April 2013

MITIGATION MONITORING REPORT
Reaches 12 and 13 - 2nd YEAR

Revelation Energy, LLC
KDNR Permit No. 813-0359
Corps ID No. 2004-1252

Responsible Organization
Revelation Energy, LLC
160 Lank Branch Suite 2
Pikeville, KY 41501

Project Location
Unnamed Tributaries of Big Caney Creek
Breathitt County, KY

Date of Preparation
April 2013

Prepared by:
Summit Engineering, Inc.
131 Summit Drive
Pikeville, KY 41501
Tel: 606 | 432-1447
Fax: 606 | 432-1440

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KDNR Permit No. 813-0359
USACE ID No. LRL-2004-1252
Mitigation Reaches 12 and 13

PROJECT OVERVIEW

Introduction

Revelation Energy, LLC has been charged with performing remedial stream enhancement work as part of a compensatory mitigation package submitted to the U.S. Army Corps of Engineers (COE) on August 31, 2004 for pending KDNR Permit No. 813-0387 (formerly KDNR Permit No. 813-0359, 813-0343, 813-0309, and 813-0263 A1) Corps ID No. LRL 2004-1252. Revelation Energy, LLC has been charged with performing remedial stream enhancement work as part of a compensatory mitigation package submitted to the U.S. Army Corps of Engineers (COE) on August 31st, 2004. A detailed work plan for all mitigation was outlined in the Compensatory Mitigation Plan (CMP) prepared by Walturn Engineering, Inc. of Hueysville, Kentucky, dated November 23rd, 2004. The mitigation performed for these Unnamed Tributaries of Caney Creek (Reaches 12 and 13) will serve to partially mitigate losses associated with the placement of fill or dredged material into the jurisdictional waters of the U.S. under the Nationwide 21 permit authorized by the Louisville District of the COE. This report specifically addresses the second year mitigation status of Reaches 12 and 13.

In-kind mitigation for both temporary and permanent impacts will consist of off-site stream restoration and enhancement of 2,880 linear feet of the UT of Caney Creek (Reach 12) and 2,367 linear feet of another UT of Caney Creek (Reach 13). These reaches are tributaries of Big Caney Creek of Quicksand Creek of the North Fork Kentucky River in Breathitt County, Kentucky. The mitigation project utilizes the East Kentucky Stream Assessment Protocol (EKSAP) to establish both pre- and post-mitigation work stream function for impacted and mitigation stream reaches as applicable.

The ultimate post-mitigation goal is to produce an average EII rating of 0.88 for Reach 12 at maturity and an average EII rating of 0.81 for Reach 13 at maturity, resulting in EIU values of 2,390.10 and 1,917.21, respectively. Achieving this post-mitigation goal would mean a net increase of 1,296 EIUs in Reach 12 and 1,107.21 EIUs in Reach 13.

The restoration and enhancement of Reaches 12 and 13 was completed in the fall and winter 2010 by R&R Excavating, with field visits and inspection conducted by Summit Engineering, Inc. personnel. The construction reports were submitted in December 2010. A report for the first year of monitoring was submitted by Aquatic Resource Management in December of 2011. The following field visits / surveys were conducted in 2013 as part of the 2012 mitigation monitoring following the transfer of the project to Revelation Energy, LLC.

Field Visits/ Surveys Conducted by Summit Engineering, Inc.

		Parameters Measured or Assessed	
Reach	**Channel**	**Conductivity, Habitat Evaluation, Riparian Vegetation Evaluation, Substrate Assessment, and Maintenance Evaluation**	**Stream Channel Survey**
12	Unnamed Tributary of Big Creek	1/31/13	2/8/13 and 3/29/13
13	Unnamed Tributary of Big Creek	1/28/13	2/25/13 and 3/26/13

After two monitoring years, Reaches 12 and 13 are progressing toward performance standards.

Project Description

Reach 12
The Unnamed Tributary of Big Caney Creek is a second-order intermittent/ perennial tributary of Big Caney Creek of Quicksand Creek of the North Fork Kentucky River in Breathitt County, Kentucky. The mitigation project begins as the confluence of Big Caney Creek at 37° 34' 57" N, 83° 09' 41" W and continues upstream for 2,880 feet to 37° 34' 41" N, 83° 09' 25" W. See Appendix A for additional project location information.

Reach 13
The Unnamed Tributary of Big Caney Creek is a second-order intermittent/ perennial tributary of Big Caney Creek of Quicksand Creek of the North Fork Kentucky River in Breathitt County, Kentucky. The mitigation project begins as the confluence of Big Caney Creek at 37° 34' 54" N, 83° 09' 57" W and continues upstream for 2,367 feet to 37° 34' 36" N, 83° 09' 48" W. See Appendix A for additional project location information.

REQUIREMENTS

Review of Compensation Goals

The authorized CMP outlined six parameters to be measured annually in order to measure success and/or failure of the mitigation projects. Bioassessment scores, conductivity, propriety and function of stream enhancement structures, bank stability, and riparian zone vegetation density and diversity are to be evaluated annually. These parameters are to be evaluated from the confluence of the UT of Big Caney Creek with Big Caney Creek at 37° 34' 57" N, 83° 09' 41" W upstream for 2,880 feet to 37° 34' 41" N, 83° 09' 25" W in Reach 12 and from the confluence of the Unnamed Tributary of Big Caney Creek with Big Caney Creek at 37° 34' 54" N, 83° 09' 57" W upstream for 2,367 feet to 37° 34' 36" N, 83° 09' 48" W in Reach 13. See Appendix A for additional project location information.

The primary goals of the mitigation projects for Reaches 12 and 13 are to improve aquatic biodiversity within the watershed, to reduce sediment loading by watershed improvements and improving bank stability, and to improve riparian functions. Please find below a table outlining the proposed improvements in EII ratings and EIU values for these reaches as compared to the pre-mitigation scores.

Reach	Pre-Mitigation EIU Value	Average 5-Year Post-Mitigation EII Rating Goal	Average EII Rating Goal at Maturity	Average EIU Value at Maturity	Net Increase of EIUs at Maturity
12	1,094.10	0.63	0.88	2,390.10	1,296.00
13	810.06	0.42	0.81	1,917.27	1,107.21

Compensatory Mitigation Details

According to the as-built Construction Report dated December 2010, designs were developed by Abbot Engineering, Inc. and Summit Engineering, Inc. was contracted to inspect R&R Excavating's construction of these designs. The mitigation project was completed in the fall and winter of 2010. Following the construction, Aquatic Resources Management of Lexington, Kentucky was contracted to evaluate bioassessment scores, conductivity, propriety and function of stream enhancement structures, bank stability, and riparian zone vegetation density and diversity as well as author the first annual monitoring report. Following the pending transfer of the KDNR Permit No. 813-0359 from Laurel Mountain Resources, LLC to KDNR Permit No. 813-0387 under Revelation Energy, LLC, Summit Engineering, Inc. was contracted to assume these monitoring and reporting responsibilities and provide input on any repairs that may be required if the success criteria is not met. Included in the original permit application as well as the Construction Report was the Success Criteria and Monitoring Plan. Refer to Table I.

The authorized CMP proposed to utilize in-stream and watershed restoration and enhancement techniques to improve the functions of Reaches 12 and 13, watersheds impacted by mining, timbering, and natural gas/oil activities. Before mitigation efforts were utilized, these reaches appeared to be impaired from past mining and logging activities as substantial amounts of sediment have removed and replaced natural aquatic habitat. Epifaunal Substrate/Available Cover scores were in the marginal range, indicating less than desirable habitat availability and substrate that is frequently removed or disturbed. Embeddedness scores were in the poor and marginal ranges, indicating that gravel, cobble, and boulder particles were at least 50% surrounded by fine sediment. Velocity and Depth Regime scores were in the marginal range indicating that only two of the four habitat regimes were present. Sediment Deposition scored in the poor to marginal range, indicating moderate to heavy deposition of sediment within 30 to 50% of the stream channel. Frequency of Riffle scores were in the marginal range, indicating only an occasional riffle or bend with bottom contours that provide some habitat. Bank Stability scores were also in the marginal range, indicating moderately unstable banks with 30 to 60% banks in the reach affected by erosion and high erosion potential during floods. Vegetative Protection scores were also in the marginal range indicating that only 50-70% of the stream bank surfaces were covered in vegetation with patches of bare soil or closely cropped vegetation common. Riparian Vegetative Zone Width scored in the sub-optimal range, indicating that the stream banks were at least 18 meters wide.

Success Criteria

The success of off-site mitigation areas will be based upon attainment of the RBP habitat parameter values and admissible specific conductivity measurements such that the five year EII goals for each mitigation area are met. The predicted EII values which are to be in-place at the end of the five year monitoring period are listed in Table I. As EII values are calculated with RBP parameter scores, it will be acceptable for an individual habitat parameter to be lower than predicted as long as the resulting loss is offset by an unpredicted gain in one or more other parameters. Increase in RBP habitat scores will be verified through field investigations and specific conductivity will be measured annually. In addition, success criteria for the physical conditions and revegetation success of the mitigation areas are as follows:

- Mitigation areas should show no signs of substantial erosion.
- Stream enhancement structures should be in-place and properly functioning.
- Determination of successful tree and shrub stocking of the revegetated area will utilize the following standards:
    - A minimum stocking density of 300 trees or trees/shrubs per acre determined with a statistical confidence of 90 percent, with tree (not shrub) species comprising at least 75% of the total stock, shall be achieved on at least 70 percent of the area stocked.
    - At least 6 species of trees and shrubs shall be planted in a mixed distribution pattern with each of the 6 species comprising at least 10 percent of the total stock; however, none of the species shall comprise more than 50% of the total stock.
    - Should unwanted invading non-native non-riparian vegetative species become prevalent within any area, they will be controlled or eliminated by mechanical or manual methods.
    - Volunteer native riparian vegetation will be encouraged.

Table I. Predicted Five Year EII Scores by Reach

Mitigation Type	Mitigation Reach	Predicted Post-Mitigation EII Score (5 Years)
Off-Site	Reach 12: Unnamed Tributary of Big Caney Creek	0.63
	Reach 13: Unnamed Tributary of Big Caney Creek	0.42

Monitoring Plan

The monitoring and management plan will evaluate the success of the mitigation work and will allow for any necessary adjustments to assure success of the mitigation site. Short term plans for all mitigation sites are limited to achieving the required improvement and/or attainment of performance standards and aquatic functions as described previously. The success of the mitigation work will is dependent upon achieving success standards previously described. Thus, the success of the mitigation work will be determined by monitoring the parameters in Table II.

Table II. Monitoring Parameters

Parameter	Frequency of Assessment
Bioassessment Score	Assess and complete RBP at target reference points annually
Conductivity	Measure at target reference points annually
Propriety and Function of Stream Enhancement Structures	Assess and document annually
Bank Condition	Assess and document annually
Vegetation Density	Assess and Document Annually
Vegetation Diversity	Assess and Document Annually

Monitoring Methods

An annual site visit will be conducted in order to determine the progress of the mitigation project. Following are the parameters and the methodologies that were utilized in 2013 to assess the 2012 monitoring period:

- Bioassessment Score – The U.S. EPA's Rapid Bioassessment Protocol for Use in Streams and Wadeable Rivers was utilized to assess each of the previously-determined evaluation sites, to be compared to the pre-work habitat values. RBP sheets and EII calculation sheets are included in Appendices B and C, respectively.
- Conductivity – Conductivity was obtained using digital meters and recorded on the RBP sheets which can be found in Appendix B.
- Stream Morphology– Summit Engineering, Inc. personnel, utilizing standard surveying methods as described in the approved mitigation plan, conducted surveying of the mitigation reaches. The surveyed cross sections are included in Appendix A. In addition photographic documentation of stream bank stabilization measures and enhancement structures can be found in Appendix E. A discussion of the bank stability and enhancement structure evaluation can be found in the Summary Data section of this report.
- Riparian Vegetation – A field evaluation of the previous plantings throughout the restored riparian zones, including tree and shrub transects, was completed to assess the density and diversity riparian zone revegetation. Tree transect field sheets and summary tables can be found in Appendix D. Photographic documentation of ground cover is included in Appendix E.

SUMMARY DATA

Table III. UT of Big Caney Creek (Reach 12) Monitoring Results

Water Quality Parameters and Bioassessment Scores of the UT of Big Caney Creek (Reach 12)			
Parameter	**Immediately After Mitigation 2010**	**Year 1 2011**	**Year 2 2012**
Average RBP Score	83.7	131	130.5
Conductivity (uhmos)	Data Not Reported	Data Not Reported	107
Average EII Score	0.39	Data Not Reported	0.705
Average Temperature (°C)	Data Not Reported	Data Not Reported	5.8
Average pH (SU)	Data Not Reported	Data Not Reported	8.5
Average Dissolved Oxygen (mg/L)	Data Not Reported	Data Not Reported	12.08

Enhancement Structure Status of the UT of Big Caney Creek (Reach 12)	
Monitoring Year	**Comments**
Immediately After Mitigation 2010	The following structures have been included in the enhancement design: boulder clusters, single and double deflectors, log sills, step pools, root wads, and rock riffles
Year 1 2011	Rock and log cross vanes were installed at designated intervals within each segment to increase sediment transport and create macroinvertebrate habitat.
Year 2 2012	A few log deflectors and sills now lie above water level. Cribbing structures remain in place for the most part. Cross vanes, step pools, and rock riffles all functioning.

Bank Stability of the UT of Big Caney Creek (Reach 12)	
Monitoring Year	**RBP Score**
Immediately After Mitigation 2010	Marginal -moderately unstable banks with 30-60% of the reach affected by erosion and high erosion potential during floods
Year 1 2011	Sub-optimal - moderately stable, infrequent, small areas of erosion mostly healed over, 5-30% of bank in reach has areas of erosion
Year 2 2012	Sub-optimal - moderately stable, infrequent, small areas of erosion mostly healed over, 5-30% of bank in reach has areas of erosion

Tree and Shrub Assessment of the Unnamed Tributary of Big Caney Creek (Reach 12) Monitoring Location 1					
Species	**Common Name**	**Number of Individuals Within Reach**		**Total By Species**	**Percent of Population**
		Right Bank	**Left Bank**		
Acer rubrum	Red Maple	0	1	1	1.64
Acer sachrum	Sugar Maple	1	2	3	4.92
Betula lenta	Sweet Birch	0	1	1	1.64
Betula nigra	River Birch	0	3	3	4.92
Carpinus caroliniana	Ironwood	0	1	1	1.64
Carya glabra	Pignut Hickory	0	3	3	4.92
Fagus grandifolia	American Beech	0	3	3	4.92
Liriodendron tulipifera	Tulip Poplar	6	1	7	11.48
Platanus occidentalis	Sycamore	21	4	25	40.98
Quercus alba	White Oak	0	1	1	1.64
TOTAL Trees in total Riparian Zone (5,000 Square Feet)		48			
Trees per Square Foot		0.0096			
Trees per acre		418.176			

Tree and Shrub Assessment of the Unnamed Tributary of Big Caney Creek (Reach 12) Monitoring Location 3					
Species	**Common Name**	**Number of Individuals Within Reach**		**Total By Species**	**Percent of Population**
		Right Bank	**Left Bank**		
Acer rubrum	Red Maple	5	6	11	18.03
Fagus grandifolia	American Beech	6	2	8	13.11
Magnolia macrophylla	Large Leaf Magnolia	6	0	6	9.84
Oxydendrum arboreum	Sourwood	0	4	4	6.56
Tsuga canadensis	Eastern Hemlock	9	2	11	18.03
TOTAL Trees in total Riparian Zone (5,000 Square Feet)		40			
Trees per Square Foot		0.008			
Trees per acre		348.48			

Vegetation Density and Diversity Summary of the UT of Big Caney Creek (Reach 12)		
Goals	**Year 2 (2012)**	
	Monitoring location 1	**Monitoring Location 3**
> 300 stems/acre	418 stems per acre (39% above stocking goal)	348 stems per acre (16% above stocking goal)
Tree species > 75% of stems/acre	Tree species comprise 100% of stems/acre	Tree species comprise 100% of stems/acre
> 6 species of trees and shrubs	10 species	Only 5 species
Each species ≥ 10% of stems/acre, but < 50%	No species comprises more than 50% of stems/acre. Only two species, *Platanus occidentalis* and *Liriodendron tulipifera*, comprise as much as 10%	No species comprises more than 50% of stems/acre. However, four species comprise approximately 10% or more of the population
Presence of invasive species	None noted.	None noted.

Substrate Particle Size Distribution of the UT of Big Caney Creek (Reach 12)		
Percent less than	**Year 2 (2012) Particle Size (mm)**	
	Site 1	**Site 3**
D16	14.446	13.077
D35	21.59	21.02
D50	29.4	26.7
D65	38	34
D84	54	51
D95	76	70

Channel Dimensions of the UT of Big Caney Creek (Reach 12)		
Parameter		**Year 2 (2012)**
Average Channel Width (ft)		6.96
Average Channel Depth (ft)		0.70
Average Water Depth (ft)		0.23
Average Bank Slope	**Left Descending Bank**	2.68: 1
	Right Descending Bank	3.45: 1

Table IV. Unnamed Tributary of Big Caney Creek (Reach 13) Monitoring Results

Water Quality Parameters and Bioassessment Scores of the UT of Big Caney Creek (Reach 13)			
Parameter	**Immediately After Mitigation 2010**	**Year 1 2011**	**Year 2 2012**
Average RBP Score	85	143	116.5
Conductivity (uhmos)	Data Not Reported	Data Not Reported	281.5
Average EII Score	0.37	Data Not Reported	0.445
Average Temperature (°C)	Data Not Reported	Data Not Reported	6.35
Average pH (SU)	Data Not Reported	Data Not Reported	8.6
Average Dissolved Oxygen (mg/L)	Data Not Reported	Data Not Reported	8.46

Enhancement Structure Status of the Unnamed Tributary of Big Caney Creek (Reach 13)	
Monitoring Year	**Comments**
Immediately After Mitigation 2010	The following structures have been included in the enhancement design: boulder clusters, single and double deflectors, log sills, step pools, root wads, and rock riffles
Year 1 2011	Rock and log cross vanes were installed at designated intervals within each segment to increase sediment transport and create macroinvertebrate habitat.
Year 2 2012	Only two log deflectors and one root wad are not fully within the channel. Cribbing structures remain in place for the most part. Cross vanes, step pools, and rock riffles all functioning.

Bank Stability of the Unnamed Tributary of Big Caney Creek (Reach 13)	
Monitoring Year	**RBP Score**
Immediately After Mitigation 2010	Marginal - moderately unstable banks with 30-60% of the reach affected by erosion and high erosion potential during floods.
Year 1 2011	Optimal – banks stable with evidence of erosion or bank failure absent or minimal
Year 2 2012	Marginal-Sub-optimal - moderately stable, infrequent small areas of erosion mostly healed over, 5-60% of bank in reach has areas of erosion

Tree and Shrub Assessment of the Unnamed Tributary of Big Caney Creek (Reach 13) Monitoring Location 2					
Species	**Common Name**	**Number of Individuals Within Reach**		**Total By Species**	**Percent of Population**
		Right Bank	**Left Bank**		
Acer rubrum	Red Maple	14	10	24	39.34
Acer sachrum	Sugar Maple	2	0	2	3.28
Betula lenta	Sweet Birch	3	0	3	4.92
Carpinus caroliniana	Ironwood	1	5	6	9.84
Cornus florida	Flowering Dogwood	1	1	2	3.28
Fagus grandifolia	American Beech	21	10	31	50.82
Liriodendron tulipifera	Tulip Poplar	2	7	9	14.75
Magnolia macrophylla	Large Leaf Magnolia	4	0	4	6.56
Nyssa sylvatica	Black Gum	1	0	1	1.64
Platanus occidentalis	Sycamore	1	1	2	3.28
Tsuga canadensis	Eastern Hemlock	5	0	5	8.20
TOTAL Trees in total Riparian Zone (5,000 Square Feet)		89			
Trees per Square Foot		0.0178			
Trees per acre		775.368			

Tree and Shrub Assessment of the Unnamed Tributary of Big Caney Creek (Reach 13) Monitoring Location 3					
Species	**Common Name**	**Number of Individuals Within Reach**		**Total By Species**	**Percent of Population**
		Right Bank	**Left Bank**		
Acer rubrum	Red Maple	3	5	8	13.11
Carpinus caroliniana	Ironwood	1	0	1	1.64
Fagus grandifolia	American Beech	34	20	54	88.52
Liriodendron tulipifera	Tulip Poplar	0	8	8	13.11
Quercus alba	White Oak	0	3	3	4.92
TOTAL Trees in total Riparian Zone (5,000 Square Feet)		74			
Trees per Square Foot		0.0148			
Trees per acre		644.688			

Unnamed Tributary of Big Caney Creek (Reach 13) Vegetation Density and Diversity Summary		
Goals	**Year 2 (2012)**	
	Monitoring location 1	**Monitoring Location 3**
> 300 stems/acre	775 stems/acre (158% above stocking goal)	644 stems/acre (114% above stocking goal)
Tree species > 75% of stems/acre	100% of stems/acre are tree sp.	100% of stems/acre are tree sp.
> 6 species of trees and shrubs	11 species	Only five species
Each species ≥ 10% of stems/acre, but < 50%	No species comprises more than 50% of the population. Only *Acer rubrum*, *Fagus grandifolia*, and *Liriodendron tulipifera* comprise as much as 10% of the population.	*Fagus grandifilia* comprises 88.52% of the stems/acre. Only two other species comprise at least 10% of the population
Presence of invasive species	None noted.	None noted.

Substrate Particle Size Distribution of the Unnamed Tributary of Big Caney Creek (Reach 13)		
Percent less than	**Year 2 (2012) Particle Size (mm)**	
	Site 2	**Site 3**
D16	12.143	13.266
D35	23.99	23.42
D50	34.4	32.0
D65	43	42
D84	61	60
D95	152	114

Channel Dimensions of the Unnamed Tributary of Big Caney Creek (Reach 13)		
Parameter		**Year 2 (2012)**
Average Channel Width (ft)		5.42
Average Channel Depth (ft)		0.55
Average Water Depth (ft)		0.24
Average Bank Slope	**Left Descending Bank**	2.56: 1
	Right Descending Bank	4.44: 1

Current Mitigation Status Summary

The primary goals of the mitigation projects for Reaches 12 and 13 are to improve aquatic biodiversity within the watersheds, to reduce sediment loading by watershed improvements and improving bank stability, and to improve riparian functions. The post mitigation goal is to produce EII ratings of 0.63 in Reach 12 and 0.42 in Reach 13 within 5 years after construction and, ultimately, EII ratings of 0.88 in Reach 12 and 0.81 in Reach 13 at maturity. Currently Reach 12 has an average EII rating of 0.705 (an average of both EII ratings at Monitoring Location 1: 0.73 and Monitoring Location 3: 0.68), while Reach 13 has an average EII rating of 0.445 (an average of both EII ratings at Monitoring Location 2: 0.51 and Monitoring Location 3: 0.38) after the 2nd year of monitoring. This means that in only the second year of monitoring, each of these channels has surpassed their five-year EII rating goals.

Average conductivity measurements for Reaches 12 and 13 are 107 uhmos and 281.5 uhmos, respectively. It is anticipated that the conductivity levels for these channels will continue to decline throughout the monitoring period as areas of erosion heal with vegetation and sediments are flushed from the channels.

For the most part, the stream enhancement structures lie in their original placements and are functioning well. These enhancement structures are functioning to sequester sediments and increase dissolved oxygen while protecting stream banks. Enhancement structures are being assimilated into these reaches and aiding in their return to natural settings where populations of aquatic organisms associated with lotic habitats can thrive as they once did before impacts occurred. Minor maintenance is needed on a few enhancement structures and this will be addressed during a period of low flow in future monitoring periods, as necessary. See appendix E for photographic documentation of stream enhancement structure placement and function.

The bank stability of Reach 12 has improved since the post-construction evaluation from a ranking of marginal to one of sub-optimal. This means a decrease of erosional areas from a range of 30-60% of the stream banks, to only 5-30% of the stream banks, indicating re-vegetation success in these areas. In addition, the bank stability scores for Reach 13 have also slightly improved from the marginal range for the post-construction evaluation, to being in the marginal to suboptimal range for the second annual monitoring period. These reaches continue to experience erosion in some areas. Maintenance of these erosional areas will be addressed during a period of low flow in future monitoring periods, as necessary.

Each of the assessed monitoring locations within Reaches 12 and 13 have met and exceeded the standard stocking goal of 300 tree and/or shrub stems per acre. In addition, no invasive species have been noted within these reaches for the second monitoring year. However, the requirement that each of six species comprise a minimum of 10% of the standing population, but no more than 50%, has not yet been achieved. It may be necessary in future monitoring periods to initiate additional tree planting to meet the diversity goals.

Each of the reaches had temperature, pH, and dissolved oxygen results sufficient for the support of macroinvertebrate populations. Additionally, the mitigation projects in Reaches 12 and 13 have already achieved the stocking goal of 300 stems per acre in only the second year of monitoring as well as achieving their five- year post-mitigation EII rating goals. These mitigation projects are progressing toward the primary goal of improving aquatic biodiversity by providing stable and diverse habitats. Continued improvements to bank stability and riparian function, as well as the maintenance of the enhancement structures, will lead to reduced sediment loading and lower conductivity measurements. Though natural succession will improve diversity and aid in healing erosional areas, additional re-vegetation efforts may prove necessary, as it is still early in the five-year monitoring period. Further, continued increases in tree density and growth will not only aid in bank stabilization, but will also lead to increased shading of the stream, lowering temperatures and contributing to an increased capacity to retain dissolved oxygen concentrations, as well as contributing allochthonous materials which will support benthic macroinvertebrate colonization and detrital food chains, thus supporting improvements to aquatic biodiversity within these reaches.

APPENDIX A: MAPS

EXHIBIT 1: PROJECT LOCATION MAP

EXHIBIT 2: UT OF BIG CANEY CREEK (REACH 12)

EXHIBIT 3: UT OF BIG CANEY CREEK (REACH 13)