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MITIGATION MONITORING REPORT
Reach 8 - 2nd YEAR

Revelation Energy, LLC
KDNR Permit No. 813-0359
Corps ID No. 2003-1428

Responsible Organization

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

Project Location

Deep Ford 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. 813-0359
USACE ID No. LRL-2003-1428
Mitigation Reach 8**

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. 813-0387 (formerly KDNR Permit No. 813-0359, 813-0343, 813-0309, and 813-0263) Corps ID No. LRL 2003-1428. Revelation Energy, LLC has been charged with performing remedial stream enhancement work as part of a compensatory mitigation package approved by the U.S. Army Corps of Engineers (COE) on August 13th, 2003. 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 Deep Ford Branch (Reach 8) 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 8.

In-kind mitigation for both temporary and permanent impacts will consist of off-site stream restoration and enhancement of 4,417 linear feet of Deep Ford Branch (Reach 8). This reach 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. 813-0359 states that impacts to jurisdictional waters would result in a net loss of 3,090 linear feet of stream following the placement of four sediment structures. The ultimate post-mitigation goal is to produce an average EII rating of 0.71 for Reach 8 at maturity, resulting in an EIU value of 3,173.70. Attaining this post-mitigation goal would mean a net increase of 2,011.50 EIUs in Reach 8.

The restoration and enhancement of Reach8 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 report was 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.

Reach	Channel	Parameters Measured or Assessed	
		Conductivity, Habitat Evaluation, Riparian Vegetation Evaluation, Substrate Assessment, and Maintenance Evaluation	Stream Channel Survey
8	Deep Ford Branch	2/4/13 and 2/5/13	3/6/13 and 3/29/13

After two monitoring years, Reach 8 is progressing toward performance standards.

Project Description

Reach 8

The Deep Ford 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 at the confluence of Big Caney Creek at 37° 35' 50.61" N, 83° 07' 58.51" W and continues upstream for 4,417 feet to end at 37° 36' 26" N, 83° 08' 18" W. While the mitigation for this project only continues for 4,417 linear feet of Deep Ford Branch, a total of 9,600 linear feet of Deep Ford Branch have been mitigated in total. The remaining 5,183 feet of mitigation were constructed to partially mitigate losses associated with KDNR permit 860-0518 and, as such, are not addressed in this mitigation monitoring report. 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 Deep Ford Branch with Big Caney Creek at 37° 35' 50.61" N, 83° 07' 58.51" W upstream for 4,417 feet to 37° 36' 26" N, 83° 08' 18" W. See Appendix A for additional project location information.

The primary goals of the mitigation projects for Reach 8 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	5-Year Post-Mitigation EII Rating Goal	EII Rating Goal at Maturity	EIU Value at Maturity	Net Increase of EIUs at Maturity
8	1,162.20	0.46	0.71	3,173.70	2,011.50

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 Reach 8, a watershed 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. 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 8: Deep Ford Branch	0.71

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 be 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. Deep Ford Branch (Reach 8) Monitoring Results

Water Quality Parameters and Bioassessment Scores of Deep Ford Branch (Reach 8)			
Parameter	Immediately After Mitigation 2010	Year 1 2011	Year 2 2012
Average RBP Score	97	137	132.5
Conductivity (uhmos)	358	Data Not Reported	242
Average EII Score	0.26	Data Not Reported	0.58
Average Temperature (°C)	Data Not Reported	Data Not Reported	5.4
Average pH (SU)	Data Not Reported	Data Not Reported	8.65
Average Dissolved Oxygen (mg/L)	Data Not Reported	Data Not Reported	10.42

Enhancement Structure Status of Deep Ford Branch (Reach 8)	
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 now lie above water level while some log sills are submerged Cribbing structures remain in place for the most part. Log sills, step pools, root wads, and rock riffles functioning.

Bank Stability of Deep Ford Branch (Reach 8)	
Monitoring Year	RBP Score
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

Revelation Energy, LLC					
Tree and Shrub Assessment of Deep Ford Branch (Reach 8) Monitoring Location 1					
Species	Common Name	Number of Individuals Within Reach		Total By Species	Percent of Population
		Right Bank	Left Bank		
<i>Acer rubrum</i>	Red Maple	5	6	11	18.03
<i>Betula lenta</i>	Sweet Birch	3	2	5	8.20
<i>Carpinus caroliniana</i>	Ironwood	9	3	12	19.67
<i>Carya glabra</i>	Pignut Hickory	0	1	1	1.64
<i>Cornus florida</i>	Flowering Dogwood	0	2	2	3.28
<i>Fagus grandifolia</i>	American Beech	5	0	5	8.20
<i>Liriodendron tulipifera</i>	Tulip Poplar	6	0	6	9.84
<i>Magnolia macrophylla</i>	Large Leaf Magnolia	6	0	6	9.84
<i>Oxydendrum arboreum</i>	Sourwood	0	7	7	11.48
<i>Pinus virginiana</i>	Virginia Pine	0	2	2	3.28
<i>Platanus occidentalis</i>	Sycamore	12	4	16	26.23
<i>Quercus alba</i>	White Oak	0	7	7	11.48
<i>Quercus coccinea</i>	Scarlet Oak	1	2	3	4.92
<i>Tsuga canadensis</i>	Eastern Hemlock	4	26	30	49.18
TOTAL					
Trees in total Riparian Zone (5,000 Square Feet)		113			
Trees per Square Foot		0.0226			
Trees per acre		984.456			

Tree and Shrub Assessment of Deep Ford Branch (Reach 8) Monitoring Location 2					
Species	Common Name	Number of Individuals Within Reach		Total By Species	Percent of Population
		Right Bank	Left Bank		
<i>Acer rubrum</i>	Red Maple	6	4	10	16.39
<i>Betula lenta</i>	Sweet Birch	1	0	1	1.64
<i>Carpinus caroliniana</i>	Ironwood	3	3	6	9.84
<i>Fagus grandifolia</i>	American Beech	6	14	20	32.79
<i>Liriodendron tulipifera</i>	Tulip Poplar	5	1	6	9.84
<i>Magnolia macrophylla</i>	Large Leaf Magnolia	0	3	3	4.92
<i>Quercus alba</i>	White Oak	3	1	4	6.56
<i>Tsuga canadensis</i>	Eastern Hemlock	6	8	14	22.95
TOTAL					
Trees in total Riparian Zone (5,000 Square Feet)		64			
Trees per Square Foot		0.0128			
Trees per acre		557.568			

Vegetation Density and Diversity Summary of Deep Ford Branch (Reach 8)		
Goals	Year 2 (2012)	
	Monitoring location 1	Monitoring Location 2
> 300 stems/acre	984 stems per acre (228% above stocking goal)	557 stems per acre (85% 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	14 species	8 species
Each species ≥ 10% of stems/acre, but < 50%	<i>Tsuga Canadensis</i> comprises 49% of standing population. Six other species comprise approximately 10% or more each. Six remaining species comprise <10% each.	No species comprises 50% of the population; however, only five species comprise approximately 10% or more
Presence of invasive species	None noted.	None noted.

Substrate Particle Size Distribution of Deep Ford Branch (Reach 8)		
Percent less than	Year 2 (2012) Particle Size (mm)	
	Site 1	Site 2
D16	17.399	18.254
D35	23.52	22.60
D50	28.8	27.6
D65	36	34
D84	53	44
D95	76	59

Channel Dimensions of Deep Ford Branch (Reach 8)		
Parameter		Year 2 (2012)
Average Channel Width (ft)		9.91
Average Channel Depth (ft)		0.86
Average Water Depth (ft)		0.33
Average Bank Slope	Left Descending Bank	3.95: 1
	Right Descending Bank	4.95: 1

Current Mitigation Status Summary

The primary goals of the mitigation project for Reach 8 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 an EII rating of 0.46 in Reach 8 within 5 years after construction and, ultimately, an EII rating of 0.71 in this channel at maturity. Currently Reach 8 has an average EII rating of 0.58 (an average of both EII ratings at Monitoring Location 1: 0.58 and Monitoring Location 2: 0.58). Reach 8 has already achieved and surpassed the five- year EII goal of 0.46 after only the 2nd year of monitoring.

The average conductivity measurement for Reach 8 is 242 uhmos. Conductivity has decreased since the post-construction measurements. Additionally, it is anticipated that the conductivity levels for this channel 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.

While the bank stability of Reach 8 has not seen improvement since the first annual evaluation, it is important to note that the initial bank stability ranking was in the sub-optimal range to begin with. Further, bank stability has not decreased since this evaluation. While this reach continues to experience erosion in some areas, it is anticipated that the bank stability for this channel will continue to improve as areas of erosion heal with vegetation. Further, 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 Reach 8 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, 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 project in Reach 8 has not only achieved the stocking goal of 300 stems per acre, but has also already met and exceeded the five-year EII goal of 0.46 in only the second year of monitoring. 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 this reach.

APPENDIX A: MAPS

APPENDIX B: RBP SHEETS

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

Stream Name	Deepford 8-1	Client	Ken - Emery
Site Number	8-1	Project Name	restoration
Latitude (dd-mm-ss)	37.59829	County	Bradley
Longitude (dd-mm-ss)	-83.13310	Quadrangle	
General Location		Field Technician(s)	CA/VJ
Reach Length	100	Date & Time	2/4/13 11:00am

WEATHER CONDITIONS

Weather Now	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Steady Rain	Weather Past 24 Hours	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Steady Rain	Weather Last 7 Days	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Steady Rain
	<input checked="" type="checkbox"/> Cloudy	<input type="checkbox"/> Heavy Rain		<input checked="" type="checkbox"/> Cloudy	<input type="checkbox"/> Heavy Rain		<input checked="" type="checkbox"/> Cloudy	<input type="checkbox"/> Heavy Rain
	<input type="checkbox"/> Showers	Temp: 48°F		<input type="checkbox"/> Showers	<input type="checkbox"/> Snow		<input checked="" type="checkbox"/> Showers	<input type="checkbox"/> Snow

FIELD WATER CHEMISTRY DATA & PHOTOS

pH (S.U.)	Temperature (°C)	Dissolved O ₂ (mg/L)	Conductivity (µS)	Velocity (ft/s)	Picture #
8.8	5.3	10.58	238	1.4	117-6468

STREAM CLASSIFICATION & WATER DESCRIPTION

Stream Subsystem	<input type="checkbox"/> Ephemeral	<input checked="" type="checkbox"/> Intermittent	<input type="checkbox"/> Perennial
Stream Type	<input checked="" type="checkbox"/> High-Gradient	<input type="checkbox"/> Headwater	<input type="checkbox"/> Wadeable
Odors	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Sewage	<input type="checkbox"/> Eggs
Surface Oils	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Slick	<input type="checkbox"/> Sheen
Turbidity	<input checked="" type="checkbox"/> Clear	<input type="checkbox"/> Slightly turbid	<input type="checkbox"/> Turbid

CROSS-SECTION DATA & FLOW

Across ()														
Depth ()														
Stream Flow Observed	<input type="checkbox"/> Dry	<input type="checkbox"/> Pooled	<input type="checkbox"/> Low	<input type="checkbox"/> Normal	Area (sq. ft)									
	<input type="checkbox"/> High	<input type="checkbox"/> Very Rapid					Flow (cfs)							

PHYSICAL DESCRIPTIONS

Immediate Land Use & Structures	<input checked="" type="checkbox"/> Forest	<input type="checkbox"/> Partial Forest	<input type="checkbox"/> Field	<input type="checkbox"/> Logging	<input type="checkbox"/> Agriculture	<input type="checkbox"/> Residential	<input type="checkbox"/> Commercial	<input type="checkbox"/> Industrial	<input type="checkbox"/> Mining
	<input type="checkbox"/> Dam	<input type="checkbox"/> Culvert	<input type="checkbox"/> Bridge	<input type="checkbox"/> Paved Road	<input type="checkbox"/> Gravel Road	<input checked="" type="checkbox"/> Dirt Road	<input type="checkbox"/> Other:		
Vegetation Assessment	<input checked="" type="checkbox"/> Trees	<input type="checkbox"/> Fully Exposed (0-25%)			Vegetative Species				
	<input checked="" type="checkbox"/> Grasses	<input checked="" type="checkbox"/> Partially Exposed (25-50%)							
	<input type="checkbox"/> Shrubs	<input type="checkbox"/> Partially Shaded (50-75%)							
	<input checked="" type="checkbox"/> Herbaceous	<input type="checkbox"/> Fully Shaded (75-100%)							
Describe Substrate	Rocky - Good Quality								
Riffle Variability	<input type="checkbox"/> Shallow Riffles	<input checked="" type="checkbox"/> Moderate Riffles	<input type="checkbox"/> Thick Riffles	Riffle 75% Pool 15% Run 10%					

AQUATIC LIFE

ADDITIONAL COMMENTS

HABITAT SAMPLED

AMOUNT

Salamanders	<input type="checkbox"/>	Total Pils for Deepford 117-6468 to 117-6504	<input type="checkbox"/>	Undercut/Root (6 jabs & 1 for roots)	
Crayfish	<input type="checkbox"/>		<input type="checkbox"/>	Aquatic Vegetation/Justicia (3 jabs)	
Frogs	<input type="checkbox"/>		<input type="checkbox"/>	Woody Debris [H=2-4 m, W=3-6 m]	
Mollusks	<input type="checkbox"/>		<input type="checkbox"/>	Rocks Picks [H=5 (pools), W=15]	
Fishes	<input type="checkbox"/>		<input type="checkbox"/>	Sieved Sediments [3 (1 from ea regime)]	
Beaver Damage	<input type="checkbox"/>		<input type="checkbox"/>	Bedrock [3 sweeps (pool/run)]	
Algae/Periphyton	<input type="checkbox"/>		<input type="checkbox"/>	Leaf Packs [9 (3 from ea regime)]	
Aquatic Vegetation	<input type="checkbox"/>		<input type="checkbox"/>	Aufwuchs (3 jabs)	

Stream Name	Deepford Br.	Site Number	8-1
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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 <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
Embeddedness <i>RIFFLES</i>	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 <i>POOLS</i>	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:

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

Stream Name	<u>Deep Ford Br.</u>	Client	<u>Rev. Energy</u>
Site Number	<u>8-2</u>	Project Name	<u>mitigation</u>
Latitude (dd-mm-ss)	<u>37.60013</u>	County	<u>Breathitt</u>
Longitude (dd-mm-ss)	<u>83.13439</u>	Quadrangle	
General Location	<u>8-2</u>	Field Technician(s)	<u>C&PJS</u>
Reach Length		Date & Time	<u>2/5/13 12:00</u>

WEATHER CONDITIONS

Weather Now	<input type="checkbox"/> Sunny	<input type="checkbox"/> Steady Rain	Weather Past 24 Hours	<input type="checkbox"/> Sunny	<input type="checkbox"/> Steady Rain	Weather Last 7 Days	<input type="checkbox"/> Sunny	<input type="checkbox"/> Steady Rain
	<input checked="" type="checkbox"/> Cloudy	<input type="checkbox"/> Heavy Rain		<input checked="" type="checkbox"/> Cloudy	<input type="checkbox"/> Heavy Rain		<input checked="" type="checkbox"/> Cloudy	<input type="checkbox"/> Heavy Rain
	<input type="checkbox"/> Showers	Temp: <u> </u> °F		<input type="checkbox"/> Showers	<input type="checkbox"/> Snow		<input checked="" type="checkbox"/> Showers	<input type="checkbox"/> Snow

FIELD WATER CHEMISTRY DATA & PHOTOS

pH (S.U.)	Temperature (°C)	Dissolved O ₂ (mg/L)	Conductivity (µS)	Velocity (ft/s)	Picture #
<u>8.5</u>	<u>5.5</u>	<u>10.25</u>	<u>246</u>	<u>1.2</u>	<u>1176489</u>

STREAM CLASSIFICATION & WATER DESCRIPTION

Stream Subsystem	<input type="checkbox"/> Ephemeral	<input checked="" type="checkbox"/> Intermittent	<input type="checkbox"/> Perennial
Stream Type	<input checked="" type="checkbox"/> High-Gradient	<input type="checkbox"/> Headwater	<input type="checkbox"/> Wadecable
Odors	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Sewage	<input type="checkbox"/> Eggs
Surface Oils	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Slick	<input type="checkbox"/> Sheen
Turbidity	<input checked="" type="checkbox"/> Clear	<input type="checkbox"/> Slightly turbid	<input type="checkbox"/> Turbid

CROSS-SECTION DATA & FLOW

Across ()	<u>X</u>													
Depth ()														
Stream Flow Observed	<input type="checkbox"/> Dry	<input type="checkbox"/> Pooled	<input type="checkbox"/> Low	<input type="checkbox"/> Normal	Area (sq. ft)									
	<input type="checkbox"/> High	<input type="checkbox"/> Very Rapid					Flow (cfs)							

PHYSICAL DESCRIPTIONS

Immediate Land Use & Structures	<input checked="" type="checkbox"/> Forest	<input type="checkbox"/> Partial Forest	<input type="checkbox"/> Field	<input type="checkbox"/> Logging	<input type="checkbox"/> Agriculture	<input type="checkbox"/> Residential	<input type="checkbox"/> Commercial	<input type="checkbox"/> Industrial	<input type="checkbox"/> Mining
	<input type="checkbox"/> Dam	<input type="checkbox"/> Culvert	<input type="checkbox"/> Bridge	<input type="checkbox"/> Paved Road	<input type="checkbox"/> Gravel Road	<input checked="" type="checkbox"/> Dirt Road	<input type="checkbox"/> Other:		
Vegetation Assessment	<input checked="" type="checkbox"/> Trees	<input type="checkbox"/> Fully Exposed (0-25%)			Vegetative Species				
	<input checked="" type="checkbox"/> Grasses	<input checked="" type="checkbox"/> Partially Exposed (25-50%)							
	<input type="checkbox"/> Shrubs	<input type="checkbox"/> Partially Shaded (50-75%)							
	<input checked="" type="checkbox"/> Herbaceous	<input type="checkbox"/> Fully Shaded (75-100%)							
Describe Substrate									
Riffle Variability	<input type="checkbox"/> Shallow Riffles	<input checked="" type="checkbox"/> Moderate Riffles	<input type="checkbox"/> Thick Riffles	Riffle <u>70%</u> Pool <u>20%</u> Run <u>10%</u>					

AQUATIC LIFE

ADDITIONAL COMMENTS

HABITAT SAMPLED

AMOUNT

Salamanders	<input type="checkbox"/>		<input type="checkbox"/>	Undercut/Root (6 jabs & 1 for roots)	
Crayfish	<input type="checkbox"/>		<input type="checkbox"/>	Aquatic Vegetation/Justicia (3 jabs)	
Frogs	<input type="checkbox"/>		<input type="checkbox"/>	Woody Debris [H=2-4 m, W=3-6 m]	
Mollusks	<input type="checkbox"/>		<input type="checkbox"/>	Rocks Picks [H=5 (pools), W=15]	
Fishes	<input type="checkbox"/>		<input type="checkbox"/>	Sieved Sediments [3 (1 from ea regime)]	
Beaver Damage	<input type="checkbox"/>		<input type="checkbox"/>	Bedrock [3 sweeps (pool/run)]	
Algae/Periphyton	<input type="checkbox"/>		<input type="checkbox"/>	Leaf Packs [9 (3 from ea regime)]	
Aquatic Vegetation	<input type="checkbox"/>		<input type="checkbox"/>	Aufwuchs (3 jabs)	

Stream Name	8-2 Dep F-2B	Site Number	8-2
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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 <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
Embeddedness <i>R. HPC/BSH</i>	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 <i>POOL/SH</i>	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:	Deep Ford Branch (Reach 8) Monitoring Location 1
Assessment Objectives:	2nd Annual Monitoring Period

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.88	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	13	no units
2. Embeddedness	14	no units
3. Velocity/Depth Regime	13	no units
4. Sediment Deposition	12	no units
5. Channel Flow Status	18	no units
6. Channel Alteration	11	no units
7. Freq. Of Riffles (bends)	11	no units
8. Bank stability (both combined)	15	no units
9. Veg. Protection (both combined)	13	no units
10. Riparian Width (both combined)	12	no units

Total Habitat Score 132 no units

Subindex

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

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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:	Deep Ford Branch (Reach 8) Monitoring Location 2
Assessment Objectives:	2nd Annual Monitoring Period

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.58	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	14	no units
2. Embeddedness	15	no units
3. Velocity/Depth Regime	12	no units
4. Sediment Deposition	11	no units
5. Channel Flow Status	19	no units
6. Channel Alteration	11	no units
7. Freq. Of Riffles (bends)	12	no units
8. Bank stability (both combined)	10	no units
9. Veg. Protection (both combined)	11	no units
10. Riparian Width (both combined)	15	no units

Total Habitat Score 133 no units

Subindex

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

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APPENDIX D: RIPARIAN ZONE TREE AND SHRUB TRANSECTS

Tree Density for Mitigation Monitoring Sites

Company: Rev Energy Stream Name: 8-1 Deepford
 Site No.: 8-1 Lat: 37.59829 Long: 83.13310 Date: 2-5-13
Left Bank

Species: <u>Sycamore</u> Seedlings:	Species: <u>Dogwood</u> Seedlings:	Species: <u>Red Maple</u> Seedlings:
Saplings:	Saplings: <u>1</u>	Saplings: <u>1111</u>
DBH: <u>4.1, 7.3, 8.2,</u> <u>6.5,</u>	DBH: <u>4.0,</u>	DBH:
Species: <u>Iron wood</u> Seedlings:	Species: <u>White Oak</u> Seedlings:	Species: <u>Sour Wood</u> Seedlings:
Saplings: <u>111</u>	Saplings:	Saplings: <u>111</u>
DBH:	DBH: <u>12.3, 14.2, 4.8,</u> <u>5.2, 8.2, 8.0, 7.8,</u>	DBH: <u>4.0, 4.1, 4.0, 4.2</u>

Species: <i>Eastern Hem</i>	Species: <i>Virginia Pine</i>	Species: <i>Swamp Birch</i>
Seedlings:	Seedlings:	Seedlings:
Saplings: <i>HT HT HT HT</i>	Saplings:	Saplings: <i>//</i>
DBH: <i>10.8, 4.0, 4.2, 22.5, 4.2, 4.1,</i>	DBH: <i>11.8, 12.0</i>	DBH:
Species: <i>Scarlet Oak</i>	Species: <i>Pignut Hickory</i>	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH: <i>8.5, 12.4,</i>	DBH: <i>4.3,</i>	DBH:
Species:	Species:	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH:	DBH:	DBH:

Tree Density for Mitigation Monitoring Sites

Company: EW Energy Stream Name: B-1 Deepford

Site No.: B-1 Lat: 37.59829 Long: 83.13310 Date:

Kt Bandy

Species: <u>Red maple</u> Seedlings:	Species: <u>Sycamore</u> Seedlings:	Species: <u>Tulip</u> Seedlings:
Saplings: <u>///</u>	Saplings: <u>///</u>	Saplings:
DBH: <u>8.3, 4.3</u>	DBH: <u>8.2, 15.4, 13.6</u> <u>21.3, 9.5, 11.5,</u> <u>8.7,</u>	DBH: <u>11.2, 10.0, 13.8</u> <u>14.1, 9.8, 8.5</u>
Species: <u>Iron wood</u> Seedlings:	Species: <u>Beech</u> Seedlings:	Species: <u>Soft. Hem.</u> Seedlings:
Saplings: <u>///</u>	Saplings: <u>///</u>	Saplings: <u>///</u>
DBH: <u>5.2, 4.4, 4.1,</u> <u>4.0, 4.2, 4.0</u>	DBH: <u>4.2,</u>	DBH: <u>10.4,</u>

Species: <i>rg. Leaf May.</i>	Species: <i>Sweet Oak</i>	Species: <i>Green Birch</i>
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
<i>111-1</i>		
DBH:	DBH:	DBH:
	<i>15.6</i>	<i>10.2, 13.0, 5.0</i>
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 Deep Ford Branch (Reach 8) Monitoring Location 1						
Species	Common Name	Number of Individuals Within Reach		Total By Species	Percent of Population	
		Right Bank	Left Bank			
<i>Acer rubrum</i>	Red Maple	5	6	11	18.03	
<i>Betula lenta</i>	Sweet Birch	3	2	5	8.20	
<i>Carpinus caroliniana</i>	Ironwood	9	3	12	19.67	
<i>Carya glabra</i>	Pignut Hickory	0	1	1	1.64	
<i>Cornus florida</i>	Flowering Dogwood	0	2	2	3.28	
<i>Fagus grandifolia</i>	American Beech	5	0	5	8.20	
<i>Liriodendron tulipifera</i>	Tulip Poplar	6	0	6	9.84	
<i>Magnolia macrophylla</i>	Large Leaf Magnolia	6	0	6	9.84	
<i>Oxydendrum arboreum</i>	Sourwood	0	7	7	11.48	
<i>Pinus virginiana</i>	Virginia Pine	0	2	2	3.28	
<i>Platanus occidentalis</i>	Sycamore	12	4	16	26.23	
<i>Quercus alba</i>	White Oak	0	7	7	11.48	
<i>Quercus coccinea</i>	Scarlet Oak	1	2	3	4.92	
<i>Tsuga canadensis</i>	Eastern Hemlock	4	26	30	49.18	
TOTAL		113				
Trees in total Riparian Zone (5,000 Square Feet)						
Trees per Square Foot		0.0226				
Trees per acre		984.456				

Tree Density for Mitigation Monitoring Sites

Company: Red Energy Stream Name: Deep Ford Br.
 Site No.: 8-2 Lat: 37.6003 Long: -83.13439 Date: 2/5/13
Left Bank

Species: <u>13. LAF. mag.</u> Seedlings:	Species: <u>Tulip Tree</u> Seedlings:	Species: <u>CASC. Hem.</u> Seedlings:
Saplings: <u>11</u>	Saplings:	Saplings: <u>111</u>
DBH: <u>4.3</u>	DBH: <u>11.0</u>	DBH: <u>16.5, 4.0, 4.2,</u>
Species: <u>Beech</u> Seedlings:	Species: <u>White Oak</u> Seedlings:	Species: <u>Red Maple</u> Seedlings:
Saplings: <u>111 111 1</u>	Saplings:	Saplings: <u>111</u>
DBH: <u>15.2, 18.5, 10.0,</u>	DBH: <u>4.0,</u>	DBH: <u>7.9,</u>

Species: <i>Iron Wood</i>	Species:	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings: ///	Saplings:	Saplings:
DBH:	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: RW Energy Stream Name: Deep Ford Br.

Site No.: 8-2 Lat: 37.60013 Long: -83.13439 Date: 2/5/13
Rd. Bank

Species: <u>Beech</u> Seedlings:	Species: <u>White Oak</u> Seedlings:	Species: <u>East Hem.</u> Seedlings:
Saplings: <u>///</u>	Saplings:	Saplings: <u>/// 1</u>
DBH: <u>8.9, 7.9, 13.0,</u>	DBH: <u>6.8, 7.2, 25.2,</u>	DBH:
Species: <u>Sweet Birch</u> Seedlings:	Species: <u>Tulip Tree</u> Seedlings:	Species: <u>Pine Wood</u> Seedlings:
Saplings:	Saplings:	Saplings: <u>///</u>
DBH: <u>4.0,</u>	DBH: <u>10.5, 12.2, 15.8,</u> <u>9.2, 14.0,</u>	DBH:

Species: <i>Red Maple</i>	Species:	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings: <i>1111</i>	Saplings:	Saplings:
DBH: <i>7.9</i>	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 Deep Ford Branch (Reach 8) Monitoring Location 2					
Species	Common Name	Number of Individuals Within Reach		Total By Species	Percent of Population
		Right Bank	Left Bank		
<i>Acer rubrum</i>	Red Maple	6	4	10	16.39
<i>Betula lenta</i>	Sweet Birch	1	0	1	1.64
<i>Carpinus caroliniana</i>	Ironwood	3	3	6	9.84
<i>Fagus grandifolia</i>	American Beech	6	14	20	32.79
<i>Liriodendron tulipifera</i>	Tulip Poplar	5	1	6	9.84
<i>Magnolia macrophylla</i>	Large Leaf Magnolia	0	3	3	4.92
<i>Quercus alba</i>	White Oak	3	1	4	6.56
<i>Tsuga canadensis</i>	Eastern Hemlock	6	8	14	22.95
TOTAL		64			
Trees in total Riparian Zone (5,000 Square Feet)					
Trees per Square Foot		0.0128			
Trees per acre		557.568			