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MITIGATION MONITORING REPORT
Reach 11 - 2nd YEAR

Revelation Energy, LLC
KDNR Permit No. 813-0361
Corps ID No. 2005-0408

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

Project Location
Little Sue Branch of Big Caney Creek
Breathitt County, KY

Date of Preparation
April 2013

Prepared by:
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Revelation Energy, LLC
KDNR Permit No. 813-0361
USACE ID No. LRL-2005-0408
Mitigation Reach 11

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 February 23rd, 2005 for pending KDNR Permit No. 813-0389 (formerly KDNR Permit No. 813-0361, 813-0345, and 813-0311) Corps ID No. LRL 2005-0408. A detailed work plan for all mitigation was outlined in the Compensatory Mitigation Plan (CMP) prepared by P&A Engineers and Consultants, Inc. of Louisa, Kentucky, dated February 23, 2005. The mitigation performed for Little Sue Branch (Reach 11) 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 Reach 11.

In-kind mitigation for both temporary and permanent impacts will consist of off-site stream restoration and enhancement of 2,111 linear feet of the Left Fork of Big Sourwood Branch (Reach 4), 3,815 linear feet of an Unnamed Tributary of Little Sue Branch (Reach 11). Little Sue Branch is a tributary 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 Nationwide 21 authorization for KDNR No. 813-0361 states that impacts to jurisdictional waters would result in a net loss of 872.3 EIUs. The pre-mitigation Ecological Integrity Unit (EIU) value of the stream is 1,329.93 based on EII scores calculated along the stream reach. The ultimate post-mitigation goal is to produce an EII Rating of 0.9 at maturity for Reaches 11, resulting in an EIU value of 1,899.90. Attaining this post-mitigation goal would mean a net increase of 569.97 EIUs in Reach 11. The EIU gain for Little Sue branch as proposed will serve to partially mitigate losses associated with this project.

The restoration and enhancement of Reaches 11 was completed in the fall and winter of 2010 by R&R Excavating, with field visits and inspection conducted by Summit Engineering, Inc. personnel. The construction report was submitted in January 2011. 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	
Monitoring Location	**Channel**	**Conductivity, Habitat Evaluation, Riparian Vegetation Evaluation, Substrate Assessment, and Maintenance Evaluation**	**Stream Channel Survey**
6	Little Sue Branch	1/28/13	2/25/13
7	Little Sue Branch	1/29/13	2/25/13

After two monitoring years, Reach 11 is progressing toward performance standards.

Project Description

Reach 11
The Little Sue Branch 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° 35' 06" N, 83° 09' 37" W and continues upstream for 2,110 feet to end at 37° 34' 56" N, 83° 09' 18" 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 Little Sue Branch with Big Caney Creek at 37° 35' 06" N, 83° 09' 37" W and continue upstream for 2,110 feet to end at 37° 34' 56" N, 83° 09' 18" W. See Appendix A for additional project location information.

The primary goals of the mitigation projects for Reach 11 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 this reach as compared to the pre-mitigation scores.

Reach	Pre-Mitigation EIU Value	5-Year Post-Mitigation EII Rating Goal	EII Rating Goal at Maturity	EIU Value at Maturity	Net Increase of EIUs at Maturity
11	1,329.93	0.72	0.9	1,899.90	569.97

Compensatory Mitigation Details

According to the as-built Construction Report dated January, 2011, designs were developed by P&A Engineers and Consultants, Inc. and Summit Engineering, Inc. was contracted to inspect the construction of these designs as performed by R&R Excavating during 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. 813-0361 from Laurel Mountain Resources, LLC to KDNR Permit No. 813-0389 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 the Reach 11 watershed impacted by mining, timbering, and natural gas/oil activities. Before mitigation efforts were utilized, this reach 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 sub-optimal range, indicating a 40-70% mix of stable habitat, well suited for colonization potential. Sediment deposition scores were in the marginal range, indicating moderate deposition of new gravel, sand or fine sediment on old and new bars, with 30-50% of the bottom affected and moderate deposition in pools. Embeddedness scores were in the sub-optimal range, indicating that gravel, cobble, and boulder particles were 25-50% surrounded by fine sediment. Bank Stability

scores were in the marginal range, indicating moderately unstable banks with 30-60% of the reach affected by erosion and high erosion potential during floods. Vegetative Protection and Riparian Vegetative Zone Width scores were in the marginal and sub-optimal ranges, indicating that the stream banks are at least 70% covered with native vegetation and that the riparian zone was greater than 6 meters wide. Past timbering and mining activities within the watershed had altered these reaches from their original state leaving them in need of restoration and enhancement activities.

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 11: Little Sue Branch	0.72

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. Left Fork of Big Sourwood Branch (Reach 11) Monitoring Results

Water Quality Parameters and Bioassessment Scores of the Little Sue Branch (Reach 11)			
Parameter	**Immediately After Mitigation 2010**	**Year 1 2011**	**Year 2 2012**
Average RBP Score	116	130	116
Conductivity (uhmos)	95.3	Data Not Reported	113
Average EII Score	0.63	Data Not Reported	0.63
Average Temperature (°C)	Data Not Reported	Data Not Reported	11.8
Average pH (SU)	Data Not Reported	Data Not Reported	8.7
Average Dissolved Oxygen (mg/L)	Data Not Reported	Data Not Reported	10.74

Enhancement Structure Status of the Left Fork of Big Sourwood Branch (Reach 4)	
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	Some log deflectors and log sills now lie above water level. Cribbing structures remain in place. Cross veins, step pools, and rock riffles all functioning.

Bank Stability of Little Sue Branch (Reach 11)	
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 – banks moderately stable with infrequent, small areas of erosion mostly healed over, 5-30% of the banks in a reach with 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 Little Sue Branch (Reach 11) Monitoring Location 5

Species	Common Name	Number of Individuals Within Reach		Total By Species	Percent of Population
		Right Bank	Left Bank		
Acer rubrum	Red Maple	5	7	12	19.67
Acer sachrum	Sugar Maple	0	5	5	8.20
Betula lenta	Sweet Birch	0	5	5	8.20
Carpinus caroliniana	Ironwood	0	1	1	1.64
Fagus grandifolia	American Beech	4	11	15	24.59
Liriodendron tulipifera	Tulip Poplar	1	5	6	9.84
Magnolia macrophylla	Large Leaf Magnolia	4	0	4	6.56
Pinus rigida	Pich Pine	0	1	1	1.64
Platanus occidentalis	Sycamore	0	6	6	9.84
Quercus alba	White Oak	2	0	2	3.28
Quercus coccinea	Scarlet Oak	1	0	1	1.64
Tsuga canadensis	Eastern Hemlock	3	18	21	34.43
Ulmus ruba	Elm	0	1	1	1.64
TOTAL Trees in Riparian Zone Transect (5,000 Square Feet)		80			
Trees per Square Foot		0.016			
Trees per acre		696.96			

Tree and Shrub Assessment of Little Sue Branch (Reach 11) Monitoring Location 6					
Species	**Common Name**	**Number of Individuals Within Reach**		**Total By Species**	**Percent of Population**
		Right Bank	**Left Bank**		
Acer rubrum	Red Maple	1	4	5	8.20
Betula lenta	Sweet Birch	1	0	1	1.64
Carpinus caroliniana	Ironwood	1	1	2	3.28
Carya glabra	Pignut Hickory	1	0	1	1.64
Cornus florida	Flowering Dogwood	1	2	3	4.92
Fagus grandifolia	American Beech	5	9	14	22.95
Juglans nigra	Black Walnut	3	0	3	4.92
Lindera benzoin	Spice Bush	0	6	6	9.84
Liriodendron tulipifera	Tulip Poplar	4	6	10	16.39
Magnolia macrophylla	Large Leaf Magnolia	1	0	1	1.64
Platanus occidentalis	Sycamore	3	1	4	6.56
Tsuga canadensis	Eastern Hemlock	0	2	2	3.28
TOTAL Trees in total Riparian Zone (5,000 Square Feet)		52			
Trees per Square Foot		0.0104			
Trees per acre		453.024			

Vegetation Density and Diversity Summary of Little Sue Branch (Reach 11)		
Goals	**Year 2 (2012)**	
	Monitoring location 5	**Monitoring Location 6**
> 300 stems/acre	696 stems per acre (132% above stocking goal)	453 stems per acre (51% above stocking goal)
Tree species > 75% of stems/acre	Tree species comprise 100% of stems/acre	Tree species comprise 90% of stems/acre
> 6 species of trees and shrubs	13 species	12 species
Each species ≥ 10% of stems/acre, but < 50%	No species comprises >50% of the population. However, only 5 species comprise approximately 10% or more of the standing population.	No species comprises >50% of the population. However, only 3 species comprise approximately 10% or more of the standing population.
Presence of invasive species	None noted.	None noted.

Substrate Particle Size Distribution of Little Sue Branch (Reach 11)		
Percent less than	**Year 2 (2012) Particle Size (mm)**	
	Monitoring Location 5	**Monitoring Location 6**
D16	12.463	15.268
D35	24.93	26.92
D50	39.0	36.6
D65	54	46
D84	80	71
D95	116	180

Channel Dimensions of Little Sue Branch (Reach 11)		
Parameter		**Year 2 (2012)**
Average Channel Width (ft)		6.49
Average Channel Depth (ft)		0.52
Average Water Depth (ft)		0.17
Average Bank Slope	**Left Descending Bank**	2.42
	Right Descending Bank	8.34

Current Mitigation Status Summary

The primary goals of the mitigation project for Reach 11 are to improve aquatic biodiversity within the watershed, to reduce sediment loading by watershed improvements and improving bank stability, and to improve riparian functions. The post mitigation goal is to produce an EII rating of 0.72 within 5 years after construction and, ultimately an EII rating of 0.9 at maturity. Currently Reach 11 has an average EII rating of 0.63 (an average of both EII ratings at Monitoring Location 5: 0.60 and Monitoring Location 6: 0.63), after the 2nd year of monitoring. This EII score has not increased since the post-construction assessment, indicating that the reach is providing a stable habitat and is likely still experiencing the effects of erosion, sediment loading, and high specific conductance.

The average conductivity measurement for Reach 11 was 113 µhmos, which is slightly higher than the result obtained immediately following construction. While conductivities have increased since the post-construction measurements, 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 channel.

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 11 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. This reach

continues 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.

Both of the assessed monitoring locations within Reach 11 have met and exceeded the standard stocking goal of 300 tree and/or shrub stems per acre as well as the diversity requirement that these stems are comprised of more than 6 individual species. In addition, no invasive species have been noted within these reaches for the second monitoring year. However, the requirement that each of the six species comprise a minimum of 10% of the standing population has not yet been achieved. It may be necessary in future monitoring periods to initiate additional tree planting to meet the diversity goals.

Reach 11 had temperature, pH, and dissolved oxygen results sufficient for the support of macroinvertebrate populations. Additionally, the mitigation in Reach 11 has already achieved the stocking goal of 300 stems per acre in only the second year of monitoring and is progressing toward the prost-mitigation EII rating goal. This mitigation project is 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

APPENDIX B: RBP SHEETS

117-6225 Reach 11/6

SUMMIT ENGINEERING, INC.

HIGH GRADIENT FIELD DATA SHEET AND RBP

Stream Name	11/6	**Client**	Rev Energy
Site Number	11/6	**Project Name**	Mt. 71
Latitude (dd-mm-ss)	37.58447	**County**	Breathitt
Longitude (dd-mm-ss)	83.15853	**Quadrangle**	
General Location	Co	**Field Technician(s)**	CK/PJ
Reach Length	100	**Date & Time**	

WEATHER CONDITIONS

Weather Now	□ Sunny	□ Steady Rain	**Weather Past 24 Hours**	□ Sunny	□ Steady Rain	**Weather Last 7 Days**	□ Sunny	□ Steady Rain
	☒ Cloudy	□ Heavy Rain		☒ Cloudy	□ Heavy Rain		☒ Cloudy	□ Heavy Rain
	□ Showers	□ Temp: 50 °F		☒ Showers	□ Snow		□ Showers	□ Snow

FIELD WATER CHEMISTRY DATA & PHOTOS

pH (S.U.)	Temperature (°C)	Dissolved O_2 (mg/L)	Conductivity (µS)	Velocity (ft/s)	Picture #
8.9	6.6	9.85	100	1.4/sec.	117-6225

STREAM CLASSIFICATION & WATER DESCRIPTION

Stream Subsystem	□ Ephemeral	☒ Intermittent	□ Perennial		
Stream Type	√ High-Gradient	☒ Headwater	□ Wadeable	□ Warm-water	□ Cold-water
Odors	☒ None	□ Sewage	□ Eggs	□ Petroleum	□ Other: _____
Surface Oils	☒ None	□ Slick	□ Sheen	□ Globs	□ Flecks
Turbidity	☒ Clear	□ Slightly turbid	□ Turbid	□ Opaque	□ Stained

CROSS-SECTION DATA & FLOW

Across (X)													
Depth ( )													

Stream Flow Observed	□ Dry	□ Pooled	□ Low	☒ Normal	**Area (sq. ft)**	
	□ High	□ Very Rapid			**Flow (cfs)**	

PHYSICAL DESCRIPTIONS

Immediate Land Use & Structures	☒ Forest	□ Partial Forest	□ Field	□ Logging	□ Agriculture	□ Residential	□ Commercial	□ Industrial	□ Mining
	□ Dam	□ Culvert	□ Bridge	□ Paved Road	□ Gravel Road	☒ Dirt Road	□ Other:		

Vegetation Assessment	☒	Trees	□	Fully Exposed (0-25%)
	☒	Grasses	□	Partially Exposed (25-50%)
	□	Shrubs	□	Partially Shaded (50-75%)
	☒	Herbaceous	□	Fully Shaded (75-100%)

Vegetative Species

Describe Substrate	
Riffle Variability	□ Shallow Riffles □ Moderate Riffles □ Thick Riffles

Riffle 70% Pool 10% Run 20%

AQUATIC LIFE		ADDITIONAL COMMENTS
Salamanders	□	Total Pic #s for Reach 11 are #
Crayfish	□	
Frogs	□	
Mollusks	□	
Fishes	□	
Beaver Damage	□	
Algae/Periphyton	□	
Aquatic Vegetation	□	

HABITAT SAMPLED		AMOUNT
□	Undercut/Root (6 jabs & 1 for roots)	
□	Aquatic Vegetation/Justicia (3 jabs)	
□	Woody Debris [H=2-4 m, W=3-6 m]	
□	Rocks Picks [H=5 (pools), W=15]	
□	Sieved Sediments [3 (1 from ea regime)]	
□	Bedrock [3 sweeps (pool/run)]	
□	Leaf Packs [9 (3 from ea regime)]	
□	Aufwuchs (3 jabs)	

Stream Name	11/6	Site Number	11/6

High Gradient Rapid Bioassessment Protocol Data Sheet

Parameter	Optimal	Suboptimal	Marginal	Poor
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 not new fall and not 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
Embeddedness RIFFLES	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment.	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
Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).	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 (usually slow-deep).
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
Sediment Deposition POOLS!!!	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 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% (80% for low-gradient) 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
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
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.	Channelization may be extensive; embankments or shoring structures present on both banks	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In-stream 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
Riffle Frequency (or bends)	Occurrence of riffles relatively frequent; variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
Bank Stability (score each bank)	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 frequent 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
Vegetative Protection (score each bank)	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the stream bank 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank 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
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.
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:

(11/6)

Reach 11/5 | 117-6226

SUMMIT ENGINEERING, INC.
HIGH GRADIENT FIELD DATA SHEET AND RBP

Stream Name	Reach 11/5	**Client**	Revelation Energy, LLC
Site Number	11/5	**Project Name**	
Latitude (dd-mm-ss)	37.58387, ✗	**County**	Brethitt
Longitude (dd-mm-ss)	✗ 83.15769	**Quadrangle**	
General Location		**Field Technician(s)**	PJ/JA
Reach Length	100ft	**Date & Time**	1/29/13 10:00am

WEATHER CONDITIONS

Weather Now	☐ Sunny	☐ Steady Rain	**Weather Past 24 Hours**	☐ Sunny	☐ Steady Rain	**Weather Last 7 Days**	☑ Sunny	☐ Steady Rain
	☑ Cloudy	☐ Heavy Rain		☐ Cloudy	☐ Heavy Rain		☑ Cloudy	☐ Heavy Rain
	☐ Showers	☐ Temp:____°F		☑ Showers	☐ Snow		☑ Showers	☐ Snow

FIELD WATER CHEMISTRY DATA & PHOTOS

pH (S.U.)	Temperature (°C)	Dissolved O_2 (mg/L)	Conductivity (µS)	Velocity (ft/s)	Picture #
8.5	5.2	11.62	126	1.0	

STREAM CLASSIFICATION & WATER DESCRIPTION

Stream Subsystem	☐ Ephemeral	☑ Intermittent	☐ Perennial		
Stream Type	√ High-Gradient	☑ Headwater	☐ Wadeable	☐ Warm-water	☐ Cold-water
Odors	☑ None	☐ Sewage	☐ Eggs	☐ Petroleum	☐ Other: _____
Surface Oils	☑ None	☐ Slick	☐ Sheen	☐ Globs	☐ Flecks
Turbidity	☐ Clear	☑ Slightly turbid	☐ Turbid	☐ Opaque	☐ Stained

CROSS-SECTION DATA & FLOW

Across ( )													
Depth ( )													

Stream Flow Observed	☐ Dry	☐ Pooled	☐ Low	☑ Normal	**Area (sq. ft)**	
	☐ High	☐ Very Rapid			**Flow (cfs)**	

PHYSICAL DESCRIPTIONS

Immediate Land Use & Structures	☑ Forest ☑ Partial Forest ☐ Field ☐ Logging ☐ Agriculture ☐ Residential ☐ Commercial ☐ Industrial ☑ Mining		
	☐ Dam ☐ Culvert ☐ Bridge ☐ Paved Road ☐ Gravel Road ☑ Dirt Road ☐ Other:		
Vegetation Assessment	☐ Trees	☐ Fully Exposed (0-25%)	**Vegetative Species**
	☐ Grasses	☐ Partially Exposed (25-50%)	Tulip tree, Red Maple, E. Hemlock, Am beech, Sycamore
	☐ Shrubs	☑ Partially Shaded (50-75%)	
	☐ Herbaceous	☐ Fully Shaded (75-100%)	
Describe Substrate	Abundance of Cobble and gravel.		
Riffle Variability	☑ Shallow Riffles ☐ Moderate Riffles ☐ Thick Riffles		Riffle 80% Pool 10% Run 10%

AQUATIC LIFE		ADDITIONAL COMMENTS	HABITAT SAMPLED		AMOUNT
Salamanders	☐	117-6226 3 pics for 117-6295. All of Reach 11	☐	**Undercut/Root (6 jabs & 1 for roots)**	
Crayfish	☐		☐	**Aquatic Vegetation/Justicia (3 jabs)**	
Frogs	☐		☐	**Woody Debris [H=2-4 m, W=3-6 m]**	
Mollusks	☐		☐	**Rocks Picks [H=5 (pools), W=15]**	
Fishes	☐		☐	**Sieved Sediments [3 (1 from ea regime)]**	
Beaver Damage	☐		☐	**Bedrock [3 sweeps (pool/run)]**	
Algae/Periphyton	☐		☐	**Leaf Packs [9 (3 from ea regime)]**	
Aquatic Vegetation	☐		☐	**Aufwuchs (3 jabs)**	

Stream Name	W/S	Site Number	W/S

High Gradient Rapid Bioassessment Protocol Data Sheet

Parameter	Optimal	Suboptimal	Marginal	Poor
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 not new fall and not 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
Embeddedness POOLS!!!	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment.	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
Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).	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 (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
Sediment Deposition POOLS!!!	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 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% (80% for low-gradient) 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
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
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.	Channelization may be extensive; embankments or shoring structures present on both banks	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In-stream 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
Riffle Frequency (or bends)	Occurrence of riffles relatively frequent; variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Bank Stability (score each bank)	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 frequent 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
Vegetative Protection (score each bank)	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the stream bank 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank 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
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.
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:

APPENDIX C: EII CALCULATIONS

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

****(Family Level Taxonomy - All Habitats)****

Project ID:	Revelation Energy, LLC
Stream/Reach:	Little Sus Branch (Reach 11) Monitoring Location 6
Assessment Objectives:	2nd Annual Monitoring Period

EII	Model
[illegible]	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
[illegible]	Ecological Integrity Index (Habitat Integrity + Conductivity)

Variables	Measure	Units
>>>>>>>	Enter quantitative or categorical measure from Field Data Sheet in shaded cells	
RBP Habitat Parameters		
1. Epifaunal Substrate	12	no units
2. Embeddedness	10	no units
3. Velocity/Depth Regime	13	no units
4. Sediment Deposition	10	no units
5. Channel Flow Status	17	no units
6. Channel Alteration	11	no units
7. Freq. Of Riffles (bends)	9	no units
8. Bank stability (both combined)	14	no units
9. Veg. Protection (both combined)	14	no units
10. Riparian Width (both combined)	12	no units
Total Habitat Score	122	no units

Macroinvertebrate Data - Family Level (All Habitats)			Subindex
11. Family Taxa Richness		# of taxa sampled	
12. Family EPT Richness		# of EPT species sampled	
13. % Ephemeroptera		% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta		% Midges & Worms (0-100)	
15. mFBI		no units	
	100		

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

****(Family Level Taxonomy - All Habitats)****

Project ID:	Revelation Energy, LLC
Stream/Reach:	Little Sue Branch (Reach 11) Monitoring Location 5
Assessment Objectives:	2nd Annual Monitoring Period

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0-60	Ecological Integrity Index (Habitat Integrity + Conductivity)

	Variables	Measure	Units
>>>>>>>	Enter quantitative or categorical measure from Field Data Sheet in shaded cells		
	RBP Habitat Parameters		
	1. Epifaunal Substrate	12	no units
	2. Embeddedness	10	no units
	3. Velocity/Depth Regime	10	no units
	4. Sediment Deposition	7	no units
	5. Channel Flow Status	5	no units
	6. Channel Alteration	5	no units
	7. Freq. Of Riffles (bends)	13	no units
	8. Bank stability (both combined)	16	no units
	9. Veg. Protection (both combined)	11	no units
	10. Riparian Width (both combined)	12	no units
	Total Habitat Score	110	no units
	Macroinvertebrate Data - Family Level (All Habitats)		
	11. Family Taxa Richness		# of taxa sampled
	12. Family EPT Richness		# of EPT species sampled
	13. % Ephemeroptera		% Mayflies (0-100)
	14. % Chironomidae & Oligochaeta		% Midges & Worms (0-100)
	15. mFBI		no units
		126	

Subindex

APPENDIX D: RIPARIAN ZONE TREE AND SHRUB TRANSECTS

Tree Density for Mitigation Monitoring Sites

Company: Revelation Energy Stream Name: Reach 11/5

Site No.: 11/5 Lat: 37.58387 Long: 83.15769 Date: 1/29/13

left Bank

Species: Pitch Pine	Species: Tulip Tree	Species: Sweet Birch
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings: 1
DBH: 8.5	DBH: 5.0, 7.6, 6.5, 10.0	DBH: 5.6, 4.2, 4.4, 6.8
	Ø 10.9	
Species: Eastern Hemlock	Species: Red Maple	Species: American Beech
Seedlings:	Seedlings:	Seedlings:
Saplings: IIII IIII I	Saplings: II	Saplings: IIII IIII
DBH: 4.3, 3.5, 4.0, 4.2, 6.0	DBH: 4, 4.1, 4.0, 5.5, 5.6	DBH: 7.0, 5.0
4.6, 5.5		

Species: Sycamore	Species: Large leaf Magnolia	Species: Elm
Seedlings:	Seedlings:	Seedlings:
Saplings: 11	Saplings:	Saplings:
DBH: 11.1, 9.2, 16, 15.3	DBH: 7.5, 6.3, 5.2	DBH: 9.6
Species: Sugar maple	Species: Iron Wood	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings: 1110	Saplings:	Saplings:
DBH: 4.1, 21.5	DBH: 4.0	DBH:
Species:	Species:	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH:	DBH:	DBH:

Tree Density for Mitigation Monitoring Sites

Company: Revelation Energy Stream Name: Reach 11/5

Site No.: 11/5 Lat: 37.58387 Long: 82.15769 Date: 1/29/13

Right Bank

Species: Beech (American)	Species: Scarlet Oak	Species: Red Maple
Seedlings:	Seedlings:	Seedlings:
Saplings: 1	Saplings:	Saplings: 111
DBH: 12.5, 12.2, 14.5	DBH: 13	DBH: 12
Species: White Oak	Species: Large Leaf Magnolia	Species: Eastern Hemlock
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings: 11
DBH: 10.5, 14	DBH: 1	DBH: 5.1

Species: Tulip Tree	Species:	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH: 22	DBH:	DBH:
Species:	Species:	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH:	DBH:	DBH:
Species:	Species:	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH:	DBH:	DBH:

Revelation Energy, LLC					
Tree and Shrub Assessment of Little Sue Branch (Reach 11) Monitoring Location 5					
Species	**Common Name**	**Number of Individuals Within Reach**		**Total By Species**	**Percent of Population**
		Right Bank	**Left Bank**		
Acer rubrum	Red Maple	5	7	12	19.67
Acer sachrum	Sugar Maple	0	5	5	8.20
Betula lenta	Sweet Birch	0	5	5	8.20
Carpinus caroliniana	Ironwood	0	1	1	1.64
Fagus grandifolia	American Beech	4	11	15	24.59
Liriodendron tulipifera	Tulip Poplar	1	5	6	9.84
Magnolia macrophylla	Large Leaf Magnolia	4	0	4	6.56
Pinus rigida	Pich Pine	0	1	1	1.64
Platanus occidentalis	Sycamore	0	6	6	9.84
Quercus alba	White Oak	2	0	2	3.28
Quercus coccinea	Scarlet Oak	1	0	1	1.64
Tsuga canadensis	Eastern Hemlock	3	18	21	34.43
Ulmus ruba	Elm	0	1	1	1.64
TOTAL Trees in total Riparian Zone (5,000 Square Feet)		80			
Trees per Square Foot		0.016			
Trees per acre		696.96			

Tree Density for Mitigation Monitoring Sites

Company: Rev Energy Stream Name: 11/6

Site No.: Left Lat: Long: Date: 11/20/13

Species: Tulip	Species: Red Maple	Species: Spi Amore
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH: 5.2, 9.4, 6.5, 13 6.2, 6.3	DBH: 4.2, 6.3, 5.0, 9.4	DBH: 11.5
Species: Beech	Species: East. Hem	Species: Dog Wood
Seedlings:	Seedlings:	Seedlings:
Saplings: ~~HH~~	Saplings: 11	Saplings:
DBH: 4.0, 4.2, 4.1 4.2,	DBH:	DBH: 6.2, 4.0

Species: Iron Wood	Species: Spice Bush	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings: ||| /	Saplings:
DBH: 4.2	DBH:	DBH:
Species:	Species:	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH:	DBH:	DBH:
Species:	Species:	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH:	DBH:	DBH:

Tree Density for Mitigation Monitoring Sites

Company: Rev. Energy Stream Name: 11/6

Site No: 11/6 Lat: _____ Long: _____ Date: 1/28/13

Right Bank

Species: Sycamore	Species: Tulip	Species: Dog Wood
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH: 7.5, 20.6, 4.0	DBH: 9.8, 10.2, 6.8, 12.5	DBH: 5.1
Species: Beech	Species: Ag. Leaf Mag	Species: Sweet Birch
Seedlings:	Seedlings:	Seedlings:
Saplings: 11	Saplings: 1	Saplings:
DBH: 7.2, 8.3, 4.2	DBH:	DBH: 9.9

Species: Red Maple	Species: Iron Wood	Species: Blk Walnut
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH: 6.2	DBH: 5.2	DBH: 11.1
Species: Pig Nut Hickory	Species:	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH: 41	DBH:	DBH:
Species:	Species:	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH:	DBH:	DBH:

Revelation Energy, LLC					
Tree and Shrub Assessment of Little Sue Branch (Reach 11) Monitoring Location 6					
Species	**Common Name**	**Number of Individuals Within Reach**		**Total By Species**	**Percent of Population**
		Right Bank	**Left Bank**		
Acer rubrum	Red Maple	1	4	5	8.20
Betula lenta	Sweet Birch	1	0	1	1.64
Carpinus caroliniana	Ironwood	1	1	2	3.28
Carya glabra	Pignut Hickory	1	0	1	1.64
Cornus florida	Flowering Dogwood	1	2	3	4.92
Fagus grandifolia	American Beech	5	9	14	22.95
Juglans nigra	Black Walnut	3	0	3	4.92
Lindera benzoin	Spice Bush	0	6	6	9.84
Liriodendron tulipifera	Tulip Poplar	4	6	10	16.39
Magnolia macrophylla	Large Leaf Magnolia	1	0	1	1.64
Platanus occidentalis	Sycamore	3	1	4	6.56
Tsuga canadensis	Eastern Hemlock	0	2	2	3.28
TOTAL Trees in total Riparian Zone (5,000 Square Feet)		52			
Trees per Square Foot		0.0104			
Trees per acre		453.024			