequency of Riffles	Occurrence of riffles relatively frequent; spacing between riffles 5 to 7 stream widths. Variety of habitat is key. In streams where riffles are continuous, boulders or logs are important.	Occurrence of riffles infrequent; distance between riffles divided by stream width is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by stream width is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by stream width is > than 25.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>

**Total Score**

**110**

**NOTES/COMMENTS;**

## High Gradient Stream Data Sheet

STREAM NAME: <i>INT 2 (DS)</i>			LOCATION: <i>Doc Cole</i>		
STATION: <i>WP218</i>		DRAINAGE AREA (AC)	BASIN/WATERSHED		
LAT: <i>37-33-20.7</i>		LONG: <i>87-37-05.0</i>	COUNTY: <i>Webster</i> USGS 7.5 TOPO;		
DATE: <i>2-15-11</i>		TIME: <i>4:10 CT</i> <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM	INVESTIGATORS: <i>Rick Heil / Julie Clark</i>		
TYPE SAMPLE: <input type="checkbox"/> P-CHEM <input type="checkbox"/> Macroinvertebrate <input type="checkbox"/> FISH <input type="checkbox"/> BACT.					
WEATHER: Now <input type="checkbox"/> Past 24 hours <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input checked="" type="checkbox"/> Clear/sunny					
Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
Air temperature <i>50</i> °F. Inches rainfall in past 24 hours <i>0</i> in					
% Cloud Cover <i>60</i>					
P-Chem: Temp (°F) <i>41.2</i> D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond.µs <i>153</i> <input type="checkbox"/> Grab					
<b>INSTREAM WATERSHED FEATURES</b>			<b>LOCAL WATERSHED FEATURES:</b>		
Stream BW <i>1.2-3.0</i> ft			Predominant Surrounding Land Use:		
Stream Width BF <i>3.0-4.0</i> ft			<input type="checkbox"/> Surface Mining <input type="checkbox"/> Construction <input checked="" type="checkbox"/> Forest		
BF Max Depth <i>.50</i> ft			<input type="checkbox"/> Deep Mining <input type="checkbox"/> Commercial <input type="checkbox"/> Pasture/Grazing		
Discharge _____ cfs			<input type="checkbox"/> Oil Wells <input type="checkbox"/> Industrial <input type="checkbox"/> Silviculture		
Est. Reach Length _____ ft			<input type="checkbox"/> Land Disposal <input type="checkbox"/> Row Crops <input type="checkbox"/> Urban Runoff/Storm Sewers		
Hydraulic Structures:		Stream Flow;		Stream Type;	
<input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input type="checkbox"/> Other <input type="checkbox"/> Culverts		<input type="checkbox"/> Dry <input type="checkbox"/> Pooled <input type="checkbox"/> Low <input checked="" type="checkbox"/> Normal <input type="checkbox"/> High <input type="checkbox"/> Very Rapid or Torrential		<input type="checkbox"/> Perennial <input checked="" type="checkbox"/> Intermittent <input type="checkbox"/> Ephemeral <input type="checkbox"/> Seep	
Riparian Vegetation:		Dom. Tree/Shrub Taxa		Channel Alterations;	
Dominate Type:		<i>Blackgum</i>		Dredging	
<input checked="" type="checkbox"/> Trees <input checked="" type="checkbox"/> Shrubs		<i>Red Maple</i>		<input type="checkbox"/> Channelization	
<input type="checkbox"/> Grasses <input checked="" type="checkbox"/> Herbaceous		<i>White Oak</i>		<input type="checkbox"/> Full <input type="checkbox"/> Partial	
Number of Strata <i>3</i>		<i>Green Ash</i>			
Canopy Cover:					
<input type="checkbox"/> Fully Exposed (0-25%)					
<input type="checkbox"/> Partially Exposed (25-50%)					
<input checked="" type="checkbox"/> Partially Shaded (50-75%)					
<input type="checkbox"/> Fully Shaded (75-100%)					
Substrate <input checked="" type="checkbox"/> Est. <input type="checkbox"/> P.C		Riffle <i>40</i> %		Run; <i>20</i> %	
				Pool <i>40</i> %	
Silt/Clay (<0.06 mm)		<i>10</i>		<i>20</i>	
Sand (0.06-2 mm)				<i>70</i>	
Gravel (2-64 mm)		<i>20</i>		<i>30</i>	
Cobble (64-256 mm)		<i>20</i>			
Boulders (>256 mm)		<i>20</i>			
Bedrock		<i>30</i>		<i>15</i>	
<b>Habitat</b>		<b>Condition Category</b>			
<b>Parameter</b>		<b>Optimal</b>	<b>Suboptimal</b>	<b>Marginal</b>	<b>Poor</b>
1. Epifaunal Substrate/ Available Cover		Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
2. Embeddedness		Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
3. Velocity/Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow. Deep > 1.5 feet.	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)	Only 2 of the 4 habitat regimes present (if fast-shallow or slow shallow are missing, score low)	Dominated by 1 velocity/depth regime.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
7. Frequency of Riffles	Occurrence of riffles relatively frequent; spacing between riffles 5 to 7 stream widths. Variety of habitat is key. In streams where riffles are continuous, boulders or logs are important.	Occurrence of riffles infrequent; distance between riffles divided by stream width is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by stream width is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by stream width is > than 25.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>

Total Score

138

NOTES/COMMENTS;

## High Gradient Stream Data Sheet

STREAM NAME: <i>INT 3</i>			LOCATION: <i>Doc Cole</i>		
STATION: <i>WP209</i>		DRAINAGE AREA (AC)	BASIN/WATERSHED		
LAT: <i>37-33-23.0</i>		LONG: <i>87-37-09.2</i>	COUNTY: <i>Webster</i> USGS 7.5 TOPO;		
DATE: <i>2-15-11</i>		TIME: <i>2:50 CT</i> <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM	INVESTIGATORS: <i>Rick Heil / Julie Clark</i>		
TYPE SAMPLE: <input type="checkbox"/> P-CHEM <input type="checkbox"/> Macroinvertebrate <input type="checkbox"/> FISH <input type="checkbox"/> BACT.					
WEATHER: Now <input type="checkbox"/> Past 24 hours <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input checked="" type="checkbox"/> Clear/sunny					
Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
Air temperature <i>53</i> °F. Inches rainfall in past 24 hours <i>0</i> in					
% Cloud Cover <i>50</i>					
P-Chem: Temp (°F) <i>46.4</i> D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond.µs <i>82.9</i> <input type="checkbox"/> Grab					
<b>INSTREAM WATERSHED FEATURES</b>			<b>LOCAL WATERSHED FEATURES:</b>		
Stream BW <i>2.0</i> ft			Predominant Surrounding Land Use:		
Stream Width BF <i>4.5</i> ft			<input type="checkbox"/> Surface Mining <input type="checkbox"/> Construction <input checked="" type="checkbox"/> Forest		
BF Max Depth <i>.50</i> ft			<input type="checkbox"/> Deep Mining <input type="checkbox"/> Commercial <input type="checkbox"/> Pasture/Grazing		
Discharge _____ cfs			<input type="checkbox"/> Oil Wells <input type="checkbox"/> Industrial <input type="checkbox"/> Silviculture		
Est. Reach Length _____ ft			<input type="checkbox"/> Land Disposal <input type="checkbox"/> Row Crops <input type="checkbox"/> Urban Runoff/Storm Sewers		
Hydraulic Structures:		Stream Flow:		Stream Type:	
<input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input type="checkbox"/> Dry <input type="checkbox"/> Pooled <input type="checkbox"/> Low <input checked="" type="checkbox"/> Normal		<input type="checkbox"/> High <input type="checkbox"/> Very Rapid or Torrential		<input type="checkbox"/> Perennial <input checked="" type="checkbox"/> Intermittent	
<input type="checkbox"/> Island <input type="checkbox"/> Waterfalls				<input type="checkbox"/> Ephemeral <input type="checkbox"/> Seep	
<input type="checkbox"/> Other <input type="checkbox"/> Culverts					
Riparian Vegetation:		Dom. Tree/Shrub Taxa		Canopy Cover:	
Dominate Type:		<i>Sycamore</i>		<input type="checkbox"/> Fully Exposed (0-25%)	
<input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <i>Tulip-Poplar</i>		<i>Shagbark Hickory</i>		<input type="checkbox"/> Partially Exposed (25-50%)	
<input type="checkbox"/> Grasses <input checked="" type="checkbox"/> Herbaceous <i>Flowering Dogwood</i>				<input checked="" type="checkbox"/> Partially Shaded (50-75%)	
Number of Strata <i>2</i>				<input type="checkbox"/> Fully Shaded (75-100%)	
				Channel Alterations:	
				Dredging	
				<input type="checkbox"/> Channelization	
				<input type="checkbox"/> Full <input type="checkbox"/> Partial	
Substrate <input checked="" type="checkbox"/> Est. <input type="checkbox"/> P.C		Riffle <i>70</i> %		Run: <i>20</i> %	
				Pool <i>10</i> %	
Silt/Clay (<0.06 mm)		<i>10</i>		<i>10</i>	
Sand (0.06-2 mm)		<i>10</i>		<i>10</i>	
Gravel (2-64 mm)		<i>30</i>		<i>30</i>	
Cobble (64-256 mm)		<i>40</i>		<i>40</i>	
Boulders (>256 mm)		<i>10</i>		<i>10</i>	
Bedrock					
<b>Habitat</b>		<b>Condition Category</b>			
<b>Parameter</b>		<b>Optimal</b>	<b>Suboptimal</b>	<b>Marginal</b>	<b>Poor</b>
1. Epifaunal Substrate/ Available Cover		Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient.	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
2. Embeddedness		Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
3. Velocity/Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow. Deep > 1.5 feet.	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)	Only 2 of the 4 habitat regimes present (if fast-shallow or slow shallow are missing, score low)	Dominated by 1 velocity/depth regime.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
7. Frequency of Riffles	Occurrence of riffles relatively frequent; spacing between riffles 5 to 7 stream widths. Variety of habitat is key. In streams where riffles are continuous, boulders or logs are important.	Occurrence of riffles infrequent; distance between riffles divided by stream width is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by stream width is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by stream width is > than 25.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>

**Total Score**

134

**NOTES/COMMENTS;**

## High Gradient Stream Data Sheet

STREAM NAME: <i>EPH 1</i>			LOCATION: <i>Doc Cole</i>		
STATION: <i>WP4</i>		DRAINAGE AREA (AC)	BASIN/WATERSHED		
LAT: <i>37-33-14.9</i>		LONG: <i>87-37-23.1</i>	COUNTY: <i>Webster</i>		USGS 7.5 TOPO:
DATE: <i>1-25-11</i>		TIME: <i>2:45 CT</i> <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM	INVESTIGATORS: <i>Rick Heil / Julie Clark</i>		
TYPE SAMPLE: <input type="checkbox"/> P-CHEM <input type="checkbox"/> Macroinvertebrate <input type="checkbox"/> FISH <input type="checkbox"/> BACT.					
WEATHER: Now <input type="checkbox"/> Past 24 hours <input type="checkbox"/> Heavy rain <input checked="" type="checkbox"/> Steady rain <input checked="" type="checkbox"/> Intermittent showers <input type="checkbox"/> Clear/sunny					
Has there been a heavy rain in the last 7 days? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					
Air temperature <i>36</i> °F. Inches rainfall in past 24 hours <i>.01</i> in					
% Cloud Cover <i>100</i>					
P-Chem: Temp (°C) <i>N/A</i> D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond.µs <i>N/A</i> <input type="checkbox"/> Grab					
<b>INSTREAM WATERSHED FEATURES</b>			<b>LOCAL WATERSHED FEATURES:</b>		
Stream BW <i>1.0-2.0</i> ft			Predominant Surrounding Land Use:		
Stream Width BF <i>2.0-3.0</i> ft			<input type="checkbox"/> Surface Mining	<input type="checkbox"/> Construction	<input type="checkbox"/> Forest
BF Max Depth <i>.50</i> ft			<input type="checkbox"/> Deep Mining	<input type="checkbox"/> Commercial	<input checked="" type="checkbox"/> Pasture/Grazing
Discharge _____ cfs			<input type="checkbox"/> Oil Wells	<input type="checkbox"/> Industrial	<input type="checkbox"/> Silviculture
Est. Reach Length _____ ft			<input type="checkbox"/> Land Disposal	<input type="checkbox"/> Row Crops	<input type="checkbox"/> Urban Runoff/Storm Sewers
Hydraulic Structures:		Stream Flow:		Stream Type:	
<input type="checkbox"/> Dams	<input type="checkbox"/> Bridge Abutments	<input checked="" type="checkbox"/> Dry	<input checked="" type="checkbox"/> Pooled	<input type="checkbox"/> Low	<input type="checkbox"/> Normal
<input type="checkbox"/> Island	<input type="checkbox"/> Waterfalls	<input type="checkbox"/> High	<input type="checkbox"/> Very Rapid or Torrential		<input checked="" type="checkbox"/> Perennial
<input type="checkbox"/> Other	<input type="checkbox"/> Culverts	<input type="checkbox"/> Intermittent			
<input checked="" type="checkbox"/> Ephemeral	<input type="checkbox"/> Seep				
Riparian Vegetation:		Dom. Tree/Shrub Taxa		Channel Alterations:	
Dominate Type:		<i>Black Walnut</i>		Dredging	
<input checked="" type="checkbox"/> Trees	<input type="checkbox"/> Shrubs	<i>Black Cherry</i>		<input type="checkbox"/> Channelization	
<input checked="" type="checkbox"/> Grasses	<input type="checkbox"/> Herbaceous	<i>Locust sp.</i>		<input type="checkbox"/> Full <input type="checkbox"/> Partial	
Number of Strata <i>2</i>	<i>Black Willow</i>		Canopy Cover:		
				<input type="checkbox"/> Fully Exposed (0-25%)	
				<input checked="" type="checkbox"/> Partially Exposed (25-50%)	
				<input type="checkbox"/> Partially Shaded (50-75%)	
				<input type="checkbox"/> Fully Shaded (75-100%)	
Substrate <input checked="" type="checkbox"/> Est. <input type="checkbox"/> P.C		Riffle <i>30</i> %	Run; <i>60</i> %	Pool <i>10</i> %	
Silt/Clay (<0.06 mm)		<i>100</i>	<i>100</i>	<i>100</i>	
Sand (0.06-2 mm)					
Gravel (2-64 mm)					
Cobble (64-256 mm)					
Boulders (>256 mm)					
Bedrock					
<b>Habitat</b>		<b>Condition Category</b>			
<b>Parameter</b>		<b>Optimal</b>	<b>Suboptimal</b>	<b>Marginal</b>	<b>Poor</b>
1. Epifaunal Substrate/Available Cover		Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
2. Embeddedness		Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
3. Velocity/Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow. Deep > 1.5 feet.	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)	Only 2 of the 4 habitat regimes present (if fast-shallow or slow shallow are missing, score low)	Dominated by 1 velocity/depth regime.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
7. Frequency of Riffles	Occurrence of riffles relatively frequent; spacing between riffles 5 to 7 stream widths. Variety of habitat is key. In streams where riffles are continuous, boulders or logs are important.	Occurrence of riffles infrequent; distance between riffles divided by stream width is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by stream width is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by stream width is > than 25.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>

**Total Score**

**87**

**NOTES/COMMENTS;**

## High Gradient Stream Data Sheet

STREAM NAME: <i>EPH 2</i>			LOCATION: <i>Doc Cole</i>		
STATION: <i>WP7</i>		DRAINAGE AREA (AC)	BASIN/WATERSHED		
LAT: <i>37-33-15.4</i>		LONG: <i>87-37-23.7</i>	COUNTY: <i>Webster</i> USGS 7.5 TOPO;		
DATE: <i>1-25-11</i>		TIME: <i>3:00 CT</i> <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM	INVESTIGATORS: <i>Rick Heil /Julie Clark</i>		
TYPE SAMPLE: <input type="checkbox"/> P-CHEM <input type="checkbox"/> Macroinvertebrate <input type="checkbox"/> FISH <input type="checkbox"/> BACT.					
WEATHER: Now Past 24 hours Has there been a heavy rain in the last 7 days?					
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain Air temperature <u>36</u> °F. Inches rainfall in past 24 hours <u>.01</u> in <input checked="" type="checkbox"/> Intermittent showers <u>100</u> % Cloud Cover <input type="checkbox"/> Clear/sunny <input type="checkbox"/> Clear/sunny					
P-Chem: Temp (°C) <u>N/A</u> D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond.µs <u>N/A</u> <input type="checkbox"/> Grab					
<b>INSTREAM WATERSHED FEATURES</b>			<b>LOCAL WATERSHED FEATURES:</b>		
Stream BW <u>1.0-3.0</u> ft Stream Width BF <u>1.5-3.5</u> ft BF Max Depth <u>.20</u> ft Discharge _____ cfs Est. Reach Length _____ ft			Predominant Surrounding Land Use: <input type="checkbox"/> Surface Mining <input type="checkbox"/> Construction <input type="checkbox"/> Forest <input type="checkbox"/> Deep Mining <input type="checkbox"/> Commercial <input checked="" type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Oil Wells <input type="checkbox"/> Industrial <input type="checkbox"/> Silviculture <input type="checkbox"/> Land Disposal <input type="checkbox"/> Row Crops <input type="checkbox"/> Urban Runoff/Storm Sewers		
Hydraulic Structures:		Stream Flow:		Stream Type:	
<input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input checked="" type="checkbox"/> Dry <input type="checkbox"/> Pooled <input type="checkbox"/> Low <input type="checkbox"/> Normal <input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input type="checkbox"/> High <input type="checkbox"/> Very Rapid or Torrential <input type="checkbox"/> Other <input type="checkbox"/> Culverts				<input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input checked="" type="checkbox"/> Ephemeral <input type="checkbox"/> Seep	
Riparian Vegetation:		Dom. Tree/Shrub Taxa	Canopy Cover:		Channel Alterations:
Dominate Type: <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input checked="" type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous Number of Strata <u>2</u>		<i>Black Walnut</i> <i>Winged Elm</i> <i>Locust sp.</i>	<input type="checkbox"/> Fully Exposed (0-25%) <input type="checkbox"/> Partially Exposed (25-50%) <input checked="" type="checkbox"/> Partially Shaded (50-75%) <input type="checkbox"/> Fully Shaded (75-100%)		Dredging <input type="checkbox"/> Channelization ( <input type="checkbox"/> Full <input type="checkbox"/> Partial)
Substrate <input checked="" type="checkbox"/> Est. <input type="checkbox"/> P.C		Riffle <u>30</u> %	Run; <u>70</u> %		Pool _____ %
Silt/Clay (<0.06 mm)		<u>20</u>	<u>10</u>		
Sand (0.06-2 mm)		<u>20</u>	<u>10</u>		
Gravel (2-64 mm)		<u>20</u>	<u>20</u>		
Cobble (64-256 mm)		<u>10</u>	<u>5</u>		
Boulders (>256 mm)		<u>20</u>	<u>10</u>		
Bedrock		<u>10</u>	<u>45</u>		
<b>Habitat</b>		<b>Condition Category</b>			
<b>Parameter</b>		<b>Optimal</b>	<b>Suboptimal</b>	<b>Marginal</b>	<b>Poor</b>
1. Epifaunal Substrate/ Available Cover		Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient.	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
2. Embeddedness		Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
3. Velocity/Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow. Deep > 1.5 feet.	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)	Only 2 of the 4 habitat regimes present (if fast-shallow or slow shallow are missing, score low)	Dominated by 1 velocity/depth regime.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
7. Frequency of Riffles	Occurrence of riffles relatively frequent; spacing between riffles 5 to 7 stream widths. Variety of habitat is key. In streams where riffles are continuous, boulders or logs are important.	Occurrence of riffles infrequent; distance between riffles divided by stream width is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by stream width is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by stream width is > than 25.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>

**Total Score**

91

**NOTES/COMMENTS:**

## High Gradient Stream Data Sheet

STREAM NAME: <i>EPH 3</i>			LOCATION: <i>Doc Cole</i>		
STATION: <i>WP31</i>		DRAINAGE AREA (AC)	BASIN/WATERSHED		
LAT: <i>37-33-19.4</i>		LONG: <i>87-37-25.1</i>	COUNTY: <i>Webster</i> USGS 7.5 TOPO;		
DATE: <i>1-25-11</i>		TIME: <i>5:00 CT</i> <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM	INVESTIGATORS: <i>Rick Heil /Julie Clark</i>		
TYPE SAMPLE: <input type="checkbox"/> P-CHEM <input type="checkbox"/> Macroinvertebrate <input type="checkbox"/> FISH <input type="checkbox"/> BACT.					
WEATHER: Now <input type="checkbox"/> Past 24 hours <input type="checkbox"/> Heavy rain <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Steady rain <input checked="" type="checkbox"/> Intermittent showers <input type="checkbox"/> Clear/sunny					
Has there been a heavy rain in the last 7 days? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					
Air temperature <i>34</i> °F. Inches rainfall in past 24 hours <i>.01</i> in					
% Cloud Cover <i>100</i>					
P-Chem: Temp (°C) <i>N/A</i> D.O. (mg/l) _____ % Saturation _____ PH(S.U.) _____ Cond. µs <i>N/A</i> <input type="checkbox"/> Grab					
<b>INSTREAM WATERSHED FEATURES</b>			<b>LOCAL WATERSHED FEATURES:</b>		
Stream BW <i>1.0</i> ft			Predominant Surrounding Land Use:		
Stream Width BF <i>1.5</i> ft			<input type="checkbox"/> Surface Mining <input type="checkbox"/> Construction <input type="checkbox"/> Forest		
BF Max Depth <i>.20</i> ft			<input type="checkbox"/> Deep Mining <input type="checkbox"/> Commercial <input checked="" type="checkbox"/> Pasture/Grazing		
Discharge _____ cfs			<input type="checkbox"/> Oil Wells <input type="checkbox"/> Industrial <input type="checkbox"/> Silviculture		
Est. Reach Length _____ ft			<input type="checkbox"/> Land Disposal <input type="checkbox"/> Row Crops <input type="checkbox"/> Urban Runoff/Storm Sewers		
Hydraulic Structures:		Stream Flow:		Stream Type:	
<input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input checked="" type="checkbox"/> Dry <input type="checkbox"/> Pooled <input type="checkbox"/> Low <input type="checkbox"/> Normal		<input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input type="checkbox"/> High <input type="checkbox"/> Very Rapid or Torrential		<input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent	
<input type="checkbox"/> Other <input type="checkbox"/> Culverts				<input checked="" type="checkbox"/> Ephemeral <input type="checkbox"/> Seep	
Riparian Vegetation: Dominate Type:		Dom. Tree/Shrub Taxa		Channel Alterations:	
<input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <i>Winged Elm</i>				Dredging	
<input checked="" type="checkbox"/> Grasses <input checked="" type="checkbox"/> Herbaceous <i>River Birch</i>				<input type="checkbox"/> Channelization	
Number of Strata <i>3</i>		<i>Red Oak</i>		<input type="checkbox"/> Full <input type="checkbox"/> Partial	
Canopy Cover:					
<input type="checkbox"/> Fully Exposed (0-25%)					
<input type="checkbox"/> Partially Exposed (25-50%)					
<input checked="" type="checkbox"/> Partially Shaded (50-75%)					
<input type="checkbox"/> Fully Shaded (75-100%)					
Substrate <input checked="" type="checkbox"/> Est. <input type="checkbox"/> P.C		Riffle <i>20</i> %		Run; <i>80</i> %	
				Pool _____ %	
Silt/Clay (<0.06 mm)		<i>60</i>		<i>60</i>	
Sand (0.06-2 mm)		<i>20</i>		<i>20</i>	
Gravel (2-64 mm)		<i>20</i>		<i>20</i>	
Cobble (64-256 mm)					
Boulders (>256 mm)					
Bedrock					
<b>Habitat</b>		<b>Condition Category</b>			
<b>Parameter</b>		<b>Optimal</b>	<b>Suboptimal</b>	<b>Marginal</b>	<b>Poor</b>
1. Epifaunal Substrate/ Available Cover		Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
2. Embeddedness		Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>1 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
3. Velocity/Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow. Deep > 1.5 feet.	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)	Only 2 of the 4 habitat regimes present (if fast-shallow or slow shallow are missing, score low)	Dominated by 1 velocity/depth regime.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pool prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
7. Frequency of Riffles	Occurrence of riffles relatively frequent; spacing between riffles 5 to 7 stream widths. Variety of habitat is key. In streams where riffles are continuous, boulders or logs are important.	Occurrence of riffles infrequent; distance between riffles divided by stream width is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by stream width is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by stream width is > than 25.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable. 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>

**Total Score**

**89**

**NOTES/COMMENTS:**

## High Gradient Stream Data Sheet

STREAM NAME: <i>EPH 4</i>			LOCATION: <i>Doc Cole</i>		
STATION: <i>WP212</i>		DRAINAGE AREA (AC)	BASIN/WATERSHED		
LAT: <i>37-33-23.0</i>		LONG: <i>87-37-08.1</i>	COUNTY: <i>Webster</i> USGS 7.5 TOPO:		
DATE: <i>2-15-11</i>		TIME: <i>3:20 CT</i> <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM	INVESTIGATORS: <i>Rick Heil /Julie Clark</i>		
TYPE SAMPLE: <input type="checkbox"/> P-CHEM <input type="checkbox"/> Macroinvertebrate <input type="checkbox"/> FISH <input type="checkbox"/> BACT.					
WEATHER: Now <input type="checkbox"/> Past 24 hours <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input checked="" type="checkbox"/> Clear/sunny					
Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
Air temperature <i>51</i> °F. Inches rainfall in past 24 hours <i>0</i> in					
% Cloud Cover <i>50</i>					
P-Chem: Temp (°F) <i>42.6</i> D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond.µs <i>71.8</i> <input type="checkbox"/> Grab					
<b>INSTREAM WATERSHED FEATURES</b>			<b>LOCAL WATERSHED FEATURES:</b>		
Stream BW <i>.40</i> ft			Predominant Surrounding Land Use:		
Stream Width BF <i>1.8</i> ft			<input type="checkbox"/> Surface Mining <input type="checkbox"/> Deep Mining <input type="checkbox"/> Oil Wells <input type="checkbox"/> Land Disposal		
BF Max Depth <i>.30</i> ft			<input type="checkbox"/> Construction <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> Row Crops		
Discharge _____ cfs			<input checked="" type="checkbox"/> Forest <input type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Silviculture <input type="checkbox"/> Urban Runoff/Storm Sewers		
Est. Reach Length _____ ft					
Hydraulic Structures:		Stream Flow:		Stream Type:	
<input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input type="checkbox"/> Island <input type="checkbox"/> Other		<input checked="" type="checkbox"/> Dry <input checked="" type="checkbox"/> Pooled <input type="checkbox"/> Low <input type="checkbox"/> Normal <input type="checkbox"/> High <input type="checkbox"/> Very Rapid or Torrential		<input type="checkbox"/> Perennial <input checked="" type="checkbox"/> Ephemeral <input type="checkbox"/> Intermittent <input type="checkbox"/> Seep	
Riparian Vegetation: Dominate Type:		Dom. Tree/Shrub Taxa		Channel Alterations;	
<input checked="" type="checkbox"/> Trees <input type="checkbox"/> Grasses <input type="checkbox"/> Shrubs <input checked="" type="checkbox"/> Herbaceous		<i>Winged Elm</i> <i>White Oak</i>		Dredging <input type="checkbox"/> Channelization ( <input type="checkbox"/> Full <input type="checkbox"/> Partial)	
Number of Strata <i>2</i>					
Substrate <input checked="" type="checkbox"/> Est. <input type="checkbox"/> P.C.		Riffle <i>90</i> %		Run; _____ %	
				Pool <i>10</i> %	
Silt/Clay (<0.06 mm)		<i>10</i>		<i>100</i>	
Sand (0.06-2 mm)		<i>10</i>			
Gravel (2-64 mm)		<i>20</i>			
Cobble (64-256 mm)		<i>10</i>			
Boulders (>256 mm)		<i>50</i>			
Bedrock					
<b>Habitat</b>		<b>Condition Category</b>			
<b>Parameter</b>		<b>Optimal</b>	<b>Suboptimal</b>	<b>Marginal</b>	<b>Poor</b>
1. Epifaunal Substrate/ Available Cover		Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient.	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
2. Embeddedness		Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
3. Velocity/Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow. Deep > 1.5 feet.	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)	Only 2 of the 4 habitat regimes present (if fast-shallow or slow shallow are missing, score low)	Dominated by 1 velocity/depth regime.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles	Occurrence of riffles relatively frequent; spacing between riffles 5 to 7 stream widths. Variety of habitat is key. In streams where riffles are continuous, boulders or logs are important.	Occurrence of riffles infrequent; distance between riffles divided by stream width is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by stream width is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by stream width is > than 25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score

122

NOTES/COMMENTS;

## High Gradient Stream Data Sheet

STREAM NAME: <i>EPH 5</i>			LOCATION: <i>Doc Cole</i>		
STATION: <i>WP216</i>		DRAINAGE AREA (AC)	BASIN/WATERSHED		
LAT: <i>37-33-21.9</i>		LONG: <i>87-37-06.5</i>	COUNTY: <i>Webster</i> USGS 7.5 TOPO;		
DATE: <i>2-15-11</i>		TIME: <i>3:45 CT</i> <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM	INVESTIGATORS: <i>Rick Heil /Julie Clark</i>		
TYPE SAMPLE: <input type="checkbox"/> P-CHEM <input type="checkbox"/> Macroinvertebrate <input type="checkbox"/> FISH <input type="checkbox"/> BACT.					
WEATHER: Now <input type="checkbox"/> Past 24 hours <input type="checkbox"/> Heavy rain <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
<input type="checkbox"/> <input type="checkbox"/> Steady rain <input type="checkbox"/> Air temperature <u>50</u> °F. Inches rainfall in past 24 hours <u>0</u> in <input type="checkbox"/> <input type="checkbox"/> Intermittent showers <u>60</u> % Cloud Cover <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Clear/sunny					
P-Chem: Temp (°F) <u>43.5</u> D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond.µs <u>67.3</u> <input type="checkbox"/> Grab					
<b>INSTREAM WATERSHED FEATURES</b>			<b>LOCAL WATERSHED FEATURES:</b>		
Stream BW <u>.40</u> ft Stream Width BF <u>1.0</u> ft BF Max Depth <u>.15</u> ft Discharge _____ cfs Est. Reach Length _____ ft			Predominant Surrounding Land Use: <input type="checkbox"/> Surface Mining <input type="checkbox"/> Construction <input checked="" type="checkbox"/> Forest <input type="checkbox"/> Deep Mining <input type="checkbox"/> Commercial <input type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Oil Wells <input type="checkbox"/> Industrial <input type="checkbox"/> Silviculture <input type="checkbox"/> Land Disposal <input type="checkbox"/> Row Crops <input type="checkbox"/> Urban Runoff/Storm Sewers		
Hydraulic Structures:		Stream Flow:		Stream Type:	
<input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input checked="" type="checkbox"/> Dry <input checked="" type="checkbox"/> Pooled <input type="checkbox"/> Low <input type="checkbox"/> Normal <input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input type="checkbox"/> High <input type="checkbox"/> Very Rapid or Torrential <input type="checkbox"/> Other <input type="checkbox"/> Culverts				<input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input checked="" type="checkbox"/> Ephemeral <input type="checkbox"/> Seep	
Riparian Vegetation:		Dom. Tree/Shrub Taxa	Canopy Cover:		Channel Alterations:
Dominate Type: <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input checked="" type="checkbox"/> Herbaceous Number of Strata <u>2</u>		<i>Flowering Dogwood</i> <i>Winged Elm</i> <i>White Oak</i>	<input checked="" type="checkbox"/> Fully Exposed (0-25%) <input type="checkbox"/> Partially Exposed (25-50%) <input type="checkbox"/> Partially Shaded (50-75%) <input type="checkbox"/> Fully Shaded (75-100%)		<input type="checkbox"/> Dredging <input type="checkbox"/> Channelization <input type="checkbox"/> Full <input type="checkbox"/> Partial
Substrate <input checked="" type="checkbox"/> Est. <input type="checkbox"/> P.C.		Riffle _____ %	Run; <u>90</u> %		Pool <u>10</u> %
Silt/Clay (<0.06 mm)			<u>100</u>		<u>100</u>
Sand (0.06-2 mm)					
Gravel (2-64 mm)					
Cobble (64-256 mm)					
Boulders (>256 mm)					
Bedrock					
<b>Habitat</b>		<b>Condition Category</b>			
<b>Parameter</b>		<b>Optimal</b>	<b>Suboptimal</b>	<b>Marginal</b>	<b>Poor</b>
1. Epifaunal Substrate/Available Cover		Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient.	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
2. Embeddedness		Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
3. Velocity/Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow. Deep > 1.5 feet.	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)	Only 2 of the 4 habitat regimes present (if fast-shallow or slow shallow are missing, score lower)	Dominated by 1 velocity/depth regime.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
7. Frequency of Riffles	Occurrence of riffles relatively frequent; spacing between riffles 5 to 7 stream widths. Variety of habitat is key. In streams where riffles are continuous, boulders or logs are important.	Occurrence of riffles infrequent; distance between riffles divided by stream width is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by stream width is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by stream width is > than 25.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>

**Total Score**

**91**

**NOTES/COMMENTS:**

## High Gradient Stream Data Sheet

STREAM NAME: <i>EPH 6</i>			LOCATION: <i>Doc Cole</i>		
STATION: <i>WP221</i>		DRAINAGE AREA (AC)	BASIN/WATERSHED		
LAT: <i>37-33-12.3</i>		LONG: <i>87-37-15.9</i>	COUNTY: <i>Webster</i> USGS 7.5 TOPO;		
DATE: <i>2-16-11</i>		TIME: <i>8:20 CT</i> <input checked="" type="checkbox"/> AM <input type="checkbox"/> PM	INVESTIGATORS: <i>Rick Heil /Julie Clark</i>		
TYPE SAMPLE: <input type="checkbox"/> P-CHEM <input type="checkbox"/> Macroinvertebrate <input type="checkbox"/> FISH <input type="checkbox"/> BACT.					
WEATHER: Now <input type="checkbox"/> Past 24 hours <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input checked="" type="checkbox"/> Clear/sunny					
Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
Air temperature <i>50</i> °F. Inches rainfall in past 24 hours <i>0</i> in					
% Cloud Cover <i>70</i>					
P-Chem: Temp (°F) <i>43.3</i> D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond.µs <i>94.4</i> <input type="checkbox"/> Grab					
<b>INSTREAM WATERSHED FEATURES</b>			<b>LOCAL WATERSHED FEATURES:</b>		
Stream BW <i>.40-1.0</i> ft			Predominant Surrounding Land Use:		
Stream Width BF <i>1.4-2.0</i> ft			<input type="checkbox"/> Surface Mining <input type="checkbox"/> Construction <input checked="" type="checkbox"/> Forest		
BF Max Depth <i>.15</i> ft			<input type="checkbox"/> Deep Mining <input type="checkbox"/> Commercial <input checked="" type="checkbox"/> Pasture/Grazing		
Discharge _____ cfs			<input type="checkbox"/> Oil Wells <input type="checkbox"/> Industrial <input type="checkbox"/> Silviculture		
Est. Reach Length _____ ft			<input type="checkbox"/> Land Disposal <input type="checkbox"/> Row Crops <input type="checkbox"/> Urban Runoff/Storm Sewers		
Hydraulic Structures:		Stream Flow:		Stream Type:	
<input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input checked="" type="checkbox"/> Dry <input checked="" type="checkbox"/> Pooled <input type="checkbox"/> Low <input type="checkbox"/> Normal		<input type="checkbox"/> High <input type="checkbox"/> Very Rapid or Torrential		<input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent	
<input type="checkbox"/> Island <input type="checkbox"/> Waterfalls				<input checked="" type="checkbox"/> Ephemeral <input type="checkbox"/> Seep	
<input type="checkbox"/> Other <input type="checkbox"/> Culverts					
Riparian Vegetation: Dominate Type:		Dom. Tree/Shrub Taxa		Channel Alterations:	
<input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <i>Cherrybark Oak</i>		<i>Black Cherry</i>		Dredging <input type="checkbox"/> Channelization <input type="checkbox"/> Full <input type="checkbox"/> Partial	
<input type="checkbox"/> Grasses <input checked="" type="checkbox"/> Herbaceous					
Number of Strata <i>2</i>					
Substrate <input checked="" type="checkbox"/> Est. <input type="checkbox"/> P.C		Riffle <i>10</i> %		Run: <i>70</i> %	
				Pool <i>20</i> %	
Silt/Clay (<0.06 mm)		<i>80</i>		<i>80</i>	
Sand (0.06-2 mm)		<i>10</i>		<i>10</i>	
Gravel (2-64 mm)		<i>10</i>			
Cobble (64-256 mm)					
Boulders (>256 mm)					
Bedrock					
<b>Habitat</b>		<b>Condition Category</b>			
<b>Parameter</b>		<b>Optimal</b>	<b>Suboptimal</b>	<b>Marginal</b>	<b>Poor</b>
1. Epifaunal Substrate/ Available Cover		Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
2. Embeddedness		Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
3. Velocity/Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow. Deep > 1.5 feet.	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)	Only 2 of the 4 habitat regimes present (if fast-shallow or slow shallow are missing, score low)	Dominated by 1 velocity/depth regime.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
7. Frequency of Riffles	Occurrence of riffles relatively frequent; spacing between riffles 5 to 7 stream widths. Variety of habitat is key. In streams where riffles are continuous, boulders or logs are important.	Occurrence of riffles infrequent; distance between riffles divided by stream width is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by stream width is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by stream width is > than 25.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>

**Total Score**

98

**NOTES/COMMENTS;**

## High Gradient Stream Data Sheet

STREAM NAME: <i>EPH 7</i>			LOCATION: <i>Doc Cole</i>		
STATION: <i>WP224</i>		DRAINAGE AREA (AC)	BASIN/WATERSHED		
LAT: <i>37-33-13.9</i>		LONG: <i>87-37-11.8</i>	COUNTY: <i>Webster</i> USGS 7.5 TOPO;		
DATE: <i>2-16-11</i>		TIME: <i>8:45 CT</i> <input checked="" type="checkbox"/> AM <input type="checkbox"/> PM	INVESTIGATORS: <i>Rick Heil /Julie Clark</i>		
TYPE SAMPLE: <input type="checkbox"/> P-CHEM <input type="checkbox"/> Macroinvertebrate <input type="checkbox"/> FISH <input type="checkbox"/> BACT.					
WEATHER: Now <input type="checkbox"/> Past 24 hours <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input checked="" type="checkbox"/> Clear/sunny					
Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
Air temperature <i>54</i> °F. Inches rainfall in past 24 hours <i>0</i> in					
% Cloud Cover <i>50</i>					
P-Chem: Temp (°F) <i>43.9</i> D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond.µs <i>69.6</i> <input type="checkbox"/> Grab					
<b>INSTREAM WATERSHED FEATURES</b>			<b>LOCAL WATERSHED FEATURES:</b>		
Stream BW <i>.60-2.0</i> ft			Predominant Surrounding Land Use:		
Stream Width BF <i>2.0-3.0</i> ft			<input type="checkbox"/> Surface Mining <input type="checkbox"/> Construction <input checked="" type="checkbox"/> Forest		
BF Max Depth <i>.25</i> ft			<input type="checkbox"/> Deep Mining <input type="checkbox"/> Commercial <input checked="" type="checkbox"/> Pasture/Grazing		
Discharge _____ cfs			<input type="checkbox"/> Oil Wells <input type="checkbox"/> Industrial <input type="checkbox"/> Silviculture		
Est. Reach Length _____ ft			<input type="checkbox"/> Land Disposal <input type="checkbox"/> Row Crops <input type="checkbox"/> Urban Runoff/Storm Sewers		
Hydraulic Structures:		Stream Flow:		Stream Type:	
<input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input checked="" type="checkbox"/> Dry <input checked="" type="checkbox"/> Pooled <input type="checkbox"/> Low <input type="checkbox"/> Normal		<input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input type="checkbox"/> High <input type="checkbox"/> Very Rapid or Torrential		<input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent	
<input type="checkbox"/> Other <input type="checkbox"/> Culverts				<input checked="" type="checkbox"/> Ephemeral <input type="checkbox"/> Seep	
Riparian Vegetation: Dominate Type:		Dom. Tree/Shrub Taxa		Canopy Cover:	
<input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs		<i>Black Willow</i>		<input type="checkbox"/> Fully Exposed (0-25%)	
<input type="checkbox"/> Grasses <input checked="" type="checkbox"/> Herbaceous		<i>Cherrybark Oak</i>		<input type="checkbox"/> Partially Exposed (25-50%)	
Number of Strata <i>2</i>		<i>Black Cherry</i>		<input checked="" type="checkbox"/> Partially Shaded (50-75%)	
		<i>Winged Elm</i>		<input type="checkbox"/> Fully Shaded (75-100%)	
				Channel Alterations: Dredging <input type="checkbox"/> Channelization ( <input type="checkbox"/> Full <input type="checkbox"/> Partial)	
Substrate <input checked="" type="checkbox"/> Est. <input type="checkbox"/> P.C		Riffle <i>20</i> %		Run; <i>60</i> %	
		Pool <i>20</i> %			
Silt/Clay (<0.06 mm)		<i>20</i>		<i>60</i>	
Sand (0.06-2 mm)		<i>20</i>		<i>40</i>	
Gravel (2-64 mm)					
Cobble (64-256 mm)		<i>10</i>			
Boulders (>256 mm)		<i>10</i>			
Bedrock		<i>40</i>			
<b>Habitat</b>		<b>Condition Category</b>			
<b>Parameter</b>		<b>Optimal</b>	<b>Suboptimal</b>	<b>Marginal</b>	<b>Poor</b>
1. Epifaunal Substrate/ Available Cover		Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
2. Embeddedness		Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
3. Velocity/Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow. Deep > 1.5 feet.	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)	Only 2 of the 4 habitat regimes present (if fast-shallow or slow shallow are missing, score low)	Dominated by 1 velocity/depth regime.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
7. Frequency of Riffles	Occurrence of riffles relatively frequent; spacing between riffles 5 to 7 stream widths. Variety of habitat is key. In streams where riffles are continuous, boulders or logs are important.	Occurrence of riffles infrequent; distance between riffles divided by stream width is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by stream width is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by stream width is > than 25.
<b>SCORE</b>	<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 9 8 7 6</b>	<b>5 4 3 2 1 0</b>
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>

**Total Score**

**96**

**NOTES/COMMENTS;**

## High Gradient Stream Data Sheet

STREAM NAME: <i>EPH 8</i>			LOCATION: <i>Doc Cole</i>		
STATION: <i>WP227</i>		DRAINAGE AREA (AC)	BASIN/WATERSHED		
LAT: <i>37-33-24.1</i>		LONG: <i>87-37-17.2</i>	COUNTY: <i>Webster</i> USGS 7.5 TOPO:		
DATE: <i>2-16-11</i>		TIME: <i>10:30 CT</i> <input checked="" type="checkbox"/> AM <input type="checkbox"/> PM	INVESTIGATORS: <i>Rick Heil /Julie Clark</i>		
TYPE SAMPLE: <input type="checkbox"/> P-CHEM <input type="checkbox"/> Macroinvertebrate <input type="checkbox"/> FISH <input type="checkbox"/> BACT.					
WEATHER: Now <input type="checkbox"/> Past 24 hours <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input checked="" type="checkbox"/> Clear/sunny					
Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
Air temperature <i>59</i> °F. Inches rainfall in past 24 hours <i>0</i> in					
% Cloud Cover <i>0</i>					
P-Chem: Temp (°F) <i>N/A</i> D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond.µs <i>N/A</i> <input type="checkbox"/> Grab					
<b>INSTREAM WATERSHED FEATURES</b>			<b>LOCAL WATERSHED FEATURES:</b>		
Stream BW <i>.40</i> ft			Predominant Surrounding Land Use:		
Stream Width BF <i>1.2</i> ft			<input type="checkbox"/> Surface Mining <input type="checkbox"/> Deep Mining <input type="checkbox"/> Oil Wells <input type="checkbox"/> Land Disposal		
BF Max Depth <i>.35</i> ft			<input type="checkbox"/> Construction <input type="checkbox"/> Commercial <input type="checkbox"/> Row Crops <input checked="" type="checkbox"/> Forest		
Discharge _____ cfs			<input type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Industrial <input type="checkbox"/> Silviculture		
Est. Reach Length _____ ft			<input type="checkbox"/> Urban Runoff/Storm Sewers		
Hydraulic Structures:		Stream Flow:		Stream Type:	
<input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input type="checkbox"/> Island <input type="checkbox"/> Other		<input checked="" type="checkbox"/> Dry <input type="checkbox"/> Pooled <input type="checkbox"/> Low <input type="checkbox"/> Normal <input type="checkbox"/> High <input type="checkbox"/> Very Rapid or Torrential		<input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input checked="" type="checkbox"/> Ephemeral <input type="checkbox"/> Seep	
Riparian Vegetation: Dominate Type:		Dom. Tree/Shrub Taxa		Channel Alterations:	
<input checked="" type="checkbox"/> Trees <input type="checkbox"/> Grasses		<i>Cherrybark Oak</i> <i>Tulip-Poplar</i>		Dredging <input type="checkbox"/> Channelization ( <input type="checkbox"/> Full <input type="checkbox"/> Partial)	
Number of Strata <i>2</i>					
Substrate <input checked="" type="checkbox"/> Est. <input type="checkbox"/> P.C		Riffle _____ %		Run; <i>100</i> %	
				Pool _____ %	
Silt/Clay (<0.06 mm)				<i>30</i>	
Sand (0.06-2 mm)				<i>30</i>	
Gravel (2-64 mm)				<i>30</i>	
Cobble (64-256 mm)				<i>10</i>	
Boulders (>256 mm)					
Bedrock					
<b>Habitat</b>		<b>Condition Category</b>			
<b>Parameter</b>		<b>Optimal</b>	<b>Suboptimal</b>	<b>Marginal</b>	<b>Poor</b>
1. Epifaunal Substrate/ Available Cover		Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
<b>SCORE</b>		<b>20 19 18 17 16</b>	<b>15 14 13 12 11</b>	<b>10 8 7 6</b>	<b>5 4 3 2 1 0</b>
2. Embeddedness		Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
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3. Velocity/Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow. Deep > 1.5 feet.	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)	Only 2 of the 4 habitat regimes present (if fast-shallow or slow shallow are missing, score low)	Dominated by 1 velocity/depth regime.
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4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
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<b>SCORE (LB)</b>	<b>Left Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
<b>SCORE (RB)</b>	<b>Right Bank 10 9</b>	<b>8 7 6</b>	<b>5 4 3</b>	<b>2 1 0</b>
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
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10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
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**Total Score**

**96**

**NOTES/COMMENTS;**



INT-1, Looking upstream



INT-1, Looking downstream



INT-2 US, Looking upstream



INT-2 US, Looking downstream



INT-2 MS, Looking upstream



INT-2 MS, Looking downstream



INT-2 DS, Looking upstream



INT-2 DS, Looking downstream



INT-3, Looking upstream



INT-3, Looking downstream



Ephemeral 1 (E-1)



Ephemeral 2 (E-2)



Ephemeral 3 (E-3)



Ephemeral 4 (E-4)



Ephemeral 5 (E-5)



Ephemeral 6 (E-6)



Ephemeral 7 (E-7)



Ephemeral 8 (E-8)

**WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont (DRAFT)**

Project/Site: Doc Cole - Wetland A		City/County: Webster	Sampling Date: 01/25/2011
Applicant/Owner: Associated Engineers		State: KY	Sampling Point: Wetland A - 1
Investigator(s): J. Clark, R. Heil		Section, Township, Range: Ortiz	
Landform (hillslope, terrace, etc.): stream valley		Local Relief: <input type="checkbox"/> concave <input checked="" type="checkbox"/> convex <input type="checkbox"/> none	
Slope: %	Lat: 37° 33' 13.8"	Long: 87° 37' 24.6"	Datum: NAD 83
Soil Map Unit: Wellston silty clay loam, 12-20%..(WpD3)		Cowardin Classification: PFO1B	
Are climatic/hydrologic conditions on the site typical for this time of year? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No (if no, explain in Remarks.)			
Are Vegetation, Soil, or Hydrology significantly disturbed? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Are "Normal Circumstances" present? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Are Vegetation, Soil, or Hydrology naturally problematic? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		(If needed, explain in Remarks.)	

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<b>Is the Sampled Area within a Wetland?</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Hydric Soil Present? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Wetland Hydrology Present? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Remarks: Soils are problematic due to past history of site.	

**VEGETATION – Use scientific names of plants**

Tree Stratum (Plot Size: 20'x30')	Absolute % Cover	Dominant Species?	Indicator Status	<b>Dominance Test worksheet:</b> Number of Dominant Species that are OBL, FACW, or FAC: <u>5</u> (A) Total Number of Dominant Species Across all Strata: <u>5</u> (B) Percent of Dominant Species that are OBL, FACW, or FAC: <u>100</u> (A/B)
1. <i>Betula nigra</i>	20	Yes	FACW	
2. <i>Acer rubrum</i>	20	Yes	FAC	
3. <i>Liquidambar styraciflua</i>	15	Yes	FAC	
4.				
<b>Sapling/Shrub Stratum (Plot Size: 15')</b>				<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ OBL Species: _____ X 1 = _____ FACW Species: _____ X 2 = _____ FAC Species: _____ X 3 = _____ FACU Species: _____ X 4 = _____ UPL Species: _____ X 5 = _____ Column Totals:(A) _____ (B) _____ Prevalence Index = B/A = _____
1. <i>B. nigra</i>	15	Yes	FACW	
2. <i>A. rubrum</i>	10	Yes	FAC	
3.				
4.				
<b>Herbaceous Stratum (Plot Size: --)</b>				<b>Hydrophytic Vegetation Indicators:</b> <input type="checkbox"/> Rapid Test for Hydrophytic Vegetation <input checked="" type="checkbox"/> Dominance Test is >50% <input type="checkbox"/> Prevalence Index is ≤3.0 <sup>1</sup> <input type="checkbox"/> Morphological Adaptations <sup>1</sup> (Provide Supporting Data) <input type="checkbox"/> Problematic Hydrophytic Vegetation <sup>1</sup> (Explain) <sup>1</sup> Indicators of hydric soil and wetland hydrology must be
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
<b>Woody Vine (Plot Size: --)</b>				<b>Hydrophytic Vegetation Present?</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
1.				
2.				

Remarks: Herbaceous vegetation dead or unidentifiable due to winter season.

**SOIL**

Sampling Point: \_\_\_\_\_

Profile Description (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (in)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Loc <sup>2</sup>		
0-4	MIX							Red-colored soil from AMD, lots of OM
4-12	2.5Y 5/1	30	7.5YR 5/8	70			SAND	Coal, fill material, majority of matrix is red-orange
							GRITTY	

<sup>1</sup>Type: C=Concretion, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. <sup>2</sup>Location: PL=Pore Lining, M=Matrix

**Hydric Soil Indicators:**

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- 2cm Muck (A10) (LRR N, MLRA 147,148)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Dark Surface (S7)

- Polyvalue Below Surface (S8)(MLRA 147,148)
- Thin Dark Surface (S9)(MLRA 147,148)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- Fe-Mn Masses (F12)(LRR N, MLRA 136)
- Umbric Surface (F13)(LRR N, MLRA 136)
- Piedmont Floodplain Soils (F19)(MLRA 148)

**Indicators for Problematic Hydric Soils<sup>3</sup>**

- 2 cm Muck (A10)(MLRA 147)
- Piedmont Floodplain Soils (F19) (MLRA 136,147)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

<sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type:  
Depth (in):

Hydric Soil Present?  Yes  No

Remarks: Acid mine drainage from past mining appears to flood into wetland. Soils are bright red-orange and contain fill, coal. Problem soil.

**HYDROLOGY**

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li><input type="checkbox"/> Surface Water (A1)</li> <li><input type="checkbox"/> High Water Table (A2)</li> <li><input checked="" type="checkbox"/> Saturation (A3)</li> <li><input checked="" type="checkbox"/> Water Marks (B1)</li> <li><input type="checkbox"/> Sediment Deposits (B2)</li> <li><input type="checkbox"/> Drift Deposits (B3)</li> <li><input type="checkbox"/> Algal Mat or Crust (B4)</li> <li><input type="checkbox"/> Iron Deposits (B5)</li> <li><input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)</li> <li><input checked="" type="checkbox"/> Water-Stained Leaves (B9)</li> <li><input type="checkbox"/> Aquatic Fauna (B13)</li> </ul> | <ul style="list-style-type: none"> <li><input type="checkbox"/> True Aquatic Plants (B14)</li> <li><input type="checkbox"/> Hydrogen Sulfide Odor (C1)</li> <li><input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)</li> <li><input type="checkbox"/> Presence of Reduced Iron (C4)</li> <li><input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)</li> <li><input type="checkbox"/> Thin Muck Surface (C7)</li> <li><input type="checkbox"/> Other (Explain in Remarks)</li> </ul> |
|---|---|

**Secondary Indicators (minimum of two required)**

- Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Moss Trim Lines (B16)
- Dry-Season Water Table (C2)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Stunted or Stressed Plants (D1)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- Microtopographic Relief (D4)
- FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present?  Yes  No Depth (in):

Water Table Present?  Yes  No Depth (in):

Saturation Present?  Yes  No Depth (in): within upper 12"  
(includes capillary fringe)

Wetland Hydrology Present?  Yes  No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont (DRAFT)**

Project/Site: Doc Cole - Wetland B		City/County: Webster	Sampling Date: 02/16/2011
Applicant/Owner: Associated Engineers		State: KY	Sampling Point: Wetland B - 1
Investigator(s): J. Clark, R. Heil		Section, Township, Range: Ortiz	
Landform (hillslope, terrace, etc.): depression		Local Relief: <input checked="" type="checkbox"/> concave <input type="checkbox"/> convex <input type="checkbox"/> none	
Slope: %	Lat: 37° 33' 19.3"	Long: 87° 37' 11.5"	Datum: NAD 83
Soil Map Unit: Memphis silt loam, 2-6% slopes (MoB)		Cowardin Classification: PEM1B	
Are climatic/hydrologic conditions on the site typical for this time of year? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No (if no, explain in Remarks.)			
Are Vegetation, Soil, or Hydrology significantly disturbed? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Are "Normal Circumstances" present? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Are Vegetation, Soil, or Hydrology naturally problematic? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		(If needed, explain in Remarks.)	

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<b>Is the Sampled Area within a Wetland?</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Hydric Soil Present? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Wetland Hydrology Present? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Remarks:	

**VEGETATION – Use scientific names of plants**

Tree Stratum (Plot Size: --)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1.				Number of Dominant Species that are OBL, FACW, or FAC: _____ (A)  Total Number of Dominant Species Across all Strata: _____ (B)  Percent of Dominant Species that are OBL, FACW, or FAC: _____ (A/B)
2.				
3.				
4.				
5.				
Sapling/Shrub Stratum (Plot Size:--)				<b>Prevalence Index worksheet:</b>  Total % Cover of: _____ Multiply by: _____  OBL Species: _____ X 1= _____ FACW Species: _____ X 2= _____ FAC Species: _____ X 3= _____ FACU Species: _____ X 4= _____ UPL Species: _____ X 5= _____ Column Totals:(A) _____ (B) _____  Prevalence Index = B/A = _____
1.				
2.				
3.				
4.				
Herbaceous Stratum (Plot Size: --)				<b>Hydrophytic Vegetation Indicators:</b> <input type="checkbox"/> Rapid Test for Hydrophytic Vegetation <input type="checkbox"/> Dominance Test is >50% <input type="checkbox"/> Prevalence Index is ≤3.0 <sup>1</sup> <input type="checkbox"/> Morphological Adaptations <sup>1</sup> (Provide Supporting Data) <input type="checkbox"/> Problematic Hydrophytic Vegetation <sup>1</sup> (Explain) <sup>1</sup> Indicators of hydric soil and wetland hydrology must be
1. <i>Carex sp.</i>	30	Yes	NI	
2. <i>grass sp.</i>	25	Yes	NI	
3. <i>Scirpus sp.</i>	10	No	NI	
4. <i>Juncus effusus</i>	7	No	FACW	
5.				
6.				
7.				
8.				
9.				
10.				
Woody Vine (Plot Size: --)				<b>Hydrophytic Vegetation Present?</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
2.				

Remarks: Herbaceous vegetation dead or unidentifiable due to winter season, however, dominance test is likely > 50%.

**SOIL**

Sampling Point: \_\_\_\_\_

Profile Description (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (in)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Loc <sup>2</sup>		
0-2	10YR 4/2	100	--					
2-7	10YR 5/2	80	7.5YR 4/6	20	C	PL, M	LO SA	compacted below this depth

<sup>1</sup>Type: C=Concretion, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. <sup>2</sup>Location: PL=Pore Lining, M=Matrix

**Hydric Soil Indicators:**

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- 2cm Muck (A10) (LRR N, MLRA 147,148)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Dark Surface (S7)

- Polyvalue Below Surface (S8)(MLRA 147,148)
- Thin Dark Surface (S9)(MLRA 147,148)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- Fe-Mn Masses (F12)(LRR N, MLRA 136)
- Umbric Surface (F13)(LRR N, MLRA 136)
- Piedmont Floodplain Soils (F19)(MLRA 148)

**Indicators for Problematic Hydric Soils<sup>3</sup>**

- 2 cm Muck (A10)(MLRA 147)
- Piedmont Floodplain Soils (F19) (MLRA 136,147)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

<sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type:  
Depth (in):

Hydric Soil Present?  Yes  No

Remarks:

**HYDROLOGY**

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li><input type="checkbox"/> Surface Water (A1)</li> <li><input type="checkbox"/> High Water Table (A2)</li> <li><input checked="" type="checkbox"/> Saturation (A3)</li> <li><input type="checkbox"/> Water Marks (B1)</li> <li><input type="checkbox"/> Sediment Deposits (B2)</li> <li><input type="checkbox"/> Drift Deposits (B3)</li> <li><input type="checkbox"/> Algal Mat or Crust (B4)</li> <li><input type="checkbox"/> Iron Deposits (B5)</li> <li><input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)</li> <li><input checked="" type="checkbox"/> Water-Stained Leaves (B9)</li> <li><input type="checkbox"/> Aquatic Fauna (B13)</li> </ul> | <ul style="list-style-type: none"> <li><input type="checkbox"/> True Aquatic Plants (B14)</li> <li><input type="checkbox"/> Hydrogen Sulfide Odor (C1)</li> <li><input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)</li> <li><input type="checkbox"/> Presence of Reduced Iron (C4)</li> <li><input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)</li> <li><input type="checkbox"/> Thin Muck Surface (C7)</li> <li><input type="checkbox"/> Other (Explain in Remarks)</li> </ul> |
|--|---|

**Secondary Indicators (minimum of two required)**

- Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Moss Trim Lines (B16)
- Dry-Season Water Table (C2)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Stunted or Stressed Plants (D1)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- Microtopographic Relief (D4)
- FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present?  Yes  No Depth (in):

Water Table Present?  Yes  No Depth (in):  
Saturation Present?  Yes  No Depth (in): 0-7"  
(includes capillary fringe)

Wetland Hydrology Present?  Yes  No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Fringe of pond

**WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont (DRAFT)**

Project/Site: Doc Cole - Wetland C		City/County: Webster	Sampling Date: 02/16/2011
Applicant/Owner: Associated Engineers		State: KY	Sampling Point: Wetland C - 1
Investigator(s): J. Clark, R. Heil		Section, Township, Range: Ortiz	
Landform (hillslope, terrace, etc.): valley		Local Relief: <input type="checkbox"/> concave <input checked="" type="checkbox"/> convex <input type="checkbox"/> none	
Slope: %	Lat: 37° 33' 25.3"	Long: 87° 37' 18.5"	Datum: NAD 83
Soil Map Unit: Frondorf silt loam, 20-30% slopes (FdE)		Cowardin Classification: PEM1B	
Are climatic/hydrologic conditions on the site typical for this time of year? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No (if no, explain in Remarks.)			
Are Vegetation, Soil, or Hydrology significantly disturbed? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Are "Normal Circumstances" present? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Are Vegetation, Soil, or Hydrology naturally problematic? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		(If needed, explain in Remarks.)	

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<b>Is the Sampled Area within a Wetland?</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Hydric Soil Present? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Wetland Hydrology Present? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Remarks:	

**VEGETATION – Use scientific names of plants**

Tree Stratum (Plot Size: --)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1.				Number of Dominant Species that are OBL, FACW, or FAC: _____ (A)  Total Number of Dominant Species Across all Strata: _____ (B)  Percent of Dominant Species that are OBL, FACW, or FAC: _____ (A/B)
2.				
3.				
4.				
5.				
Sapling/Shrub Stratum (Plot Size:--)				<b>Prevalence Index worksheet:</b>  Total % Cover of: _____ Multiply by:  OBL Species: _____ X 1= _____ FACW Species: _____ X 2= _____ FAC Species: _____ X 3= _____ FACU Species: _____ X 4= _____ UPL Species: _____ X 5= _____ Column Totals: (A) _____ (B) _____  Prevalence Index = B/A = _____
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Herbaceous Stratum (Plot Size: --)				<b>Hydrophytic Vegetation Indicators:</b> <input type="checkbox"/> Rapid Test for Hydrophytic Vegetation <input type="checkbox"/> Dominance Test is >50% <input type="checkbox"/> Prevalence Index is ≤3.0 <sup>1</sup> <input type="checkbox"/> Morphological Adaptations <sup>1</sup> (Provide Supporting Data) <input type="checkbox"/> Problematic Hydrophytic Vegetation <sup>1</sup> (Explain) <small><sup>1</sup>Indicators of hydric soil and wetland hydrology must be</small>
1. <i>Carex sp.</i>	30	Yes	NI	
2. <i>Solidago sp.</i>	10	No	NI	
3. <i>Juncus effusus</i>	10	No	FACW	
4. <i>Boehmeria cylindrica</i>	5	No	FACW	
5.				
6.				
7.				
8.				
9.				
10.				
Woody Vine (Plot Size: --)				<b>Hydrophytic Vegetation Present?</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
1.				
2.				

Remarks: Herbaceous vegetation dead or unidentifiable due to winter season, however, dominance test is likely > 50%.

**SOIL**

Sampling Point: \_\_\_\_\_

Profile Description (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (in)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Loc <sup>2</sup>		
0-3	10YR 5/2	80	7.5YR 5/6	20	C	M	SI LO	
3-12	10YR 6/2	60	7.5YR 4/6	40	C	M	SI LO	

<sup>1</sup>Type: C=Concretion, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. <sup>2</sup>Location: PL=Pore Lining, M=Matrix

**Hydric Soil Indicators:**

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- 2cm Muck (A10) (LRR N, MLRA 147,148)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Dark Surface (S7)

- Polyvalue Below Surface (S8)(MLRA 147,148)
- Thin Dark Surface (S9)(MLRA 147,148)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- Fe-Mn Masses (F12)(LRR N, MLRA 136)
- Umbric Surface (F13)(LRR N, MLRA 136)
- Piedmont Floodplain Soils (F19)(MLRA 148)

**Indicators for Problematic Hydric Soils<sup>3</sup>**

- 2 cm Muck (A10)(MLRA 147)
- Piedmont Floodplain Soils (F19) (MLRA 136,147)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

<sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type:  
Depth (in):

Hydric Soil Present?  Yes  No

Remarks:

**HYDROLOGY**

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li><input type="checkbox"/> Surface Water (A1)</li> <li><input type="checkbox"/> High Water Table (A2)</li> <li><input checked="" type="checkbox"/> Saturation (A3)</li> <li><input type="checkbox"/> Water Marks (B1)</li> <li><input type="checkbox"/> Sediment Deposits (B2)</li> <li><input type="checkbox"/> Drift Deposits (B3)</li> <li><input type="checkbox"/> Algal Mat or Crust (B4)</li> <li><input type="checkbox"/> Iron Deposits (B5)</li> <li><input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)</li> <li><input type="checkbox"/> Water-Stained Leaves (B9)</li> <li><input type="checkbox"/> Aquatic Fauna (B13)</li> </ul> | <ul style="list-style-type: none"> <li><input type="checkbox"/> True Aquatic Plants (B14)</li> <li><input type="checkbox"/> Hydrogen Sulfide Odor (C1)</li> <li><input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)</li> <li><input type="checkbox"/> Presence of Reduced Iron (C4)</li> <li><input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)</li> <li><input type="checkbox"/> Thin Muck Surface (C7)</li> <li><input type="checkbox"/> Other (Explain in Remarks)</li> </ul> |
|---|---|

Secondary Indicators (minimum of two required)

- Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Moss Trim Lines (B16)
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- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Stunted or Stressed Plants (D1)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- Microtopographic Relief (D4)
- FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present?  Yes  No Depth (in):

Water Table Present?  Yes  No Depth (in):  
Saturation Present?  Yes  No Depth (in): 0-7"  
(includes capillary fringe)

Wetland Hydrology Present?  Yes  No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Wetland on either side of stream

**WETLAND AND POND PHOTOS**



**Wetland A –  
Palustrine Forested**



**Pond and Wetland B –  
Palustrine Emergent**



**Wetland C –  
Palustrine Emergent**

PCN

**INDIVIDUAL 404 PERMIT APPLICATION**

**SURFACE FACILITIES FOR AN  
UNDERGROUND COAL MINE OPERATION**  
In Webster County, Kentucky

**DOC COLE MINE SITE**

Prepared for:  
**Carbonado Coal Mining, LLC**  
1205 Nebo Road  
Madisonville, KY 42431

Prepared by:  
**T.H.E. J-E Engineers, Inc.**

2331 Fortune Drive, Suite #295  
Lexington, Kentucky 40509  
(859) 263-0009

August 3, 2011

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## **STANDARD OPERATING PROCEDURES**

### **1. Pre-Application Meeting.**

An on-site meeting with a representative from the United States Army Corps of Engineers (USACE) will be conducted, but has not been scheduled.

### **2. Receipt of Application.**

Please refer to ENG Form 4345 and attachments for information related to applicant, authorized agent, project location, project description and purpose, adjoining property owners and signature authorization. See Exhibit 1 for project location.

#### **A. Detailed description of proposed activity:**

##### **(1) Impacts**

Under this application, Carbonado Coal Mining, LLC, is proposing the following impacts: 2241 feet of ephemeral stream (or 0.094 surface acres), and 2730 feet of intermittent stream (or 0.221 surface acres). Three wetlands will be filled with a total area of 0.292 acres. One open water area (Pond 1) with a total area of 0.085 acres will be filled during construction. However, the pond and its associated 0.040 acres of wetland (Wetland B) appear to be isolated waters. Stream lengths to be impacted by the proposed activity are also listed below in Section 2A(1)(a).

##### **(a) Direct Impacts**

- No permanent fills will be required for the proposed activity.
- No road crossings over streams will be required for facility access.
- Three ponds will be utilized for permanent sediment control during the project, and will affect one ephemeral and two intermittent streams; for a total impact length of 300 feet.
- Mining will affect three intermittent streams totaling 2730 feet, eight ephemeral streams totaling 2241 feet, 0.292 acres of wetlands, and 0.085 acres of pond/open waters; required to develop surface operations to access the coal reserves. The pond will be drained and drainage will be temporarily diverted into a sediment basin during the mining activity. Due to the length of the project, the development of on-site mitigation is not practical; mitigation will be in the form of payment of an in lieu fee to the Kentucky Department for Fish & Wildlife Resources.

##### **(b) Indirect Impacts**

- Water will be diverted within the project boundary. No diversions outside of the project boundary will be needed during the mining process.
- Site excavation will result in impacts to streams and wetlands and will indirectly impact aquatic life movement by creating temporary obstacles.

## **(2) Drainage Acreage**

The total area within the project boundary is approximately 66 acres, located within one HUC-12 watershed; the Jackson Ditch-Deer Creek watershed (HUC 051100050103). There are two general watershed locations where existing drainage leaves the main project site. Drainage areas for these watersheds are 20 acres and 73 acres. Refer to Table 1 in the "Stream Habitat Assessment and Wetland Delineation Report" for drainage areas of each impact.

## **(3) Purpose**

The purpose of the proposed activity is to establish the surface facilities for a proposed underground coal mine operation; to extract coal from the WK #9 seam and transport it by public roadways to a barge loading facility, in order to meet future energy demands of the United States. The project is expected to last 15 to 20 years, and will provide full time employment to 90 new workers. Business activities associated with the project are expected to boost local economy in a region that has suffered economically since the 1970's.

## **(4) Schedule**

Work is expected to begin in the fall of 2011, and to be completed in 15 to 20 years.

## **(5) Dredged or Fill Material**

Material consisting of native rock and soil will be generated during project development. Streams and wetlands will be impacted by excavation during the surface development process. The volume of streams, to ordinary high water (OHW) mark, is approximately 190 cubic yards. The volume of wetlands is approximately 470 cubic yards, and the volume of ponds/open waters is approximately 410 cubic yards.

## **B. Minimal Impact Determination**

### **(1) Loss of Aquatic Functions**

Loss of aquatic functions: The primary functions of streams within the project boundary are aquatic habitat and movement, water conveyance, sediment transport and a potential water source for terrestrial animals. In addition, smaller ephemeral streams and headwaters of the larger streams supply organic material to lower reaches and eventually to larger stream systems. Intermittent streams may support aquatic insects and/or fish; however, streams located in agricultural areas may not have fully recovered from past disturbance. The primary

functions of wetlands within the project boundary include: flood water storage, energy dissipation, nutrient retention, subsurface water storage and wildlife habitat.

Some stream and wetland functions will be lost during project development and the life of the underground mining operation. Therefore, since this mining activity is expected to have an operational life of up to 20 years, mitigation will not be proposed on site.

### **(2) Gain of Aquatic Functions**

Aquatic functions will be gained by through the utilization of in-lieu fees paid to the Kentucky Department for Fish & Wildlife Resources (KDF&WR) for the enhancement/preservation of streams in the Green River watershed. The projects developed through the KDF&WR in-lieu fee program are chosen by a committee of regulatory agencies, which includes members from Corps of Engineers and Kentucky Division of Water. These projects are to provide an ecological lift to degraded resources in the watershed, and are permanently protected through conservation easements or deed restrictions. It should be noted that drainage and stream channels established during, and after mining has been completed, should return aquatic functions to the site.

### **(3) Avoidance and Minimization**

The project has been designed and constructed to avoid and minimize adverse impacts to waters of the U.S.

(a) This proposed project site is for the surface facilities associated with a proposed underground mine operation, and is not currently permitted by the Kentucky Division of Mine Permits. A permit application will be submitted in the future for the extraction of coal. Geologic exploration in the region indicates that the proposed underground mine operation is the most appropriate based on the depth and amount of recoverable coal reserves available. Other mining techniques, including surface mining, were considered, but found to be economically feasible due to the depth of the resources. Surface mining would also result in extensive environmental impacts, and would not meet the project's needs. Underground mining was determined to be the only feasible method due to the prevailing geologic conditions.

(b) A 66-acre area was investigated for streams, wetlands, and open waters. The site contains 34 acres of current agricultural-use area; where impacts to waters have already taken place. In addition, there is evidence of past underground mining (from geological mapping and the current quality of one of the intermittent streams in an area noted as having been mined in the past). Due to the long project life, and lack of opportunities for on-site mitigation,

Carbonado Coal Mining, LLC proposes to mitigate impacts by payment of in lieu fees to the Kentucky Department for Fish & Wildlife Resources. The only alternative that would result in no impacts to waters of the U.S. is the no-build alternative, which would not meet the purpose and need of the proposed project. Completely avoiding impacts to all streams and wetlands within the project boundary was determined not to be practical.

Erosion control measures during project development will be employed to minimize the increase of suspended solids and turbidity. Erosion control structures will include silt basins located as close to impact areas as practicable, diversion ditches, rock check dams, temporary seeding and mulching and silt fence. Use of existing features on the site will avoid additional impacts to waters of the U.S. For example, proposed entrance roads for access to the facility site have been located to avoid additional impacts to waters. Additional measures include timely construction and maintenance of sediment control structures.

(c) The proposed project will impact ephemeral and intermittent streams and wetlands. No information has been found that lists any of the aquatic sites as high quality waters. For example, there are no Outstanding Resource Waters, Division of Water Reference Reaches, Class 1-3 Undeveloped or Wild and Scenic Rivers or Cold Water Habitat located within the project boundary.

(d) Three sediment basins will be utilized and are located as close as practical to the surface operation boundary in order to intercept as much of the interior drainage as possible and treat water before it leaves the site.

(e) - (h) Please refer to the "Stream Habitat Assessment and Wetland Delineation Report" prepared for Carbonado Coal Mining, LLC, for a description of the aquatic environment, stream impact details, a summary of functional (habitat) assessment, delineations of waters of the U.S., descriptions of stream quality, and wetland classifications.

#### **(4) Cumulative Impacts Analysis**

(a) Land Disturbance Activities:

See **Cumulative Impacts Analysis** section of application.

(b) Watershed Improvement Projects

**Preservation Areas** –No preservation areas or Wildlife Management Areas are located within the project boundary.

**Restoration of Previously Mined Areas** – There is surface evidence of previous underground mining and reclaimed areas located within the project boundary. These areas will be restored during the reclamation phase of the project.

**Enhancement Activities** - Enhancement activities are not available due to the length of the project and the locations of the affected resources within the property boundaries.

### **C. Compensatory Mitigation:**

Mitigation for stream and wetland impacts will be accomplished by payment of an in-lieu to the Kentucky Department for Fish & Wildlife Resources; an approved recipient for stream and wetland mitigation funds. The payment of an in lieu fee is appropriate due to the expected length of the mining operation (approximately 30 years) and the lack of available sites in the project area. The proposed fee is based on the latest guidance provided by the Louisville District Corps of Engineers in *Public Notice No. LRL-2003-27-pgj*. According to this document, the fees outside of the Eastern Kentucky Coalfield Region will be related to “Adjusted Mitigation Units” and set dollar amounts per foot for streams, or per acre for wetlands. A chart of the proposed fees associated with specific impacts is attached as Table 1.

Table 1  
PROPOSED IN-LIEU FEE

DOC COLE SITE  
Webster County

Stream ID	Stream Type	Type of Impact	Acreage of Impact	Watershed size (acres)	RPB Score	Stream Quality	Impact Length	Mitigation Ratio	Adjusted Mitigation Units (AMU's)	In Lieu Fee (dollars)
INT-1	intermittent	fill	0.041	20.3	95	poor	417	1.00	417.0	85,068.00
INT-2	intermittent	fill	0.124	72.8	119 ave.	average	1775	1.50	2662.5	543,150.00
INT-3	intermittent	fill	0.056	27.2	134	average	538	1.50	807.0	164,628.00
E-1	ephemeral	fill	0.017	1.4	87	poor	294	0.50	147.0	29,988.00
E-2	ephemeral	fill	0.014	2.0	91	poor	247	0.50	123.5	25,194.00
E-3	ephemeral	fill	0.024	9.7	89	poor	685	0.50	342.5	69,870.00
E-4	ephemeral	fill	0.009	4.4	122	average	214	0.75	160.5	32,742.00
E-5	ephemeral	fill	0.007	3.3	91	poor	297	0.50	148.5	30,294.00
E-6	ephemeral	fill	0.007	4.3	98	poor	177	0.50	88.5	18,054.00
E-7	ephemeral	fill	0.013	4.1	96	poor	219	0.50	109.5	22,338.00
E-8	ephemeral	fill	0.003	0.8	96	poor	108	0.50	54.0	11,016.00
Wet. A			0.210						0.420	15,120.00
Wet. C			0.042						0.084	3,024.00
									<b>Total</b>	<b>1,050,486.00</b>

Cumulative  
Impacts  
Analysis

**CUMULATIVE IMPACTS ANALYSIS  
WEBSTER COUNTY, KENTUCKY  
Doc Cole Mine Site**

**Introduction**

This document will use terminology following current EIS guidance. An impact, or effect, means the change or modification to an environmental resource brought about by an outside action. Impacts can, and will, vary in significance, magnitude, and duration. Impacts may also be beneficial or adverse depending on the action and resource affected. For this analysis, short-term impacts are those with effects evident for a few years, generally less than the lifetime of the project (e.g. ground clearing activities). Long-term impacts generally would be those with effects extending beyond the lifetime of the project (i.e. beyond reclamation). Impact magnitude will be defined as follows: major impacts could cause significant change, stress, or depletion to an environmental resource, potentially resulting in irretrievable loss; moderate impacts could cause some change in a resource, generally with readily apparent effects; minor impacts are those that are detectable but slight; negligible impacts are those at the lower limit of detection causing insignificant change or stress to resources; and no impact applies to a level at which no discernable or measurable impacts are observed. In cases where quantitative resource evaluation was not possible, analyses were based on best available information and professional judgment. (Office of Surface Mining, 2006).

The proposed project area, also referred to as the Doc Cole Mine site, has a footprint of approximately 66 acres (surface support facilities area for an underground mine); but the cumulative impact analysis has been expanded to a 12-digit HUC (HUC-12) watershed. The "Review Area" now refers to Jackson Ditch-Deer Creek, HUC 051100050103; an area of approximately 22.9 mi<sup>2</sup> (14,664 acres). Little data, other than coal severance tax records, are available prior to the advent of SMCRA permitting in the late 1970's. As a result, much of the discussion of past impacts is qualitative. Current and future impacts are based upon the best available data for resources of concern, but still involve a degree of speculation. Cumulative impacts were considered based upon present-day baseline conditions defined. The future time boundary of the analysis is determined by the release of project areas from agency oversight. The estimated lifetime of the project (underground activity) is fifteen to twenty years, with an additional five years for reclamation and bond release of the surface support area. Therefore, the cumulative impacts analysis will focus on a period of earliest available data for each resource to twenty years after mining begins, and will refer to this timeframe as the "Review Period" for the remainder of the document.

***Baseline Conditions***

Landuse changes have impacted much of the landscape, but large forested areas remain. Forest still covers 44% of the Review Area (approximately 6,400 acres). Forests are concentrated in higher-relief areas and along the main stems and larger tributaries of local streams. Large blocks remain, and often are connected by forested riparian corridors. Cultivated agricultural land occupies 38% of the Review Area (approximately 5,500 acres), with farm production roughly evenly divided between soybean and corn (US Department of Agriculture, 2002). The remaining landuses generally reflect more recent land development. Developed areas occupy roughly 3% of

the land surface (425 acres); however, most of this is open space usage. The Review Area lies between, but outside of, the cities of Dixon, Sebree, and Slaughters. Undeveloped grassland and pasture occupy 11% of the area (approximately 1,700 acres), and is a result of agricultural development and some past mine reclamation. Open water, scrub/shrub, and herbaceous land represent other minor landcovers (2%). Wetlands, both natural and manmade, represent the remaining 2% (or approximately 290 acres) of the Review Area (NLCD, 2001; SMIS, 2010).

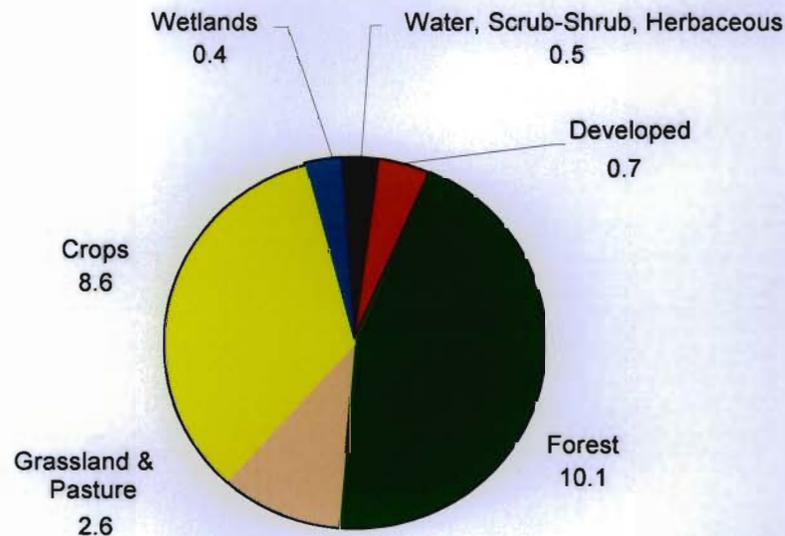


Figure 1. Review Area landcover totals in square miles. Data extracted from USGS NLCD 2001 dataset.

Agriculture has been extremely important to the economy of the region, and remains a significant source of employment and revenue, though to a lesser degree than historically. Still, the large areas cleared for pasture or row crops have converted much wetland and forest area into agricultural land. Wetland losses are difficult to quantify given sparse data for the area, but probably are in line with estimates for the state as a whole when using current acreage relative to hydric soils as a proxy to roughly estimate loss. Losses continued even after passage of the Clean Water Act, declining by approximately 1.8% of the remaining area annually (Dahl and Johnson, 1991). From 1998 to 2006, declines have been approximately 0.5% for marshes (~0.08% annually), but increases of 1.1% (~0.2% annually) have been seen in forested wetlands as scrub-shrub areas mature. Relatively large overall wetland increases are inflated by construction of ponds, and may mask an overall loss of wetland function (Dahl, 2006).

Resource extraction has not been a significant agent of landuse change, since most mining in the area has been from underground activities. Northeast of the HUC, there was pre-law underground mining of approximately 1480 acres. SMCRA-era mining, also located northeast of the Review Area, has only involved five permits; totaling 210 acres of surface disturbance. These areas all have had bond release, and are now covered in scrub-shrub, pasture, or forest. There is one active underground mine permit, for 3200 acres, with 108 acres of surface (prep plant and support facilities). This is the only

pending permit (other than the Doc Cole site), but that permit is for a procedure major revision and does not add acreage to that existing permit

### **Future Actions**

Estimates and projections of future development follow methods discussed in the Final Programmatic Environmental Impact Statement on Mountaintop Mining/Valley Fills in Appalachia issued by EPA 28 October 2005. Even though this method of mining is not utilized in Western Kentucky, the projection method is still applicable. In this method, coal mine permit information for the previous ten years was used to determine a rate of impact for that time period. Assuming this rate will continue at this level in the future, cumulative impacts were then extrapolated from the data set. This method was used in the current cumulative impacts analysis and was further applied to other potentially significant agents of change in the Review Area.

Underground mining has occurred fairly continuously outside the Review Area. Carbonado Coal Mining has the only pending mining permit in the Review Area, with a total of 66 acres of surface disturbance (the Doc Cole area). Based on an average project time span of twenty-five years, future mining is expected to progress at approximately 2.6 acres of surface disturbance per year (or 0.02% annually).

The economic impact of agriculture generally has been declining in the Review Area. After a large spike in 2002, the area of farmland returned to the pattern of decline seen since 1987. The increase in area coincides with an increase in number of farms; however, average size of farms continues to decline (USDA 1987, 1992, 1997, 2002). This may suggest reclassification of residential areas as farms that are not actively producing agricultural products. Crop production is expected to remain relatively static, future projections therefore assume no net expansion of agricultural land over the review period (although use of existing agricultural land may become more intensive).

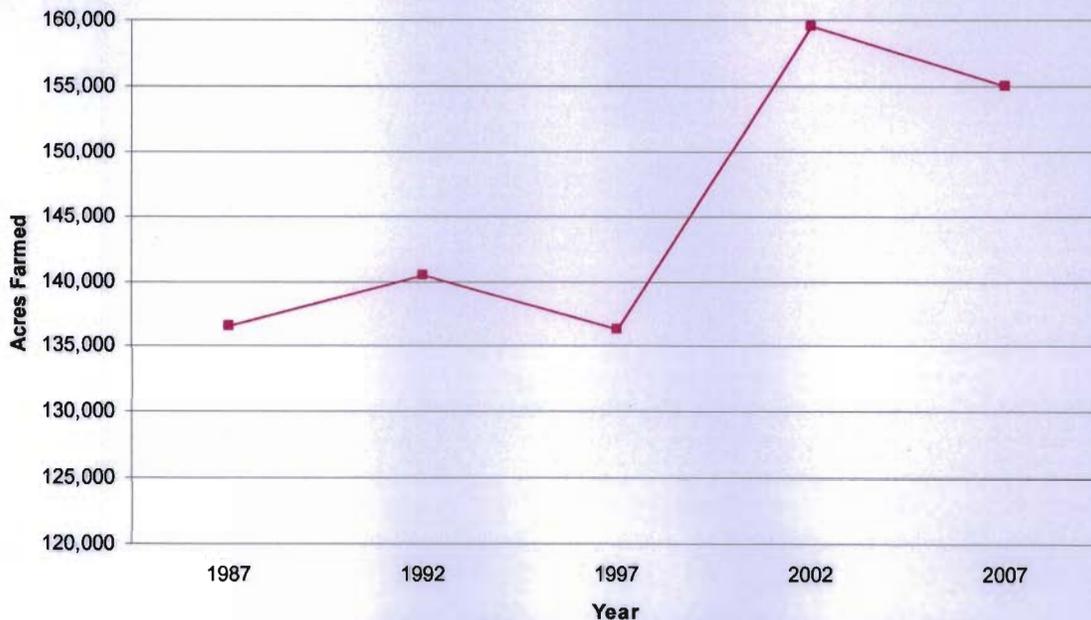


Figure 2. Acres of farmland in Webster County, 1987-2007.

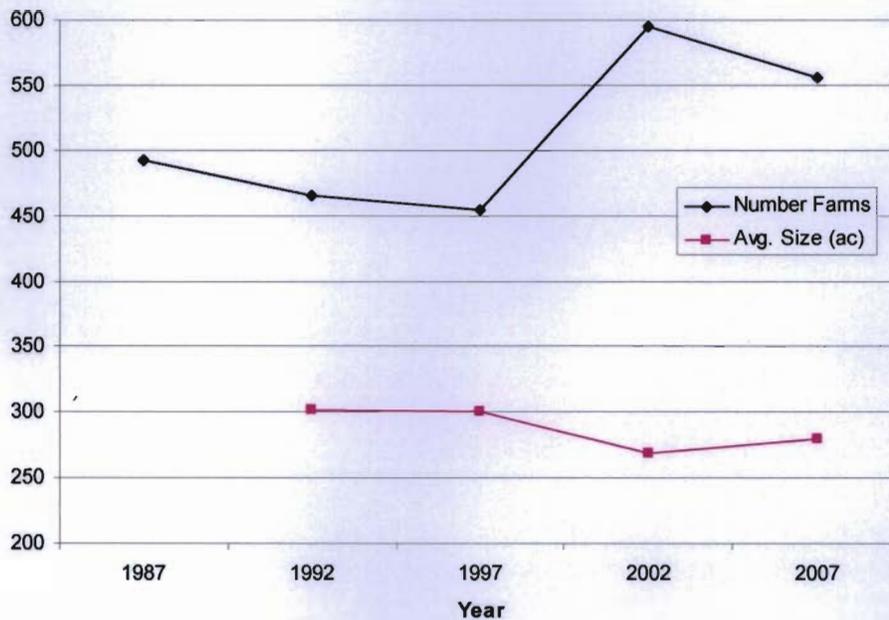


Figure 3. Number of farms and average farm size in Webster County, 1987-2007.

Construction of residences in Webster County increased by 11% from 1990 to 2000 (note 2010 census data is not yet available) while the population increased by 10.7% (USCB, 1990 & 2000). Assuming that the Review Area population follows the county trend of recent population decrease (-3.7% from 2000-2010; USCB, 2010) and housing construction and population growth remain tightly coupled, residential development is likely to continue at a slow pace in the review area. Soil data for the Review Area indicate this development will be constrained to areas outside of much of the Impact Area, as most soils within are moderately, to very, limited for construction by flooding and shallow saturation zones (NRCS, 2010). Further, it is expected that any development, which may occur, will do so around established communities outside the Review Area. Commercial development faces the same constraints due to flood-prone soils and shallow zones of saturation and is likely restricted to the same areas where residential development is expected to occur. Based on physical limitations, loss of population, and the lack of historical and current commercial development within the Review Area, future commercial development is likely negligible.

The current project will impact 0.292 acres of wetland, representing 0.1% of the total wetland area in the Review Area. The loss of wetland associated with the project plus current estimated background loss rates do not exceed historic losses. In this case, project impacts will be offset by restoration activities in the Green River watershed by the Kentucky Department for Fish & Wildlife Resources carried out through their in-lieu fee program. Cumulative impacts on wetlands therefore are expected to be minor, elevated above negligible by temporal loss of wetland function between project construction and mitigation activities.

The proposed project will remove approximately 32 acres of forest cover in the Review Area, but most of this will be re-established during stream and forested wetland

mitigation/restoration activities, and reclamation of the mine support facilities area. Low levels of forest loss with concurrent gains as well as low levels of projected development suggest minor future forest conversion. No net loss of forest should occur as a result of the proposed project. Overall forest acreage and ecological function is expected to remain near current levels during the review period; cumulative impacts on ecological systems of concern are therefore expected to be minor.

Historically, agricultural lands in the Review Area have been protected. Agriculture is not expected to expand significantly during the review period. Some farmland may be converted to residential land near urban centers, but these are outside the Review Area. Since all of the Review Area is rural, development of existing farmland is expected to be minor. Since mining in this area is predominantly an underground activity, impacts to areas currently in crop production will be negligible. In regard to the surface disturbance associated with underground mines, stockpiling of prime farmland top soils and restoration of these areas to pre-mining production levels are required by Kentucky reclamation regulations (405 KAR 16:020; 16:040; 16:200). The Doc Cole site has approximately 34 acres currently used for agricultural purposes; this equates to a 0.6% loss in agricultural lands in the Review Area during the review period.

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Alternatives  
Analysis

## ALTERNATIVES ANALYSIS

### I. INTRODUCTION

The purpose of the proposed Dock-Cole underground mine is to recover coal from properties owned and/or leased by Carbonado Coal Mining, LLC and sell this resource to local and regional utilities. The proposed action is needed to meet the energy demands of the United States, as well as to stimulate the local economy. Carbonado Coal must do this in a manner that returns a reasonable profit on investments in land and mineral rights, site development, infrastructure, and equipment while being environmentally responsible and complying with regulatory requirements. Clean Water Act Section 404(b)(1) requires that all reasonable alternatives be considered for projects that impact Jurisdictional Waters of the United States. As discussed in federal guidelines established for this regulation (45 FR 85344), an alternative is considered practicable if it may be implemented considering environmental impact, cost, existing technology, and logistics as they relate to the project's purpose. An alternative is considered reasonable if it is practicable and feasible from a common sense technical or economic standpoint. This document will demonstrate there are no practical offsite options for mine site development, the selected mining method is the only one practicable for the proposed mine site, and that the preferred mine configuration is the most reasonable choice.

### II. ALTERNATIVES CONSIDERED BUT EXCLUDED

#### ***Alternate Sites***

Prior to mine plan development, significant resources were allocated to evaluate locating the facility in an area where discharge of dredged or fill material into jurisdictional Waters of the United States would be minimal. Alternates other than the proposed permit area were rejected as they would impact prime and potential prime farmland to the south, east, and west, or impact intact forest stands to the north. Most of these are low-lying areas likely to contain jurisdictional wetlands hydrologically connected to the Deer Creek and its extensive floodplain wetland complex. Geologic Investigations indicate there are no other areas in the immediate vicinity that can be effectively mined utilizing current technology. The search for additional sites was further hampered by the lack of available property and mineral rights.

Benefits: Meets project plan and purpose.

Criteria for Exclusion: Similar impacts to areas of greater value in terms of prime farmland, wetland and stream quality, and ecological quality; lack of available property and mineral rights.

## Surface Mining

Geological investigations reveal the seam to be mined is approximately 100' deep on the north (within Study Area) end and dips a grade of greater than 7% to approximately 900' deep at the southern permit boundary. Ratios of overburden to coal would exceed 25:1 within the first 400 feet of mining, rendering surface mining much to expensive to be practical. Additionally, surface mining the southern portion of the proposed permit area would greatly increase potential impacts to active farms on prime farmland soils.

Table 1. Potential Impacts to Streams from Surface Mining

Stream Type	Mean RBP Score	Mean Conductivity ( $\mu$ S)	Location	Impact Length (ft)
Ephemeral	96	76	Study Area	2,241
Intermittent	116	483	Study Area	2,730
Ephemeral	N/A	N/A	Added Area	7,634
Intermittent	N/A	N/A	Added Area	14,770
Perennial	N/A	N/A	Added Area	3,809

**Total Impact** Ephemeral: 9,875 ft  
 Intermittent: 17,500 ft  
 Perennial: 3,809 ft

Table 2. Potential Impacts to Wetlands from Surface Mining

Wetland	Cowardin Classification	Source	Affected Area (ac)
A	PFO1B	Onsite Delineations	0.210
B*	PEM1B	Onsite Delineations	0.040
C	PEM1B	Onsite Delineations	0.042
NW11	PUBHh	NWI	0.688
NW12	PUBFx	NWI	0.307
NW13	PUBHh	NWI	0.757
AP1	PSS/PEM	2010 NAIP Imagery	~0.3
AP2	PSS	2010 NAIP Imagery	~0.3
AP3	PSS/PEM	2010 NAIP Imagery	~0.4

**Total Impact: 3.044 ac**

\*Wetland B appears to be an isolated (non-jurisdictional) water

**Benefits:** Meets project plan and purpose. Mitigation will restore streams adversely impacted by agriculture within impact watershed.

Criteria for Exclusion: Local geology prevents economic removal of coal by surface mining; represents much larger impact to jurisdictional Waters of the United States, impacts larger areas of active farmland. Will require a significant mitigation effort.

### ***No-Action (No Impact) Alternative***

The no-action alternative for the project does not meet the purpose and need of the project, namely allowing Carbonado Coal to recover coal at the project site and deliver it to the marketplace, thereby satisfying future energy needs and stimulating the local economy. Additionally, this alternative would impose an undue financial burden to the coal company, given the capital investment of approximately \$22.6 million involved in site development and obtaining coal mining rights in the area. The local economy would be adversely impacted by the loss of this investment and revenues from future coal production. Not developing the site would negate creation of 67 hourly and 23 salaried mining positions, 8 administrative positions, and a number of indirect jobs supporting the facility. These jobs represent employment of an additional 1.5% of the civilian labor force, which would be highly beneficial in a county with 7% unemployment as of April 2011 (Federal Reserve Bank of St. Louis, 2011). Potential revenues lost to the state and county are an estimated \$4.9 million in annually payroll and property taxes, and \$1.7 million in annual coal severance taxes over the 20-year operational life of the mine. Assuming a yield of 2,260 kWh per ton for coal from the site, this option represents a loss of approximately 1.8 billion kWh of energy from the 784,056 tons of coal expected to be recovered.

Benefits: Results in zero impact to jurisdictional Waters of the United States

Criteria for Exclusion: Does not meet project plan and purpose; represents significant financial loss for county and state governments; significant loss of local jobs and local economy stimulation; loss of large amount of energy for regional power grid; financially devastating for Carbonado Coal given capital investment in site.

### ***Underground Mining***

Core drilling of the proposed project area indicates underlying geology will support underground mining. The coal seam ranges dips from 100' deep in the northern portion of the permit area (proposed surface disturbance area) to approximately 900' deep in the southern portion. Although the coal dips steeply at 7% or greater, there is enough competent roof support to exceed Kentucky DNR, OSM, and MSHA safety regulations. The large amount of overburden is likely to prevent subsidence problems on the surface (e.g. dewatering of streams and wetlands)

Further, with the great amount of overburden in the southern portion of the permit area, underground mining is the only method available using current technology that will generate acceptable coal recovery ratios. The shallow coal depth in the north prevents utilizing underground methods due to roof instability, but allows this area to be used for surface support facilities once coal has been extracted. Thus, no additional surface areas will be disturbed for mine management, coal stockpile, parking areas, and the like.

By utilizing underground methods exclusively in the south, the mine will avoid disturbing significant additional Waters of the United States (compare Tables 1 & 3, 2 & 4; see Exhibit 1). These areas have been identified from USFWS National Wetlands Inventory data, USGS topographic maps, and NRCS 2010 aerial photography by methods identified in the U.S. Army Corps of Engineers *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region*. Underground mining would avoid impacts to (conservatively) 1,634 feet of ephemeral stream, 14,770 feet of intermittent stream, 3,808 feet of perennial stream, 3 NWI wetlands totaling 1.752 acres, and three likely wetland areas covering approximately one acre. Additionally, underground mining the southern permit area will avoid impacting more than 240 acres of active agricultural land, much of it on designated prime farmland soil. These areas would be avoided while effectively and safely extracting the mineral resource below.

Table 3. Impacts to Streams from Underground Mining

Stream	Habitat Score	Conductivity (μS)	Stream Type	Length (ft)
INT-1	95	1236.0	Intermittent	417
INT-2	119	146.0	Intermittent	1775
INT-3	134	82.9	Intermittent	538
E-1	87	----	Ephemeral	294
E-2	91	----	Ephemeral	247
E-3	89	----	Ephemeral	685
E-4	122	71.8	Ephemeral	214
E-5	91	67.3	Ephemeral	297
E-6	98	94.4	Ephemeral	177
E-7	96	69.9	Ephemeral	219
E-8	96	----	Ephemeral	108

**Total Impact Ephemeral: 2,241 ft  
Intermittent: 2730 ft**

Table 4. Impacts to Wetlands from Underground Mining

Wetland	Cowardin Classification	Affected Area (ac)
A	PFO1B	0.210
B*	PEM1B	0.040
C	PEM1B	0.042

**Total Impact: 0.292 ac**

\*Wetland B appears to be an isolated (non-jurisdictional) water

Benefits: Meets project plan and purpose, allowing extraction of coal on the Dock-Cole Site. Mine will produce 1.8 billion kWh of energy for the regional power grid, and will create 98 high-paying jobs. Will produce \$4.9 million in annually payroll and property taxes, and \$1.7 million in annual coal severance taxes over the 20-year operational life of the mine. Avoids impact to significant amount of aquatic resources. Avoids impacting 250 acres of actively farmed land, much of which is designated prime farmland. Impacts small enough for application of in-lieu fee, payment of which will provide monies to state resource agencies to restore priority streams, likely within the Green River watershed.

Criteria for Exclusion: Disturbance of land surface and impacts to aquatic resources.

### III. PREFERRED ALTERNATIVE AND CONCLUSION

Underground mining is the most practical alternate considered for a number of reasons. The proposed site also was available for purchase, and the geology underlying the site makes the method economically viable. All surface and mineral rights have been procured, and the area currently being permitted by KY. This alternative incurs the lowest capital expenditure and has the least potential impact on the area since no haul roads will be built. The local road system is of adequate design to safely support the volume of coal truck traffic necessary to service the mining operation.

The preferred alternate will provide recovery of nearly 1.8 billion kWh of energy from the 784,056 tons of coal to be extracted. The mine will also provide significant economic benefits to the region by supplying the area with continuing capital investment, creation of 98 high-wage jobs, and business with local industry (local preparation plant, local electric utilities). Additionally, the state and county will receive approximately \$4.9 million in annual payroll and property taxes, and \$1.7 million in annual coal severance taxes over the 20-year operational life of the facility.

There will be significant impact to streams within the northern portion of project area, but baseline studies have shown these to be relatively low-quality streams, with impaired ecological function (low RBP score, elevated conductivity). Wetland impact is minimal compared with local forested wetland complexes in the watershed. Temporal loss of some local ecological and hydrological function is anticipated, most likely disruption of natural drainage patterns and groundwater discharge/recharge. However, payment of an in-lieu fee will provide government resource agencies with monies to apply to restoration of priority waters in the Green River watershed. Thus, temporal loss of ecological function from on-site wetlands and streams, are small compared to the potential gain from restoration of function to local aquatic resources.

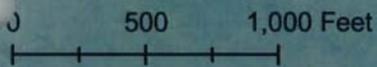
As previously discussed, application of alternate mining methods are not supported by local geology, and would result in significantly greater impacts to aquatic resources. The No-Action Alternate does not meet the purpose and need of the project. After evaluating alternate sites, mining methods, and on-site alternates, the applicant has chosen to proceed with underground mining as the Preferred Alternate at the Dock-Cole site.



-  Int. Stream Delineated
-  Eph. Stream Delineated
-  Int. Stream from Topo
-  Per. Stream from Topo
-  Delineated Wetland
-  NWI Wetland
-  Potential Wetland from Aerial

Surface Disturbance Area

Underground Mining Area



**Threatened &  
Endangered  
Species Habitat**

## THREATENED AND ENDANGERED SPECIES HABITAT ASSESSMENT

The federally endangered Indiana bat (*Myotis sodalis*) has the potential to occur in Webster County, Kentucky (USFWS 2008). The Kentucky Fish and Wildlife Information System does not have any recorded Indiana bat observations for Webster County (KDFWR 2011), and there are no Priority 1-4 caves listed in the Indiana bat's Recovery Plan for the county (USFWS 2007). Based on the available information, no "known habitat" occurs in the study area or within a 10-mile radius.

Potential summer roosting and foraging habitats exist on the proposed mine site. The site is composed of approximately 32 acres of second-growth or younger forest. Much of the project area was surface-mined in the past, but the current land use is pastureland, forest, wetlands and ponds. A summer survey for Indiana bat presence has not been conducted.



Left photo is forested section of project area. Dominant tree species on site consist of red maple, sycamore, tulip-poplar, shagbark hickory, white oak, cherrybark oak, winged elm, and flowering dogwood. Right photo is a standing snag in a section of property that has been logged in the last few years.

Due to the potential for caves, rockshelters, and abandoned mine shafts to be present onsite, site visits by T.H.E. Engineers, Inc. during January and February 2011 evaluated the site for potential Indiana bat winter habitat.

Hibernation site requirements for the Indiana bat include caves and mines with large volumes, extensive passages, and stable temperatures below 10 degrees Celsius (USFWS 2007). The Sebree USGS topographic quadrangle does not show any cave or mine adit symbols within the project boundary; however, the geologic quadrangle shows a symbol for an abandoned vertical shaft along an ephemeral stream, E-3. An opening in the rock was found near this symbol (see Exhibit) and a Phase I Habitat Assessment Data Sheet was filled out. The opening, approximately three feet tall by eight feet wide was not a vertical shaft and appeared to be a natural rockhouse but could be one of the Ortiz small-scale underground mines where the Nos. 9 and 8b coalbeds were mined for local use (Hansen, 1975). The observed length of the opening was approximately thirty feet and no airflow was detected.



Rockhouse or filled in mine entrance in hillside near stream



Inside rockhouse/mine which extends an estimated 30 feet from the front to back of opening

The geology of the project area is composed of loess and sandstone, shale, limestone, coal, and underclay from the Carbondale Formation (Hansen, 1975). Symbols for two caved adits are also shown on the geologic map. The hillside where the symbols are depicted were canvassed for signs of old mine adits or openings. Other than a trash dump, the visual survey revealed no openings.

A sinkhole-like depression within the project area contained some rock outcrops and two small holes being used by mammals (tracks were observed in snow at entrance).



Sinkhole / depression with rock outcrops and 2 small openings

The two openings are approximately ten feet apart and are likely connected. The narrow space is probably used by animals other than bats. A Phase I Habitat Assessment Data Sheet was filled out for the main opening (see "Small Opening" on exhibit). The opening extends into the hillside for an estimated ten feet but the left side may extend further and connect with the other opening ten feet away. It appears unlikely that the hole extends for 100 feet in any direction.



Small opening in hillside with animal tracks at entrance



Same opening at a later date



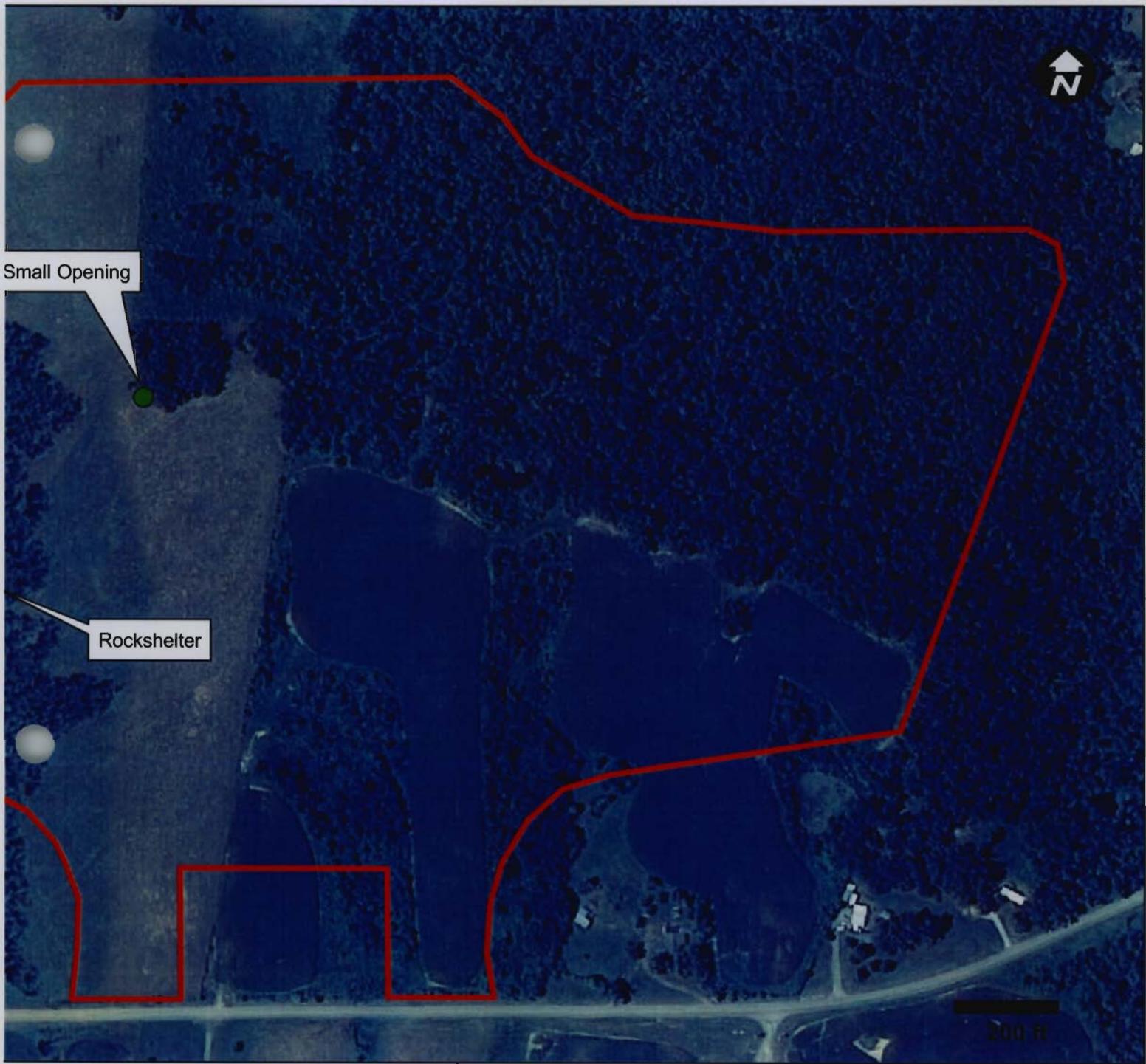
Second opening in depression

The Kentucky Surface Mining Viewer (2011) and Available Mine Maps from the Kentucky Mine Mapping Initiative (2011) were accessed for locations of mine shafts and active and closed permits. Both databases show the aforementioned mine shaft and cite the geologic map as the source. No caves, underground mines, or potential winter habitat for the Indiana bat were found on the project site.

The USFWS species database (2008) lists the federally endangered fanshell (*Cyprogenia stegaria*) as having the potential to occur in Webster County. The fanshell occurs in the upper Green River, and the preferred habitat is medium-sized to large rivers in sand and gravel (Cicerello and Schuster, 2003). No suitable habitat for this mussel is located within the project area.

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- U.S. Fish and Wildlife Service and Kentucky Department of Fish and Wildlife Resources. 2010. Indiana Bat Survey Guidance for Kentucky. Frankfort, KY.



Cole Mine		Potential <i>Myotis sodalis</i> Winter Habitat	
r	STATE: KY	NEAR: Ortiz	

## Appendix 2. Phase I Habitat Assessment Sample Data Sheet

Location: Webster Co., KY near Ortiz off KY 132

Observers: Julie Clark, Rick Heil

Latitude, Longitude: WP 33 N 33° 37' 18.6" W 87° 37' 25.1"

Date: 1/26/11 Time: 9:45 AM Temperature (outside): 28°

	Portal #1	Portal #2	Portal #3	Portal #4
Opening (cave, quarry, shaft, or adit)	cave/rock shelter			
Opening Size: Height x Width (or Diameter)	3' x 8"			
Internal Dimensions: Height x Width	2' x 10'-15' on average			
Slope (up or down from entrance)	down			
Entrance Stable?	Yes			
Direction of Airflow (In or out?)	no airflow			
Amount of Airflow (e.g., none, slight, heavy)	none			
Air warmer or cooler than outside temp.	warmer			
Evidence of collapse?	ceiling somewhat crumbly			
Ceiling Condition	Fairly stable but sandstone/mudstone crumbly			
Amount of water in opening	—			
Evidence of past flooding?	No			
Observed length of portal	~ 30'			
Distance to nearest water source	~ 10' from ephemeral stream			
% Canopy Cover at portal entrance	~ 80%			
Foraging Signs? (e.g., moth wings)	No			

Are any portals suspected or known to be connected? Which ones? No

Any observable side passages? No

Additional comments: Not sure if floor is fill material or natural

**Entry of abandoned mine portals, quarries, or caves can be extremely dangerous because of the potential for ceiling collapse and presence of toxic gases. Safety or health problems may occur as a result of entering abandoned mines. The USFWS does not authorize or require anyone to enter any potential hibernaculum that is or could be unsafe while implementing surveys. In some cases, entry is prohibited by the Kentucky Department of Mines and Minerals (KRS 352.100) and Mine Safety and Health Administration (30 CFR 75.202(b)). These guidelines do not require any applicant or applicant employee, consultant, lessee, or other such designee to enter into any cave, quarry, or mine portal**

## Appendix 2. Phase I Habitat Assessment Sample Data Sheet

Location: Webster Co., KY near Ortiz off KY 132

Observers: Julie Clark, Rick Heil

Latitude, Longitude: N37° 33' 20.4" W87° 37' 21.0"

Date: 2/16/11 Time: 11:50 AM Temperature (outside): 63°

	Portal #1	Portal #2	Portal #3	Portal #4
Opening (cave, quarry, shaft, or adit)	Cave/rockhouse			
Opening Size: Height x Width (or Diameter)	18" W x 8" H			
Internal Dimensions: Height x Width	~18" x 10'			
Slope (up or down from entrance)	down			
Entrance Stable?	yes			
Direction of Airflow (In or out?)	probably in			
Amount of Airflow (e.g., none, slight, heavy)	slight			
Air warmer or cooler than outside temp.	cooler			
Evidence of collapse?	no			
Ceiling Condition	stable			
Amount of water in opening	none			
Evidence of past flooding?	muddy floor			
Observed length of portal	~10' but can't tell where left side goes			
Distance to nearest water source	intermittent stream (Int-1)			
% Canopy Cover at portal entrance	100%			
Foraging Signs? (e.g., moth wings)	No			

Are any portals suspected or known to be connected? Which ones?

Any observable side passages?

Additional comments:

A good chance the passage connects to passage of another small hole ~15' away. Passage does not appear extensive - probably just the extent of passage between the 2 openings. Animals use this - footprints were observed in snow on 1/26/11.

**Entry of abandoned mine portals, quarries, or caves can be extremely dangerous because of the potential for ceiling collapse and presence of toxic gases. Safety or health problems may occur as a result of entering abandoned mines. The USFWS does not authorize or require anyone to enter any potential hibernaculum that is or could be unsafe while implementing surveys. In some cases, entry is prohibited by the Kentucky Department of Mines and Minerals (KRS 352.100) and Mine Safety and Health Administration (30 CFR 75.202(b)). These guidelines do not require any applicant or applicant employee, consultant, lessee, or other such designee to enter into any cave, quarry, or mine portal**

JD Forms

## Jurisdictional Determinations

Preliminary Jurisdictional Determination

Jurisdictional Determination Form for Pond 1/Wetland B

**ATTACHMENT**

**PRELIMINARY JURISDICTIONAL DETERMINATION FORM**

**BACKGROUND INFORMATION** For Doc Cole Mine Site

**A. REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD):**

**B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:** David Lamb, P.E.; Associated Engineers, Inc., 2740 North Main Street, Madisonville, KY 42431

**C. DISTRICT OFFICE, FILE NAME, AND NUMBER:**

**D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:  
(USE THE ATTACHED TABLE TO DOCUMENT MULTIPLE WATERBODIES AT DIFFERENT SITES)**

State: Kentucky County/parish/borough: Webster City: Sebree (nearest)  
Center coordinates of site (lat/long in degree decimal format): Lat. 37.555693°N,  
Long. 87.621624°W.

Universal Transverse Mercator: 4156701N 445095E

Name of nearest waterbody: UT to Jackson Ditch.

Identify (estimate) amount of waters in the review area:

Non-wetland waters: 4971 linear feet: width (ft) and/or 0.315 acres

Cowardin Class: N/A

Stream Flow: Ephemeral= 2241', Intermittent= 2730'

Wetlands: 0.252 acres

Cowardin Class: PEM1B, PFO1B

Name of any water bodies on the site that have been identified as Section 10 waters:

Tidal: N/A

Non-Tidal: N/A

**E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):**

Office (Desk) Determination. Date:

Field Determination. Date(s):

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit

applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable.

This preliminary JD finds that there "may be" waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

**SUPPORTING DATA. Data reviewed for preliminary JD (check all that apply -**

checked items should be included in case file and, where checked and requested, appropriately reference sources below):

- Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: .
- Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - Office concurs with data sheets/delineation report.
  - Office does not concur with data sheets/delineation report.
- Data sheets prepared by the Corps:
- Corps navigable waters' study:
- U.S. Geological Survey Hydrologic Atlas:
  - USGS NHD data.
  - USGS 8 and 12 digit HUC maps.
- U.S. Geological Survey map(s). Cite scale & quad name: Sebree, KY  
1:24000.
- USDA Natural Resources Conservation Service Soil Survey. Citation: Webster  
County, 1981.
- National wetlands inventory map(s). Cite name: Sebree NWI.
- State/Local wetland inventory map(s):

- FEMA/FIRM maps: Webster Co. does not participate (no mapping) .
- 100-year Floodplain Elevation is: \_\_\_\_\_ (National Geodetic Vertical Datum of 1929)
- Photographs:  Aerial (Name & Date): Unknown date  
or  Other (Name & Date): Taken during assessments.
- Previous determination(s). File no. and date of response letter:
- Other information (please specify):

**IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.**

\_\_\_\_\_  
Signature and date of  
Regulatory Project Manager  
(REQUIRED)

\_\_\_\_\_  
Signature and date of  
person requesting preliminary JD  
(REQUIRED, unless obtaining the  
signature is impracticable)

DOC COLE SITE

Site number	Latitude	Longitude	Cowardin Class/Flow Regime	Estimated amount of resource in permit area	Class of aquatic resource
INT-1	37.55381	87.62347	Intermittent	417 linear feet	non-section 10 – non-wetland
INT-2	37.55575	87.61806	Intermittent	1775 linear feet	non-section 10 – non-wetland
INT-3	37.55639	87.61922	Intermittent	538 linear feet	non-section 10 – non-wetland
E-1	37.55414	87.62308	Ephemeral	294 linear feet	non-section 10 – non-wetland
E-2	37.55428	87.62325	Ephemeral	247 linear feet	non-section 10 – non-wetland
E-3	37.55534	87.62364	Ephemeral	685 linear feet	non-section 10 – non-wetland
E-4	37.55639	87.61892	Ephemeral	214 linear feet	non-section 10 – non-wetland
E-5	37.55608	87.61847	Ephemeral	297 linear feet	non-section 10 – non-wetland
E-6	37.55342	87.62108	Ephemeral	177 linear feet	non-section 10 – non-wetland
E-7	37.55386	87.61994	Ephemeral	219 linear feet	non-section 10 – non-wetland
E-8	37.55669	87.62144	Ephemeral	108 linear feet	non-section 10 – non-wetland
Wetland A	37.55383	87.62350	PFO1B	0.210 acres	non-section 10 – wetland
Wetland C	37.55703	87.62181	PEM1B	0.042 acres	non-section 10 – wetland

*Final jurisdictional determinations will be made by US Army Corps of Engineers for all impacts.*

**APPROVED JURISDICTIONAL DETERMINATION FORM**  
**U.S. Army Corps of Engineers**

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

**SECTION I: BACKGROUND INFORMATION**

**A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD):**

**B. DISTRICT OFFICE, FILE NAME, AND NUMBER:**

**C. PROJECT LOCATION AND BACKGROUND INFORMATION: JD for Pond 1/Wetland B; Doc Cole Mine Site .**

State: Kentucky County/parish/borough: Webster City: Centertown (nearest)

Center coordinates of site (lat/long in degree decimal format): Lat. 37.55536° N, Long. 87.61986° W.

Universal Transverse Mercator: 4156663N 445250E (Zone 16S)

Name of nearest waterbody: UT to Jackson Ditch

Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows:

Name of watershed or Hydrologic Unit Code (HUC): 051100050103 (Jackson Ditch-Deer Creek)

Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.

Check if other sites (e.g., offsite mitigation sites, disposal sites, etc...) are associated with this action and are recorded on a different JD form.

**D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):**

Office (Desk) Determination. Date:

Field Determination. Date(s): 2/16/11

**SECTION II: SUMMARY OF FINDINGS**

**A. RHA SECTION 10 DETERMINATION OF JURISDICTION.**

There **Are no** "navigable waters of the U.S." within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [Required]

Waters subject to the ebb and flow of the tide.

Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.

Explain:

**B. CWA SECTION 404 DETERMINATION OF JURISDICTION.**

There **Are no** "waters of the U.S." within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [Required]

**1. Waters of the U.S.**

**a. Indicate presence of waters of U.S. in review area (check all that apply):<sup>1</sup>**

- TNWs, including territorial seas
- Wetlands adjacent to TNWs
- Relatively permanent waters<sup>2</sup> (RPWs) that flow directly or indirectly into TNWs
- Non-RPWs that flow directly or indirectly into TNWs
- Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
- Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
- Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
- Impoundments of jurisdictional waters
- Isolated (interstate or intrastate) waters, including isolated wetlands

**b. Identify (estimate) size of waters of the U.S. in the review area:**

Non-wetland waters: linear feet: width (ft) and/or 0.085 (open waters) acres.

Wetlands: 0.040 acres.

**c. Limits (boundaries) of jurisdiction based on: **Not Applicable.****

Elevation of established OHWM (if known):

**2. Non-regulated waters/wetlands (check if applicable):<sup>3</sup>**

Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional.

Explain: **Pond 1 found to be isolated, with no connectivity with downstream waters. Wetland B, a fringe wetland around the pond, is therefore found not to have connectivity as well and isolated.**

<sup>1</sup> Boxes checked below shall be supported by completing the appropriate sections in Section III below.

<sup>2</sup> For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).

<sup>3</sup> Supporting documentation is presented in Section III.F.

**SECTION III: CWA ANALYSIS**

**A. TNWs AND WETLANDS ADJACENT TO TNWs**

The agencies will assert jurisdiction over TNWs and wetlands adjacent to TNWs. If the aquatic resource is a TNW, complete Section III.A.1 and Section III.D.1. only; if the aquatic resource is a wetland adjacent to a TNW, complete Sections III.A.1 and 2 and Section III.D.1.; otherwise, see Section III.B below.

- 1. **TNW**  
Identify TNW: .  
  
Summarize rationale supporting determination: .
- 2. **Wetland adjacent to TNW**  
Summarize rationale supporting conclusion that wetland is "adjacent": .

**B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):**

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are "relatively permanent waters" (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody<sup>4</sup> is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite. The determination whether a significant nexus exists is determined in Section III.C below.

**1. Characteristics of non-TNWs that flow directly or indirectly into TNW**

- (i) **General Area Conditions:**  
Watershed size: **Pick List**  
Drainage area: **Pick List**  
Average annual rainfall: inches  
Average annual snowfall: inches

- (ii) **Physical Characteristics:**
  - (a) **Relationship with TNW:**
    - Tributary flows directly into TNW.
    - Tributary flows through **Pick List** tributaries before entering TNW.
  - Project waters are **Pick List** river miles from TNW.
  - Project waters are **Pick List** river miles from RPW.
  - Project waters are **Pick List** aerial (straight) miles from TNW.
  - Project waters are **Pick List** aerial (straight) miles from RPW.
  - Project waters cross or serve as state boundaries. Explain: .

Identify flow route to TNW<sup>5</sup>: .  
Tributary stream order, if known: .

<sup>4</sup> Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.

<sup>5</sup> Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.

(b) General Tributary Characteristics (check all that apply):

- Tributary is:  Natural  
 Artificial (man-made). Explain: \_\_\_\_\_  
 Manipulated (man-altered). Explain: \_\_\_\_\_

**Tributary properties with respect to top of bank (estimate):**

Average width: \_\_\_\_\_ feet  
Average depth: \_\_\_\_\_ feet  
Average side slopes: **Pick List**.

**Primary tributary substrate composition (check all that apply):**

- |  |  |                                   |
|--|--|-----------------------------------|
| <input type="checkbox"/> Silts                 | <input type="checkbox"/> Sands                           | <input type="checkbox"/> Concrete |
| <input type="checkbox"/> Cobbles               | <input type="checkbox"/> Gravel                          | <input type="checkbox"/> Muck     |
| <input type="checkbox"/> Bedrock               | <input type="checkbox"/> Vegetation. Type/% cover: _____ |                                   |
| <input type="checkbox"/> Other. Explain: _____ |  |                                   |

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: \_\_\_\_\_

Presence of run/riffle/pool complexes. Explain: \_\_\_\_\_

Tributary geometry: **Pick List**

Tributary gradient (approximate average slope): \_\_\_\_\_ %

(c) Flow:

Tributary provides for: **Pick List**

Estimate average number of flow events in review area/year: **Pick List**

Describe flow regime: \_\_\_\_\_

Other information on duration and volume: \_\_\_\_\_

Surface flow is: **Pick List**. Characteristics: \_\_\_\_\_

Subsurface flow: **Pick List**. Explain findings: \_\_\_\_\_

Dye (or other) test performed: \_\_\_\_\_

Tributary has (check all that apply):

- |   |   |
|---|---|
| <input type="checkbox"/> Bed and banks  |   |
| <input type="checkbox"/> OHWM <sup>6</sup> (check all indicators that apply): |   |
| <input type="checkbox"/> clear, natural line impressed on the bank            | <input type="checkbox"/> the presence of litter and debris          |
| <input type="checkbox"/> changes in the character of soil                     | <input type="checkbox"/> destruction of terrestrial vegetation      |
| <input type="checkbox"/> shelving   | <input type="checkbox"/> the presence of wrack line                 |
| <input type="checkbox"/> vegetation matted down, bent, or absent              | <input type="checkbox"/> sediment sorting                           |
| <input type="checkbox"/> leaf litter disturbed or washed away                 | <input type="checkbox"/> scour                                      |
| <input type="checkbox"/> sediment deposition                                  | <input type="checkbox"/> multiple observed or predicted flow events |
| <input type="checkbox"/> water staining                                       | <input type="checkbox"/> abrupt change in plant community           |
| <input type="checkbox"/> other (list): _____                                  |   |
| <input type="checkbox"/> Discontinuous OHWM. <sup>7</sup> Explain: _____      |   |

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):

- |  |  |
|--|--|
| <input type="checkbox"/> High Tide Line indicated by:              | <input type="checkbox"/> Mean High Water Mark indicated by:            |
| <input type="checkbox"/> oil or scum line along shore objects      | <input type="checkbox"/> survey to available datum;                    |
| <input type="checkbox"/> fine shell or debris deposits (foreshore) | <input type="checkbox"/> physical markings;                            |
| <input type="checkbox"/> physical markings/characteristics         | <input type="checkbox"/> vegetation lines/changes in vegetation types. |
| <input type="checkbox"/> tidal gauges                              |  |
| <input type="checkbox"/> other (list): _____                       |  |

(iii) **Chemical Characteristics:**

Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.).

Explain: \_\_\_\_\_

Identify specific pollutants, if known: \_\_\_\_\_

<sup>6</sup>A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.

<sup>7</sup>Ibid.

(iv) **Biological Characteristics. Channel supports (check all that apply):**

- Riparian corridor. Characteristics (type, average width):
- Wetland fringe. Characteristics:
- Habitat for:
  - Federally Listed species. Explain findings:
  - Fish/spawn areas. Explain findings:
  - Other environmentally-sensitive species. Explain findings:
  - Aquatic/wildlife diversity. Explain findings:

2. **Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW**

(i) **Physical Characteristics:**

(a) General Wetland Characteristics:

Properties:

Wetland size:        acres

Wetland type. Explain:

Wetland quality. Explain:

Project wetlands cross or serve as state boundaries. Explain:

(b) General Flow Relationship with Non-TNW:

Flow is: **Pick List**. Explain:

Surface flow is: **Pick List**

Characteristics:

Subsurface flow: **Pick List**. Explain findings:

Dye (or other) test performed:

(c) Wetland Adjacency Determination with Non-TNW:

Directly abutting

Not directly abutting

Discrete wetland hydrologic connection. Explain:

Ecological connection. Explain:

Separated by berm/barrier. Explain:

(d) Proximity (Relationship) to TNW

Project wetlands are **Pick List** river miles from TNW.

Project waters are **Pick List** aerial (straight) miles from TNW.

Flow is from: **Pick List**.

Estimate approximate location of wetland as within the **Pick List** floodplain.

(ii) **Chemical Characteristics:**

Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed characteristics; etc.). Explain:

Identify specific pollutants, if known:

(iii) **Biological Characteristics. Wetland supports (check all that apply):**

- Riparian buffer. Characteristics (type, average width):
- Vegetation type/percent cover. Explain:
- Habitat for:
  - Federally Listed species. Explain findings:
  - Fish/spawn areas. Explain findings:
  - Other environmentally-sensitive species. Explain findings:
  - Aquatic/wildlife diversity. Explain findings:

3. **Characteristics of all wetlands adjacent to the tributary (if any)**

All wetland(s) being considered in the cumulative analysis: **Pick List**

Approximately (        ) acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

Directly abuts? (Y/N)

Size (in acres)

Directly abuts? (Y/N)

Size (in acres)

Summarize overall biological, chemical and physical functions being performed:

### C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

**Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:**

1. **Significant nexus findings for non-RPW that has no adjacent wetlands and flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary itself, then go to Section III.D:
2. **Significant nexus findings for non-RPW and its adjacent wetlands, where the non-RPW flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D:
3. **Significant nexus findings for wetlands adjacent to an RPW but that do not directly abut the RPW.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D:

### D. DETERMINATIONS OF JURISDICTIONAL FINDINGS. THE SUBJECT WATERS/WETLANDS ARE (CHECK ALL THAT APPLY):

1. **TNWs and Adjacent Wetlands.** Check all that apply and provide size estimates in review area:  
 TNWs: linear feet width (ft), Or, acres.  
 Wetlands adjacent to TNWs: acres.
2. **RPWs that flow directly or indirectly into TNWs.**  
 Tributaries of TNWs where tributaries typically flow year-round are jurisdictional. Provide data and rationale indicating that tributary is perennial:  
 Tributaries of TNW where tributaries have continuous flow "seasonally" (e.g., typically three months each year) are jurisdictional. Data supporting this conclusion is provided at Section III.B. Provide rationale indicating that tributary flows seasonally:

Provide estimates for jurisdictional waters in the review area (check all that apply):

- Tributary waters: linear feet width (ft).  
 Other non-wetland waters: acres.  
Identify type(s) of waters: .

**3. Non-RPWs<sup>8</sup> that flow directly or indirectly into TNWs.**

- Waterbody that is not a TNW or an RPW, but flows directly or indirectly into a TNW, and it has a significant nexus with a TNW is jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional waters within the review area (check all that apply):

- Tributary waters: linear feet width (ft).  
 Other non-wetland waters: acres.  
Identify type(s) of waters: .

**4. Wetlands directly abutting an RPW that flow directly or indirectly into TNWs.**

- Wetlands directly abut RPW and thus are jurisdictional as adjacent wetlands.  
 Wetlands directly abutting an RPW where tributaries typically flow year-round. Provide data and rationale indicating that tributary is perennial in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: .  
 Wetlands directly abutting an RPW where tributaries typically flow "seasonally." Provide data indicating that tributary is seasonal in Section III.B and rationale in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: .

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

**5. Wetlands adjacent to but not directly abutting an RPW that flow directly or indirectly into TNWs.**

- Wetlands that do not directly abut an RPW, but when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

**6. Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs.**

- Wetlands adjacent to such waters, and have when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional wetlands in the review area: acres.

**7. Impoundments of jurisdictional waters.<sup>9</sup>**

As a general rule, the impoundment of a jurisdictional tributary remains jurisdictional.

- Demonstrate that impoundment was created from "waters of the U.S.," or  
 Demonstrate that water meets the criteria for one of the categories presented above (1-6), or  
 Demonstrate that water is isolated with a nexus to commerce (see E below).

**E. ISOLATED [INTERSTATE OR INTRA-STATE] WATERS, INCLUDING ISOLATED WETLANDS, THE USE, DEGRADATION OR DESTRUCTION OF WHICH COULD AFFECT INTERSTATE COMMERCE, INCLUDING ANY SUCH WATERS (CHECK ALL THAT APPLY):<sup>10</sup>**

- which are or could be used by interstate or foreign travelers for recreational or other purposes.  
 from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.  
 which are or could be used for industrial purposes by industries in interstate commerce.  
 Interstate isolated waters. Explain: .  
 Other factors. Explain: .

**Identify water body and summarize rationale supporting determination:** .

<sup>8</sup>See Footnote # 3.

<sup>9</sup>To complete the analysis refer to the key in Section III.D.6 of the Instructional Guidebook.

<sup>10</sup>Prior to asserting or declining CWA jurisdiction based solely on this category, Corps Districts will elevate the action to Corps and EPA HQ for review consistent with the process described in the Corps/EPA Memorandum Regarding CWA Act Jurisdiction Following Rapanos.

Provide estimates for jurisdictional waters in the review area (check all that apply):

- Tributary waters: linear feet width (ft).
- Other non-wetland waters: acres.  
Identify type(s) of waters: .
- Wetlands: acres.

**F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):**

- If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
- Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
  - Prior to the Jan 2001 Supreme Court decision in "SWANCC," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
- Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: **Pond 1 has no connectivity to downstream waters (no discharge point from impoundment). Wetland B, a fringe around Pond 1, therefore has no connectivity. In addition, the site is 50 to 60 feet above Jackson Ditch and would not be in the 100-year floodplain.**
- Other: (explain, if not covered above): .

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):

- Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
- Lakes/ponds: acres.
- Other non-wetland waters: acres. List type of aquatic resource: .
- Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):

- Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
- Lakes/ponds: 0.085 acres.
- Other non-wetland waters: acres. List type of aquatic resource: .
- Wetlands: 0.040 acres.

**SECTION IV: DATA SOURCES.**

**A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):**

- Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant:
- Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - Office concurs with data sheets/delineation report.
  - Office does not concur with data sheets/delineation report.
- Data sheets prepared by the Corps: .
- Corps navigable waters' study: .
- U.S. Geological Survey Hydrologic Atlas: .
  - USGS NHD data.
  - USGS 8 and 12 digit HUC maps.
- U.S. Geological Survey map(s). Cite scale & quad name: Sebree, 1:20000.
- USDA Natural Resources Conservation Service Soil Survey. Citation: .
- National wetlands inventory map(s). Cite name: .
- State/Local wetland inventory map(s): .
- FEMA/FIRM maps: Webster County is a non-participating community (not mapped).
- 100-year Floodplain Elevation is: (National Geodetic Vertical Datum of 1929)
- Photographs:  Aerial (Name & Date): unknown .  
or  Other (Name & Date): taken during assessments on various dates.
- Previous determination(s). File no. and date of response letter: .
- Applicable/supporting case law: .
- Applicable/supporting scientific literature: .
- Other information (please specify): Field investigation of site on several occasions.

**B. ADDITIONAL COMMENTS TO SUPPORT JD:** A field investigation did not yield evidence of an outlet, or any discharge from Pond 1. Therefore, the pond and associated Wetland B should be considered isolated. In addition, based on the elevation above Jackson Ditch (50 to 60 feet higher), the pond and wetland would not be considered within the 100-year floodplain (although Webster County is not mapped).

Macroinvertebrate  
Study

# **AQUATIC MACROINVERTEBRATE SURVEY REPORT**

**DOC-COLE SITE**  
Webster County, Kentucky  
(KDNR Permit No. 917-5022)

Prepared for:  
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June 5, 2012

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## I. Introduction

The study area lies within the boundary of Carbonado Coal Company permit number 917-5002, located between KY 132 and Starl Shelton Road; this area is approximately 5.2 miles northeast of Dixon, Kentucky, in Webster County (Sebree USGS 7.5 minute topographic quadrangle). The surrounding area is predominately agricultural land interspersed with mixed stands of second or third growth forests. Coal mining and cropping also occur within the region. Local topography consists of gently rolling terrain. Extensive stream relocation and channelization have been practiced throughout this part of Kentucky for decades.

Aquatic communities were sampled in two unnamed first-order intermittent tributaries of Jackson Ditch. Both sample reaches are within the Deer Creek 12-digit HUC, 051100050103, an area of approximately 23 mi<sup>2</sup>. The drainage area above Station DC 5002-01 is 70.6 ac (0.11 mi<sup>2</sup>), and the drainage area above Station DC 5002-02 is 19.5 ac (0.03 mi<sup>2</sup>) (See Exhibits 1 and 2).

## II. Methods

Surveys at the two stations were conducted on May 9, 2012. Stream flow at all stations appeared normal, and no rainfalls greater than 1.0 inches had occurred within the previous two weeks. Methods followed those described in *Methods for Conducting Resource Extraction Intensive Surveys in Non-OSRW Streams of the Western Kentucky Coalfields* (KDOW, 2010). Macroinvertebrates were sampled using the proportional 20-jab method at each reach. Woody debris within pooled areas were picked using tweezers. Reach lengths were approximately 100 meters. Bill Sampson and Rick Heil collected the field data at the sample locations. Jonathan Scheibly performed laboratory sorting of the macroinvertebrate samples, taxonomic identification of the samples, and oversaw quality assurance procedures. Collection was conducted under Kentucky Scientific Collecting Permit SC1211028.

Field processed material from each macroinvertebrate sample was deposited into separate containers and preserved with a solution of 95% ethanol. Upon returning to the laboratory, macroinvertebrate samples were sorted with a dissecting microscope on white background. After processing, all sorted samples were transferred to 70% ethanol solution. Samples were then identified to the lowest practical taxonomic level, using the most current taxonomic references available (listed in References section). After identification, KDOW core metrics

were calculated as described in *Methods for Conducting Resource Extraction Intensive Surveys in Non-OSRW Streams of the Western Kentucky Coalfields* (KDOW, 2010). Core metrics were used to calculate the Kentucky Macroinvertebrate Index of Biotic Integrity (MBI) score as per Pond *et al.* (2003). A voucher collection of macroinvertebrates from each sample will be maintained during the lifetime of the permit. An electronic macroinvertebrate bench sheet was produced during the sample identification process, and the metric calculation was completed with the KDOW MBI Spreadsheet. Field data sheets are presented in Appendices A and B, macroinvertebrate bench sheets are presented in Appendix C, and macroinvertebrate taxa collected and metrics calculated are presented in Table 1.

### **III. Results and Discussion**

Station DC 5001-01 was established within an intermittent, unnamed tributary of Jackson Ditch adjacent to KY 132. The stream has been heavily impacted by agricultural development along nearly its entire length; the majority of the stream flows through an active cattle pasture. Unprotected from the animal access, the riparian zone and substrate have been significantly impacted (See Figure 1), contributing to a Rapid Bioassessment Protocol score of only 82, "Poor" for the MVIR bioregion. Conductivity was elevated, at 642  $\mu\text{S}$ ; dissolved oxygen was low but not unexpectedly so at 8.4 mg/ml, and pH was very low at 3.7. Poor water quality and extremely limited available habitat resulted in collection of only 129 individuals among nine taxa at this station. The MBI was calculated at 8.81, considered "Very Poor" for the bioregion (Table 1).

Station DC 5002-02 also is located in an intermittent, unnamed tributary of Jackson Ditch adjacent to KY 132. However, this stream flows through relatively mature second to third-growth forest, with an intact riparian zone and substrate predominantly composed of cobble and gravel (Figure 2). The RBP score at this station was 127, which is considered "Fair" for the bioregion. Conductivity was 132  $\mu\text{S}$ , quite low for the area; dissolved oxygen and pH were surprisingly low at 8.4 mg/ml 5.9, respectively, suggesting some water quality impact. Three hundred seventy-eight individuals from 21 taxa were collected at this station, yielding a MBI value of 27.90, "Poor" for the bioregion (Table 2).

Table 1. Macroinvertebrates collected and metrics calculated from two unnamed tributaries of Jackson Ditch, Webster County, KY.

**STATION DC 5002-01**

Order	Family	Genus	#Ind	Clinger	ni	ai	ni x ai
Odonata	Libellulidae	<i>Plathemis</i>	1		1	10	10
Coleoptera	Dytiscidae	<i>Agabus</i>	1		1	8.9	8.9
Diptera	Psychodidae	<i>pupa</i>	1		1	10	10
" " "	Culicidae	<i>Culex</i>	1		1	10	10
" " "	Ceratopogonidae	<i>Bezzia</i>	1		1	6.8	6.8
" " "	" " "	<i>Ceratopogon</i>	8		8	6.9	55.2
" " "	Tipulidae	<i>Tipula</i>	1		1	7.3	7.3
" " "	Dolichopodidae	<i>not in key</i>	1		1	5	5
" " "	Chironomidae	-----	114		25	7	175
			129	0	40		288.2

TNI	129	%Ephemeroptera	0
Taxa Richness	0	%Clingers	0
EPT Richness	0	%Chiron + %Oligo	88.37
m% EPT	0	mHBI	7.21
<b>MBI</b>	<b>8.81</b>	<b>Classification</b>	<b>Very Poor</b>

Table 1. *Continued*

## STATION DC 5002-02

Order	Family	Genus	#Ind	Clinger	ni	ai	ni x ai
Basommatophora	Physidae	<i>Physella</i>	100		25	8.84	221.0
Heterodonta	Sphaeriidae	<i>Sphaerium</i>	6		6	7.58	45.5
Haplotaxida	Naididae	----	3		3	9.1	27.3
Ephemeroptera	Baetidae	<i>Centroptilum</i>	1		1	6.6	6.6
" " "	Leptophlebiidae	<i>Leptophlebia</i>	4		4	6.23	24.9
" " "	Heptageniidae	<i>Leucocuta</i>	13	x	13	2.4	31.2
Odonata	Cordulegastridae	<i>Cordulegaster</i>	2		2	5.76	11.5
" " "	Corduliidae	<i>Neurocordulia</i>	1		1	5.03	5.0
Hemiptera	Saldidae	<i>Immature</i>	1		1	NA	0.0
Trichoptera	Phryganeidae	<i>Ptilostomus</i>	2		2	6.37	12.7
" " "	Uenoidae	<i>Neophylax</i>	1	x	1	2.2	2.2
Coleoptera	Elmidae	<i>Stenelmis</i>	1	x	1	5.1	5.1
" " "	Dytiscidae	<i>Agabus</i>	5		5	8.9	44.5
Diptera	Chironomidae	----	24		24	7	168.0
" " "	Ceratopogonidae	<i>Bezzia</i>	1		1	6.9	6.9
" " "	Culicidae	<i>Anopheles</i>	5		5	5.58	27.9
" " "	" " "	<i>Culex</i>	9		9	10	90.0
" " "	Sciomyzidae	<i>Hedria</i>	1		1	6	6.0
Amphipoda	Gammaridae	<i>Gammarus</i>	92		25	8	200.0
Isopoda	Asellidae	<i>Lirceus</i>	105		25	7.85	196.3
Decapoda	Cambaridae	<i>no form 1 males</i>	1		1	6	6.0
			378	3	156		1138.6

TNI	378	%Ephemeroptera	4.76
Taxa Richness	21	%Clingers	3.97
EPT Richness	5	%Chiron + %Oligo	7.14
m% EPT	5.56	mHBI	7.30
<b>MBI</b>	<b>27.90</b>	<b>Classification</b>	<b>Poor</b>



Figure 1. Station DC 5002-01; A-looking downstream along sample reach, B-looking upstream along sample reach.



Figure 2. Station DC 5002-02; A-looking downstream along sample reach, B-looking upstream along sample reach.

#### IV. References

##### METHODS

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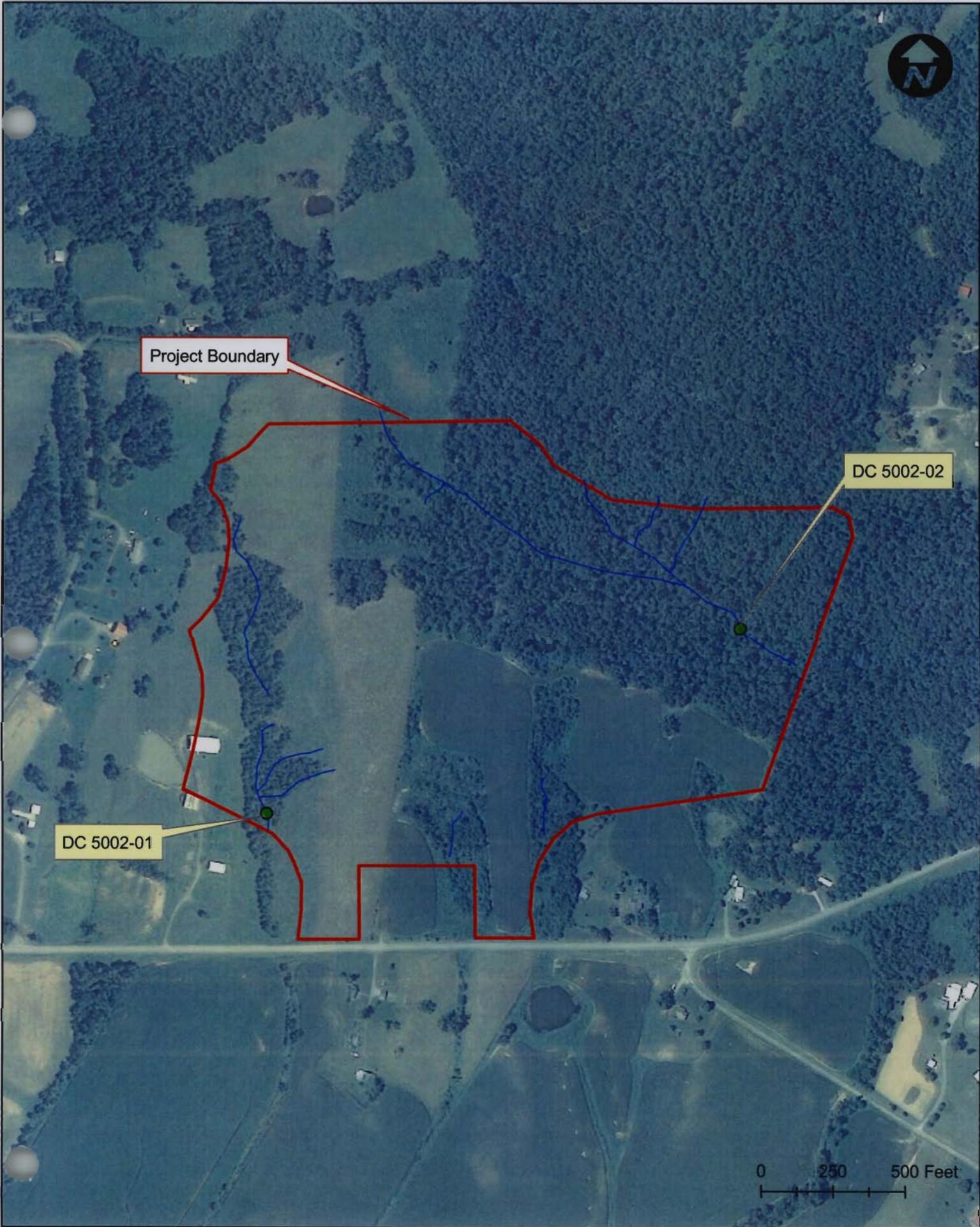
## V. EXHIBITS

Exhibit 1 – USGS Topographic Quadrangle and Survey Locations

Exhibit 2 – Aerial Photo and Survey Locations



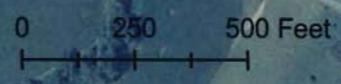
	PROJECT: Doc-Cole Mine		Aquatic Macroinvertebrate Sample Sites over USGS 7.5' Topos	
	COUNTY: Webster	STATE: KY	NEAR: Ortiz	EXHIBIT 1



Project Boundary

DC 5002-02

DC 5002-01



	PROJECT: Doc-Cole Mine		Aquatic Macroinvertebrate Sample Sites over 2010 NAIP Imagery	
	COUNTY: Webster	STATE: KY	NEAR: Ortiz	EXHIBIT 2

**VI. Appendix A - Habitat Assessment Sheets**

Low Gradient Stream Data Sheet

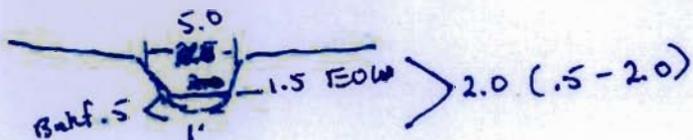
STREAM NAME: <u>Inj-1</u>		LOCATION: <u>Doc Cule</u>		
STATION: <u>WP425</u> DRAINAGE AREA (AC)		BASIN/WATERSHED: <u>Green R./Deer Cr</u>		
LAT: <u>37-33-13.2</u> LONG: <u>87-38-24.3</u>		COUNTY: <u>Webster</u> USGS 7.5 TOPO		
DATE: <u>5-9-12</u> TIME: <u>1:37</u> AM <input type="checkbox"/> PM <input checked="" type="checkbox"/>		INVESTIGATORS: <u>BS, RH</u>		
TYPE SAMPLE <input type="checkbox"/> P-CHEM <input type="checkbox"/> Macroinvertebrate <input type="checkbox"/> FISH <input type="checkbox"/> BACT				
WEATHER: Now <input type="checkbox"/> Past 24 hours <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input type="checkbox"/> Clear/sunny/overcast <input checked="" type="checkbox"/>				
Has there been a heavy rain in the last 7 days? <u>.74"</u> Appr. Air Temp <u>68</u> °F Inches rainfall in past 24 hours <u>.1</u> in <u>15</u> % Cloud Cover				
P-Chem: Temp (°F) <u>60.6</u> DO (mg/l) <u>8.2</u> % Saturation _____ pH(S.U.) <u>3.7</u> Cond <u>642</u> <input type="checkbox"/> Grab				
INSTREAM WATERSHED FEATURES (at time of assessment): Stream Width EOW <u>6.4</u> ft Stream Width BF <u>2.5</u> ft Stream Bottom Width <u>2.5</u> ft Avg Bankfull Depth <u>1.5</u> ft Avg H <sub>2</sub> O Depth Riffle <u>1.5</u> ft		LOCAL WATERSHED FEATURES: Predominant Surrounding Land Use: <input type="checkbox"/> Surface Mining <input type="checkbox"/> Construction <input type="checkbox"/> Forest <input type="checkbox"/> Deep Mining <input type="checkbox"/> Commercial <input checked="" type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Oil Wells <input type="checkbox"/> Industrial <input type="checkbox"/> Silviculture <input type="checkbox"/> Land Disposal <input type="checkbox"/> Row Crops <input type="checkbox"/> Urban Runoff/Storm Sewers		
Hydraulic Structures <input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input type="checkbox"/> Other <input type="checkbox"/> Culverts		Stream Flow: <input type="checkbox"/> Dry <input type="checkbox"/> Pooled <input type="checkbox"/> Low <input checked="" type="checkbox"/> Normal <input type="checkbox"/> High <input type="checkbox"/> Very Rapid or Torrential		
Riparian Vegetation Dom. Tree/Shrub Taxa: <u>Red maple, Red oak, Elm, R. birch</u> Canopy Cover: <input checked="" type="checkbox"/> Fully Exposed (0-25%) <input type="checkbox"/> Partially Exposed (25-50%) <input type="checkbox"/> Partially Shaded (50-75%) <input type="checkbox"/> Fully Shaded (75-100%)		Stream Type: <u>Spring</u> <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Ephemeral <input type="checkbox"/> Seep		
Channel Alterations: <input type="checkbox"/> Dredging <input type="checkbox"/> Channelization ( <input type="checkbox"/> Full <input type="checkbox"/> Partial)				
Substrate <input checked="" type="checkbox"/> Est <input type="checkbox"/> P.C. Riffle _____ % Run <u>90</u> % Pool <u>10</u> %				
Site/Clay (<0.06 mm / <0.002 in) Sand (0.06 - 2 mm / 0.002 - 0.08 in) Gravel (2 - 64 mm / 0.08 - 2.5 in) Cobble (64 - 256 mm / 2.5 - 10.1 in) Boulders (>256 mm / >10.1 in) Bedrock				
Habitat Condition Category				
Parameter	Optimal	Suboptimal	Marginal	Poor
1 Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient)	30-50% mix of stable habitat, well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale)	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2 Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present	All mud or clay or sand bottom; little or no root mat; no submerged vegetation	Hard-pan clay or bedrock; no root mat or vegetation
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3 Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present	Majority of pools large-deep, very few shallow	Shallow pools much more prevalent than deep pools	Majority of pools small-shallow or pools absent
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

4 Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-30% of the bottom affected; slight deposition in pools	Moderate deposition of new gravel, sand or fine sediment on old and new bars. 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools present	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5 Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed	Water fills 75% of the available channel, or <25% of channel substrate is exposed	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed	Very little water in channel and mostly present as standing pools
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6 Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments, evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present	Channelization may be extensive, embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted	Banks shored with gabion of cement, over 80% of the stream reach channelized and disrupted; instream habitat greatly altered or removed entirely
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7 Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line (Note - channel braiding is considered normal) in coastal plains and other low-lying areas. This parameter is not easily rated in these areas	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line	Channel straight; waterway has been channelized for a long distance
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8 Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected	Moderately stable, infrequent, small areas of erosion mostly healed over 5-30% of bank in reach has areas of erosion	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends, obvious bank sloughing; 60-100% of bank has erosional scars
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9 Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent, more than one-half of the potential plant stubble height remaining	50-70% of the streambank surfaces covered by vegetation, disruption obvious; patches of bare soil or closely cropped vegetation common, less than one-half of the potential plant stubble height remaining	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10 Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone > 18 meters, human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally	Width of riparian zone 6-12 meters; human activities has impacted zone a great deal	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score

82

NOTES/COMMENTS: Cattle access, channel entrenched/incised in places  
Spring lead



Low Gradient Stream Data Sheet

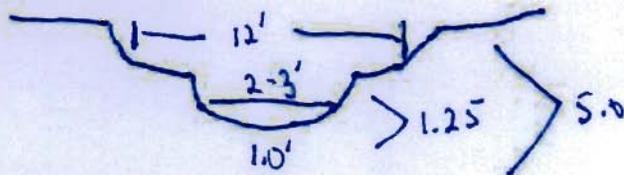
STREAM NAME: <u>JNT-2</u>		LOCATION: <u>Doc Cole</u>	
STATION: <u>WP426</u>		DRAINAGE AREA (AC):	
BASIN/WATERSHED: <u>Green R / Deer Cr.</u>			
LAT: <u>37-33-19.7</u> LONG: <u>87-37-03.7</u>		COUNTY: <u>Webster</u> USGS 7.5 TOPO	
DATE: <u>5-9-12</u> TIME: <u>2:55</u> AM <input type="checkbox"/> PM <input checked="" type="checkbox"/>		INVESTIGATORS: <u>BS, RH</u>	
TYPE SAMPLE <input type="checkbox"/> P-CHEM <input type="checkbox"/> Macroinvertebrate <input type="checkbox"/> FISH <input type="checkbox"/> BACT			
WEATHER: Now <input type="checkbox"/> Past 24 hours <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input type="checkbox"/> Clear/sunny/overcast <input type="checkbox"/>			
Has there been a heavy rain in the last 7 days? <u>.74</u>			
Appr. Air Temp <u>70</u> °F Inches rainfall in past 24 hours <u>.1</u> in			
% Cloud Cover <u>15</u>			
P-Chem: Temp (°F) <u>65.1</u> D O (mg/l) <u>8.1</u> % Saturation _____ pH(S.U.) <u>5.9</u> Cond <u>136.5</u> <input type="checkbox"/> Grab			
INSTREAM WATERSHED FEATURES (at time of assessment):		LOCAL WATERSHED FEATURES:	
Stream Width EOW <u>2-3</u> ft		Predominant Surrounding Land Use:	
Stream Width BF <u>12.0</u> ft		<input type="checkbox"/> Surface Mining <input type="checkbox"/> Construction <input checked="" type="checkbox"/> Forest	
Stream Bottom Width <u>1.8</u> ft		<input type="checkbox"/> Deep Mining <input type="checkbox"/> Commercial <input type="checkbox"/> Pasture/Grazing	
Avg Bankfull Depth <u>1.8</u> ft		<input type="checkbox"/> Oil Wells <input type="checkbox"/> Industrial <input type="checkbox"/> Silviculture	
Avg H <sub>2</sub> O Depth Riffle <u>2.1</u> ft		<input type="checkbox"/> Land Disposal <input type="checkbox"/> Row Crops <input type="checkbox"/> Urban Runoff/Storm Sewers	
Hydraulic Structures: <input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input type="checkbox"/> Other <input type="checkbox"/> Culverts		Stream Flow: <input type="checkbox"/> Dry <input type="checkbox"/> Pooled <input type="checkbox"/> Low <input checked="" type="checkbox"/> Normal <input type="checkbox"/> High <input type="checkbox"/> Very Rapid or Torrential	
Riparian Vegetation: <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses		Canopy Cover: <input type="checkbox"/> Fully Exposed (0-25%) <input type="checkbox"/> Partially Exposed (25-50%) <input type="checkbox"/> Partially Shaded (50-75%) <input checked="" type="checkbox"/> Fully Shaded (75-100%)	
Number of Straits: <u>3</u>		Channel Alterations: <input type="checkbox"/> Dredging <input type="checkbox"/> Channelization <input type="checkbox"/> Full <input type="checkbox"/> Partial	
Substrate: <input checked="" type="checkbox"/> Est <input type="checkbox"/> P C		Riffle <u>40</u> % Run <u>25</u> % Pool <u>35</u> %	
Silt/Clay (<0.06 mm / <0.002 in)		Sand (0.06 - 2 mm / 0.002 - 0.08 in)	
Gravel (2 - 64 mm / 0.08 - 2.5 in)		Cobble (64 - 256 mm / 2.5 - 10.1 in)	
Boulders (>256 mm / >10.1 in)		Bedrock	
Habitat Condition Category			
Parameter			
1. Epifaunal Substrate/Available Cover			
Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient)			
30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale)			
10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed			
Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking			
SCORE: 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0			
2. Pool Substrate/Characterization			
Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common			
Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present			
All mud or clay or sand bottom; little or no root mat, no submerged vegetation			
Hard-pan clay or bedrock; no root mat or vegetation			
SCORE: 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0			
3. Pool Availability			
Even mix of large shallow, wide-deep, small-shallow, small-deep pools present			
Majority of pools large-deep, very few shallow			
Shallow pools much more prevalent than deep pools			
Majority of pools small-shallow or pools absent			
SCORE: 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0			

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools	Moderate deposition of new gravel, sand or fine sediment on old and new bars, 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed	Water fills > 75% of the available channel; or <25% of channel substrate is exposed	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed	Very little water in channel and mostly present as standing pools
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal, stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging, (greater than past 20 yr) may be present, but recent channelization is not present	Channelization may be extensive, embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted	Banks shored with gabion of cement, over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas)	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line	Channel straight; waterway has been channelized for a long distance
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or moving minimal or not evident; almost all plants allowed to grow naturally	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent, more than one-half of the potential plant stubble height remaining	50-70% of the streambank surfaces covered by vegetation, disruption obvious; patches of bare soil or closely cropped vegetation common, less than one-half of the potential plant stubble height remaining	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally	Width of riparian zone 6-12 meters; human activities has impacted zone a great deal	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	7 6	5 4 3	2 1 0

Total Score

127

NOTES/COMMENTS: Pics 304  
Just below permit boundary.  
Channel entrenched, but new channel formation (recovery)



**VII. Appendix B - Macroinvertebrate Collection Sheets**

Macroinvertebrate Collection Field Data Sheet

Project:	County:	Stream:	Station:
Dock Cole	Webster	UT Jackson Ditch (IN7-1)	WP 425 DE 5062-01
Latitude:	Longitude:	Date:	Collectors:
37-33-13.2	87-38-24.5	5-9-12	BS, RH
Equipment Used:	Survey Method:		
D-frame net	<input type="checkbox"/> 1m <sup>2</sup> Semi-Quantitative <input type="checkbox"/> Multihabitat Qualitative <input checked="" type="checkbox"/> 20-Jab Proportional (WKY)		

Sampling Description (#jabs, habitats sampled, jabs per habitat type, etc.):

Gravel / Rubble	-	none
leaf pack	-	2
Woody debris	-	6
Roots	-	6
Sand / silt	-	4
Veget	-	2

Comments:

cattle access  
 Incised / entrenched in places  
 2 Beetles & 1 dragonfly larvae in sample

Pics 1 & 2

Macroinvertebrate Collection Field Data Sheet

Project:	County:	Stream:	Station:
Rock Cole	Webster	UT Jackson Ditch (INT-2)	WP 426 DC 5002-02
Latitude:	Longitude:	Date:	Collectors:
37-33-19.7	87-37-03.7	5-9-12	BS, RH
Equipment Used:		Survey Method:	
D-frame net		<input type="checkbox"/> 1m <sup>2</sup> Semi-Quantitative <input type="checkbox"/> Multihabitat Qualitative <input checked="" type="checkbox"/> 20-Jab Proportional (WKY)	

Sampling Description (#jabs, habitats sampled, jabs per habitat type, etc.):

Gravel/cobble	4
Silt/sand	2
Leaf packs	2
Woody debris	04
Veget	04
Roots	001
Pool rocks (picked)	3
	<hr/>
	20

Comments: PICS 344

## VIII. RESUMES

# T. H. E. Engineers, Inc.

## **WILLIAM F. SAMPSON, MS** **Aquatic Biologist**

### **EDUCATION**

M.S., Biology

Eastern Kentucky University, 1979

Thesis: *Age Growth Study of Bluegill Sunfish (Lepomis macrochirus) in Lentic Versus Lotic Environments*

B.S., Biology

Eastern Kentucky University, 1976

### **CONTINUING EDUCATION**

- Rosgen Level I: Applied Fluvial Geomorphology
- Rosgen Level II: River Morphology and Application
- Rosgen Level III: River Assessment and Monitoring
- Rosgen Level IV: River Restoration and Natural Channel Design
- Stream Restoration Construction Training (North Carolina State University)
- Best Practices in Wetland Mitigation and Stream Restoration (University of Kentucky)
- Stream Restoration Design and Construction Strategies Workshop (Biohabitats, Inc.)
- Ongoing Stream Restoration Training Course (University of Louisville Stream Institute)

### **EXPERIENCE / QUALIFICATIONS**

*Bill Sampson has 32 years of biological/environmental experience with consulting, state government and federal government. In particular, he spent seven years with the KDFWR In-Lieu Fee Program locating stream and wetland mitigation projects, and overseeing design and construction of those projects. This involved over 40 projects, benefiting more than 50 miles of stream. Bill has hands-on experience with the design of stream restoration projects, as well as other project elements, such as locating projects, rapid bio-assessment evaluation, developing conceptual plans, construction oversight, permanent protection matters, and working with landowners and other stakeholders. He also served as Co-Project Manager for stream projects, and has considerable experience with wetland delineation and restoration. Prior to KDFWR, Bill was employed with KY Division of Water and was involved with stream and wetland mitigation in regard*

*to 401 certification. Since retiring from state government, Bill has collected field data for stream restoration projects and assisted with project design, as well as conducting several wetland delineations. Other job duties in which he has performed include biological field data (fish and macroinvertebrate) collection, lab identification and analysis of biological samples, EIS preparation, environmental review, regulation development, permitting, writing SOP documents, and serving as an instructor for college students and agency personnel.*

### **LAWRENCE COUNTY**

#### **East Fork Little Sandy #5 (KDFWR In-Lieu Fee)**

Mr. Sampson was responsible for locating this project during his tenure with KDFWR. He coordinated with the landowners and developed the conceptual plan for this project.

### **MCLEAN COUNTY**

#### **Buck Creek Resources, LLC.**

Mr. Sampson assisted with preparing project plans, providing input regarding channel dimensions, and type and location of habitat and channel stability structures for 1,890 feet of Buck Creek. This project is in-progress.

### **BOYD COUNTY**

#### **Bolts Fork (KDFWR In-Lieu Fee)**

Mr. Sampson collected geomorphological field data, assisted with surveying, and assisted with the design for 6,700 feet of restoration and enhancement of Bolts Fork and its tributaries. He served as Co-Project Manager for this project. The design was completed in 2010.

### **BATH COUNTY**

#### **Salt Lick Creek (KDFWR In-Lieu Fee)**

Mr. Sampson collected field data and assisted with surveying for 5,400 feet of stream restoration along Salt Lick Creek. He served as Co-Project Manager for this project. The field data was collected in 2010.

### **KNOTT COUNTY**

#### **Balls Fork (KDFWR In-Lieu Fee)**

Mr. Sampson collected field data and designed 750 feet of stream enhancement along Balls Fork. The project was completed in 2003.

### **WAYNE COUNTY**

#### **Meadow Creek (KDFWR In-Lieu Fee/U.S. Bureau of Prisons)**

Mr. Sampson was involved with the delineation, plan preparation (including vegetation plan), contracting, construction oversight and monitoring of wetland restoration at the head of Meadow Creek. KDFWR restored hydrology for more than twelve acres by plugging ditches and creating shallow water basins, and native wetland tree and shrub species were planted on six of those acres. Construction and tree/shrub planting for the project was completed in 2002.



**JONATHAN F. SCHEIBLY, MS, PWS**  
**Environmental Scientist**

**EDUCATION**

B.S.C.E. (Expected Graduation May 2013)  
University of Kentucky  
Environmental/Water Resources Engineering Focus

M.S., Biology  
Morehead State University, 2003  
Thesis: *Life History of the Northern Madtom, Noturus stigmosus, in the Licking River, Kentucky*

B.S., Biology  
University of Kentucky, 1999

**CONTINUING EDUCATION**

- Developing a Biological Assessment (USFWS NCTC Course)
- Eastern Wetland Restoration Institute
- BCI/BCM Workshop on Indiana Bat Survey Methods
- Advanced Wetland Training and Interim Regional Method Wetland Delineation Training
- Bat Acoustic Monitoring Workshop (USFWS)
- Wetland Delineation and Management Training Program (USACE)

**EXPERIENCE / QUALIFICATIONS**

*Mr. Scheibly has 12 years of experience in research and management of state and federally listed threatened/endangered species and 9 years of experience in regulatory and permitting aspects of natural resource management. He is one of only eight certified Professional Wetland Scientists in Kentucky. He is responsible for a variety of field, laboratory, and office research, including collection and identification of fishes and aquatic macroinvertebrates, wetland delineation, threatened/endangered species surveys and habitat assessment, and mitigation design and monitoring. He is responsible for laboratory macroinvertebrate identification, biological metric calculation, and water quality analysis. He researches and writes NEPA documents, including Biological Assessments/Evaluations, Alternatives Analyses, Cumulative Impacts Analyses, Baseline Ecological Assessments, and Wetland Monitoring Reports. He is also responsible for GIS analysis, data collection, and database maintenance.*

**OHIO COUNTY**

**Kronos, Smallhaus, Midway, and Boot Mine Sites**

Mr. Scheibly delineated wetlands and assessed streams on approximately 3,600 acres as part of Section 404 permitting for proposed mine projects in western Kentucky. Mr. Scheibly assisted in writing baseline reports submitted to USACE, and authored alternative analyses and cumulative impact analyses for the individual projects. The cumulative impact analyses included adjacent watersheds and, for several projects, comparisons to the lower Green River watershed.

**LYON & CALDWELL COUNTIES**

**US 641 Item Number 1-187.31**

Mr. Scheibly delineated 89 wetlands, collected and identified fishes from three streams and macroinvertebrates from eight streams in a 5,600 acre project corridor during baseline environmental studies. During Biological Assessment studies, he performed mist netting and acoustic surveys at 17 sites for two federally endangered bat species, capturing the gray bat. He also conducted extensive pitfall trapping for the American Burying Beetle, and conducted habitat surveys for the least tern, bald eagle, five mussel species, and copperbelly watersnake.

**BREATHITT & WOLFE COUNTIES**

**KY DNR Baseline/USACE Mitigation Sites**

Mr. Scheibly prepared study plans, led field survey crews, collected and identified fishes and macroinvertebrates, calculated biological metrics, and prepared survey reports for six streams as part of SMCRA permitting and Section 404 mitigation.

**CAMPBELL COUNTY, TENNESSEE**

**Davis Creek and Sandlick Branch**

Retained as a fish expert for Copperhead Consulting, Mr. Scheibly collected and identified fishes (including blackside dace) along 3.5 miles of designated primary and secondary dace habitat in northeastern Tennessee during preliminary investigations preceding surface mining.

**Letcher County**

**US 119**

During Biological Assessment studies, Mr. Scheibly led surveys for the blackside dace along 1.6 km of the Poor Fork Cumberland River. He also conducted mist net surveys along the project corridor. During Baseline Ecological studies for waste areas, he identified macroinvertebrates and calculated biological metrics for three streams.