

CONFIDENTIAL PROPRIETARY TRADE SECRET

High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: S014			LOCATION: Bigbone, KY		
STATION #: N/A			COUNTY: Boone		PROGRAM: PROJECT:
INVESTIGATORS: SM, JF			DATE: 3/30/2016		TIME Start: (24hr) Finish:
Verify Site LAT/LONG vs GPS <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> N/A					
		Reach			
		Downstream	Upstream		
LAT				CANOPY COVER:: <input checked="" type="checkbox"/> Fully Exposed (0-25%) <input type="checkbox"/> Partially Exposed (25-50%) <input type="checkbox"/> Partially Shaded (50-75%) <input type="checkbox"/> Fully Shaded (75-100%)	
LONG				STREAM TYPE: <input type="checkbox"/> Perennial <input type="checkbox"/> Ephemeral <input checked="" type="checkbox"/> Intermittent	
WEATHER Has there been a scouring rain in the last 14 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):		
Now <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input checked="" type="checkbox"/> Intermittent showers <input checked="" type="checkbox"/> Clear/sunny <input type="checkbox"/> Cloudy			Past 24 hours <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input type="checkbox"/> Clear/sunny <input type="checkbox"/> Cloudy		
			<input type="checkbox"/> Surface Mining <input type="checkbox"/> Deep Mining <input type="checkbox"/> Oil Wells <input type="checkbox"/> Land Disposal <input checked="" type="checkbox"/> Residential		
			<input type="checkbox"/> Construction <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> Row Crops		
			<input type="checkbox"/> Forest <input type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Silviculture <input type="checkbox"/> Urban Runoff/Storm Sewers		
INSTREAM FEATURES Stream Width <u>1.5</u> ft Maximum Depth <u>0.5</u> ft Reach Length <u>101</u> m		HYDRAULIC STRUCTURES <input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input checked="" type="checkbox"/> Other: Catch basin		STREAM FLOW <input type="checkbox"/> Dry <input type="checkbox"/> Pooled <input type="checkbox"/> Low <input type="checkbox"/> High <input checked="" type="checkbox"/> Normal	
Riffle/Run/Pool Sequence (No. Sampled in Reach) 1 Riffle 1 Run 1 Pool		RIPARIAN VEGETATION Dominate Type: <input checked="" type="checkbox"/> Trees <input checked="" type="checkbox"/> Herbaceous <input type="checkbox"/> Grasses <input type="checkbox"/> Shrubs Number of strata <u> </u> Dom. Tree/Shrub Taxa <i>Juniperus virginiana, Andropogon sp.</i>		CHANNEL ALTERATIONS <input type="checkbox"/> Dredging <input checked="" type="checkbox"/> Channelization (<input type="checkbox"/> Full <input type="checkbox"/> Partial)	
P-CHEM Instrument Used: _____ Date Calibrated: _____					
Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Cond. _____ Turb. _____					
Sample Collection Verification					
Algae Sample: <input type="checkbox"/> QualMHC <input type="checkbox"/> Other <input type="checkbox"/> Visual Assessment Lead Collector: _____					
Fish <input type="checkbox"/> BPEF <input type="checkbox"/> Seine <input type="checkbox"/> Other Time: BPEF Seine Lead Collector: _____					
Habitat <input type="checkbox"/> RBP <input type="checkbox"/> Substrate <input type="checkbox"/> Other: _____ Lead Collector: _____					
Invertebrates <input type="checkbox"/> 1m ² <input type="checkbox"/> Qual <input type="checkbox"/> Other: _____ Lead Collector: _____ <input type="checkbox"/> 20 Jab (#Jabs: Cobble _____ Snags _____ Veg. Banks _____ Sand _____ Macrophytes _____ Other _____)					
Tissue: No. of Samples collected _____ Sp: _____ Lead Collector: _____					
Water Chem <input type="checkbox"/> Acid/Alk <input type="checkbox"/> Bulk <input type="checkbox"/> Nutrients <input type="checkbox"/> Metals <input type="checkbox"/> Low Hg Lead Collector: _____ <input type="checkbox"/> Herbicides <input type="checkbox"/> Pesticides <input type="checkbox"/> Ortho P <input type="checkbox"/> Other: _____					
Duplicate Samples Taken: _____					
Substrate Characterization					
Substrate <input checked="" type="checkbox"/> Est. <input type="checkbox"/> P.C.	Riffle <u>80</u> %	Run <u>10</u> %	Pool <u>10</u> %	Reach Total	
Silt/Clay (<0.06 mm)				50	
Sand (0.06 – 2 mm)				10	
Gravel (2-64 mm)				25	
Cobble (64 – 256 mm)				10	
Boulders (>256 mm)				5	
Bedrock				0	

NOTES/COMMENTS:

SITE NOT SAMPLED:	
<input type="checkbox"/> Land owner denial	<input type="checkbox"/> Dry <input type="checkbox"/> Too deep/Impounded
<input type="checkbox"/> Site not found/Secluded	<input type="checkbox"/> Unsafe
<input type="checkbox"/> Other (indicate under comments)	

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RBP High Gradient Habitat

Habitat Parameter	Condition Category																				
	Optimal					Suboptimal					Marginal					Poor					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1. Epifaunal Substrate/ Available Cover 7 Score	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.					
2. Embeddedness 10 Score	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.					
3. Velocity/ Depth Regime 8 Score	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)					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).					
4. Sediment Deposition 10 Score	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; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
5. Channel Flow Status 11 Score	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.					
6. Channel Alteration 8 Score	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
7. Frequency of Riffles (or bends) 11 Score	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); 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.					
Left/Right Bank	10	9				8	7	6			5	4	3			2	1				0
8. Bank Stability LB 4 RB 4	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.					
9. Vegetative Protection 5 LB 5 RB 5	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the 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.					
10. Riparian Vegetative Zone Width LB 6 RB 3	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.					

Total Score

NOTES/COMMENTS:

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High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: S015			LOCATION: Bigbone, KY		
STATION #: N/A			COUNTY: Boone		PROGRAM: PROJECT:
INVESTIGATORS: SM, JF			DATE: 3/30/2016		TIME Start: (24hr) Finish:
Verify Site LAT/LONG vs GPS <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> N/A					
		Reach			
		Station			
		Downstream		Upstream	
LAT				CANOPY COVER:: <input checked="" type="checkbox"/> Fully Exposed (0-25%) <input type="checkbox"/> Partially Exposed (25-50%) <input type="checkbox"/> Partially Shaded (50-75%) <input type="checkbox"/> Fully Shaded (75-100%)	
LONG				STREAM TYPE: <input type="checkbox"/> Perennial <input type="checkbox"/> Ephemeral <input checked="" type="checkbox"/> Intermittent	
WEATHER			LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):		
Has there been a scouring rain in the last 14 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			<input type="checkbox"/> Surface Mining <input type="checkbox"/> Deep Mining <input type="checkbox"/> Oil Wells <input type="checkbox"/> Land Disposal <input checked="" type="checkbox"/> Residential <input type="checkbox"/> Construction <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> Row Crops <input type="checkbox"/> Forest <input type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Silviculture <input type="checkbox"/> Urban Runoff/Storm Sewers		
Now		Past 24 hours			
<input type="checkbox"/> Heavy rain		<input type="checkbox"/> Steady rain			
<input type="checkbox"/> Intermittent showers		<input type="checkbox"/> Clear/sunny			
<input type="checkbox"/> Cloudy					
INSTREAM FEATURES		HYDRAULIC STRUCTURES		RIPARIAN VEGETATION	
Stream Width <u>2</u> ft		<input type="checkbox"/> Dams		Dominate Type: <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Herbaceous <input checked="" type="checkbox"/> Grasses <input type="checkbox"/> Shrubs	
Maximum Depth <u>1</u> ft		<input type="checkbox"/> Bridge Abutments		Number of strata <u>3</u> Dom. Tree/Shrub Taxa	
Reach Length <u>.18</u> m		<input type="checkbox"/> Island		Juniperus virginiana, Poa sp.	
Riffle/Run/Pool Sequence (No. Sampled in Reach)		<input type="checkbox"/> Waterfalls		CHANNEL ALTERATIONS	
<u>1</u> Riffle <u>1</u> Run <u>1</u> Pool		<input checked="" type="checkbox"/> Other: Culvert		<input type="checkbox"/> Dredging <input checked="" type="checkbox"/> Channelization (<input checked="" type="checkbox"/> Full <input type="checkbox"/> Partial)	
P-CHEM Instrument Used: _____ Date Calibrated: _____					
Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Cond. _____ Turb. _____					
Sample Collection Verification					
Algae Sample: <input type="checkbox"/> QualMHC <input type="checkbox"/> Other <input type="checkbox"/> Visual Assessment Lead Collector: _____					
Fish <input type="checkbox"/> BPEF <input type="checkbox"/> Seine <input type="checkbox"/> Other Time: BPEF Seine Lead Collector: _____					
Habitat <input type="checkbox"/> RBP <input type="checkbox"/> Substrate <input type="checkbox"/> Other: _____ Lead Collector: _____					
Invertebrates <input type="checkbox"/> 1m ² <input type="checkbox"/> Qual <input type="checkbox"/> Other: _____ Lead Collector: _____					
<input type="checkbox"/> 20 Jab (#Jabs: Cobble _____ Snags _____ Veg. Banks _____ Sand _____ Macrophytes _____ Other _____)					
Tissue: No. of Samples collected _____ Sp: _____ Lead Collector: _____					
Water Chem <input type="checkbox"/> Acid/Alk <input type="checkbox"/> Bulk <input type="checkbox"/> Nutrients <input type="checkbox"/> Metals <input type="checkbox"/> Low Hg Lead Collector: _____					
<input type="checkbox"/> Herbicides <input type="checkbox"/> Pesticides <input type="checkbox"/> Ortho P <input type="checkbox"/> Other: _____					
Duplicate Samples Taken:					
Substrate Characterization					
Substrate <input type="checkbox"/> Est. <input type="checkbox"/> P.C.	Riffle <u>35</u> %	Run <u>35</u> %	Pool <u>30</u> %	Reach Total	
Silt/Clay (<0.06 mm)				40	
Sand (0.06 – 2 mm)				25	
Gravel (2-64 mm)				25	
Cobble (64 – 256 mm)				10	
Boulders (>256 mm)				0	
Bedrock				0	

NOTES/COMMENTS:

SITE NOT SAMPLED:		
<input type="checkbox"/> Land owner denial	<input type="checkbox"/> Dry	<input type="checkbox"/> Too deep/Impounded
<input type="checkbox"/> Site not found/Secluded	<input type="checkbox"/> Unsafe	
<input type="checkbox"/> Other (indicate under comments)		

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RBP High Gradient Habitat

Habitat Parameter	Condition Category																				
	Optimal					Suboptimal					Marginal					Poor					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1. Epifaunal Substrate/ Available Cover 6 Score	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.					
2. Embeddedness 3 Score	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.					
3. Velocity/ Depth Regime 7 Score	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)					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).					
4. Sediment Deposition 2 Score	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; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
5. Channel Flow Status 11 Score	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.					
6. Channel Alteration 7 Score	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
7. Frequency of Riffles (or bends) 2 Score	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); 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.					
Left/Right Bank	10	9				8	7	6			5	4	3			2	1				0
8. Bank Stability LB 2 RB 2	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.					
9. Vegetative Protection LB 4 RB 4	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the 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.					
10. Riparian Vegetative Zone Width LB 2 RB 4	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.					

Total Score

NOTES/COMMENTS:

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High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: S017			LOCATION: Bigbone, KY		
STATION #: N/A			COUNTY: Boone		PROGRAM: PROJECT:
INVESTIGATORS: SM, JF			DATE: 3/30/2016	TIME (24hr)	Start: Finish:
Verify Site LAT/LONG vs GPS <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> N/A					
		Reach			
	Station	Downstream	Upstream		
LAT				CANOPY COVER:: <input type="checkbox"/> Fully Exposed (0-25%) <input type="checkbox"/> Partially Exposed (25-50%) <input checked="" type="checkbox"/> Partially Shaded (50-75%) <input type="checkbox"/> Fully Shaded (75-100%)	
LONG				STREAM TYPE: <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Ephemeral <input type="checkbox"/> Intermittent	
WEATHER Has there been a scouring rain in the last 14 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):		
Now <input type="checkbox"/> Heavy rain Past 24 hours <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input checked="" type="checkbox"/> Clear/sunny <input type="checkbox"/> Cloudy			<input type="checkbox"/> Surface Mining <input type="checkbox"/> Deep Mining <input type="checkbox"/> Oil Wells <input type="checkbox"/> Land Disposal <input type="checkbox"/> Residential <input type="checkbox"/> Construction <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> Row Crops <input checked="" type="checkbox"/> Forest <input type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Silviculture <input type="checkbox"/> Urban Runoff/Storm Sewers		
INSTREAM FEATURES		HYDRAULIC STRUCTURES		RIPARIAN VEGETATION	
Stream Width <u>8</u> ft Maximum Depth <u>2</u> ft Reach Length <u>50</u> m Riffle/Run/Pool Sequence (No. Sampled in Reach) <u>2</u> Riffle <u>2</u> Run <u>2</u> Pool		<input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input checked="" type="checkbox"/> Other: Culvert		Dominate Type: <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Herbaceous <input type="checkbox"/> Grasses <input type="checkbox"/> Shrubs Number of strata <u> </u> Dom. Tree/Shrub Taxa Acer negundo, Erythronium americanum	
		STREAM FLOW		CHANNEL ALTERATIONS	
		<input type="checkbox"/> Dry <input type="checkbox"/> Pooled <input type="checkbox"/> Low <input type="checkbox"/> High <input checked="" type="checkbox"/> Normal		<input type="checkbox"/> Dredging <input checked="" type="checkbox"/> Channelization <input type="checkbox"/> Full <input checked="" type="checkbox"/> Partial	
P-CHEM Instrument Used: _____ Date Calibrated: _____					
Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Cond. _____ Turb. _____					
Sample Collection Verification					
Algae Sample: <input type="checkbox"/> QualMHC <input type="checkbox"/> Other <input type="checkbox"/> Visual Assessment Lead Collector: _____					
Fish <input type="checkbox"/> BPEF <input type="checkbox"/> Seine <input type="checkbox"/> Other Time: BPEF Seine Lead Collector: _____					
Habitat <input type="checkbox"/> RBP <input type="checkbox"/> Substrate <input type="checkbox"/> Other: _____ Lead Collector: _____					
Invertebrates <input type="checkbox"/> 1m ² <input type="checkbox"/> Qual <input type="checkbox"/> Other: _____ Lead Collector: _____ <input type="checkbox"/> 20 Jab (#Jabs: Cobble _____ Snags _____ Veg. Banks _____ Sand _____ Macrophytes _____ Other _____)					
Tissue: No. of Samples collected _____ Sp: _____ Lead Collector: _____					
Water Chem <input type="checkbox"/> Acid/Alk <input type="checkbox"/> Bulk <input type="checkbox"/> Nutrients <input type="checkbox"/> Metals <input type="checkbox"/> Low Hg Lead Collector: _____ <input type="checkbox"/> Herbicides <input type="checkbox"/> Pesticides <input type="checkbox"/> Ortho P <input type="checkbox"/> Other: _____					
Duplicate Samples Taken: _____					
Substrate Characterization					
Substrate <input type="checkbox"/> Est. <input type="checkbox"/> P.C.	Riffle <u>50</u> %	Run <u>20</u> %	Pool <u>30</u> %	Reach Total	
Silt/Clay (<0.06 mm)				30	
Sand (0.06 – 2 mm)				20	
Gravel (2-64 mm)				20	
Cobble (64 – 256 mm)				20	
Boulders (>256 mm)				5	
Bedrock				5	

NOTES/COMMENTS:

SITE NOT SAMPLED:		
<input type="checkbox"/> Land owner denial	<input type="checkbox"/> Dry	<input type="checkbox"/> Too deep/Impounded
<input type="checkbox"/> Site not found/Secluded	<input type="checkbox"/> Unsafe	
<input type="checkbox"/> Other (indicate under comments)		

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RBP High Gradient Habitat

Habitat Parameter	Condition Category																				
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2. Embeddedness Score 10	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.					
3. Velocity/ Depth Regime Score 16	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)					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).					
4. Sediment Deposition Score 11	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; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
5. Channel Flow Status Score 10	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.					
6. Channel Alteration Score 11	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
7. Frequency of Riffles (or bends) Score 15	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); 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.					
Left/Right Bank	10	9				8	7	6			5	4	3			2	1				0
8. Bank Stability LB 6 RB 6	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.					
9. Vegetative Protection LB 6 RB 6	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the 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.					
10. Riparian Vegetative Zone Width LB 6 RB 6	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.					

Total Score

NOTES/COMMENTS:

125

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High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: S023			LOCATION: Bigbone, KY		
STATION #: N/A			COUNTY: Boone		PROGRAM: PROJECT:
INVESTIGATORS: SM, JF			DATE: 3/30/2016		TIME Start: (24hr) Finish:
Verify Site LAT/LONG vs GPS <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> N/A					
Reach			CANOPY COVER::		STREAM TYPE:
Station		Downstream		Upstream	
LAT				<input checked="" type="checkbox"/> Fully Exposed (0-25%)	<input checked="" type="checkbox"/> Perennial
LONG				<input type="checkbox"/> Partially Exposed (25-50%)	<input type="checkbox"/> Ephemeral
				<input type="checkbox"/> Partially Shaded (50-75%)	<input type="checkbox"/> Intermittent
				<input type="checkbox"/> Fully Shaded (75-100%)	
WEATHER Has there been a scouring rain in the last 14 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use): <input type="checkbox"/> Surface Mining <input type="checkbox"/> Deep Mining <input type="checkbox"/> Oil Wells <input type="checkbox"/> Land Disposal <input type="checkbox"/> Residential <input type="checkbox"/> Construction <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> Row Crops <input type="checkbox"/> Forest <input checked="" type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Silviculture <input type="checkbox"/> Urban Runoff/Storm Sewers		
INSTREAM FEATURES Stream Width <u>3.5</u> ft Maximum Depth <u>1.5</u> ft Reach Length <u>18</u> m Riffle/Run/Pool Sequence (No. Sampled in Reach) <u>2</u> Riffle <u>1</u> Run <u>1</u> Pool		HYDRAULIC STRUCTURES <input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input checked="" type="checkbox"/> Other: Culvert		STREAM FLOW <input type="checkbox"/> Dry <input type="checkbox"/> Pooled <input type="checkbox"/> Low <input type="checkbox"/> High <input checked="" type="checkbox"/> Normal	
			RIPARIAN VEGETATION Dominate Type: <input type="checkbox"/> Trees <input checked="" type="checkbox"/> Herbaceous <input checked="" type="checkbox"/> Grasses <input type="checkbox"/> Shrubs Number of strata <u> </u> Dom. Tree/Shrub Taxa Poa sp., Taraxacum officinale		CHANNEL ALTERATIONS <input type="checkbox"/> Dredging <input checked="" type="checkbox"/> Channelization <input type="checkbox"/> Full <input checked="" type="checkbox"/> Partial Culvert
P-CHEM Instrument Used: _____ Date Calibrated: _____					
Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Cond. _____ Turb. _____					
Sample Collection Verification					
Algae Sample: <input type="checkbox"/> QualMHC <input type="checkbox"/> Other <input type="checkbox"/> Visual Assessment Lead Collector: _____					
Fish <input type="checkbox"/> BPEF <input type="checkbox"/> Seine <input type="checkbox"/> Other Time: BPEF Seine Lead Collector: _____					
Habitat <input type="checkbox"/> RBP <input type="checkbox"/> Substrate <input type="checkbox"/> Other: _____ Lead Collector: _____					
Invertebrates <input type="checkbox"/> 1m ² <input type="checkbox"/> Qual <input type="checkbox"/> Other: _____ Lead Collector: _____ <input type="checkbox"/> 20 Jab (#Jabs: Cobble _____ Snags _____ Veg. Banks _____ Sand _____ Macrophytes _____ Other _____)					
Tissue: No. of Samples collected _____ Sp: _____ Lead Collector: _____					
Water Chem <input type="checkbox"/> Acid/Alk <input type="checkbox"/> Bulk <input type="checkbox"/> Nutrients <input type="checkbox"/> Metals <input type="checkbox"/> Low Hg Lead Collector: _____ <input type="checkbox"/> Herbicides <input type="checkbox"/> Pesticides <input type="checkbox"/> Ortho P <input type="checkbox"/> Other:					
Duplicate Samples Taken:					
Substrate Characterization					
Substrate <input type="checkbox"/> Est. <input type="checkbox"/> P.C.	Riffle <u>40</u> %	Run <u>30</u> %	Pool <u>30</u> %	Reach Total	
Silt/Clay (<0.06 mm)				40	
Sand (0.06 – 2 mm)				20	
Gravel (2-64 mm)				20	
Cobble (64 – 256 mm)				10	
Boulders (>256 mm)				5	
Bedrock				5	

NOTES/COMMENTS:

SITE NOT SAMPLED:		
<input type="checkbox"/> Land owner denial	<input type="checkbox"/> Dry	<input type="checkbox"/> Too deep/Impounded
<input type="checkbox"/> Site not found/Secluded	<input type="checkbox"/> Unsafe	
<input type="checkbox"/> Other (indicate under comments)		

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RBP High Gradient Habitat

Habitat Parameter	Condition Category																				
	Optimal					Suboptimal					Marginal					Poor					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1. Epifaunal Substrate/ Available Cover Score 12	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.					
2. Embeddedness Score 8	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.					
3. Velocity/ Depth Regime Score 12	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)					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).					
4. Sediment Deposition Score 6	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; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
5. Channel Flow Status Score 10	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.					
6. Channel Alteration Score 11	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
7. Frequency of Riffles (or bends) Score 12	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); 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.					
Left/Right Bank	10	9				8	7	6			5	4	3			2	1				0
8. Bank Stability LB 6 RB 6	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.					
9. Vegetative Protection LB 3 RB 3	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the 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.					
10. Riparian Vegetative Zone Width LB 0 RB 0	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.					

Total Score

NOTES/COMMENTS:

89

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High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: S025			LOCATION: Bigbone, KY				
STATION #: N/A			COUNTY: Boone		PROGRAM: PROJECT:		
INVESTIGATORS: SM, JF			DATE: 3/30/2016		TIME Start: (24hr) Finish:		
Verify Site LAT/LONG vs GPS <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> N/A							
Station		Reach		CANOPY COVER: <input type="checkbox"/> Fully Exposed (0-25%) <input checked="" type="checkbox"/> Partially Exposed (25-50%) <input type="checkbox"/> Partially Shaded (50-75%) <input type="checkbox"/> Fully Shaded (75-100%)			
		Downstream				STREAM TYPE: <input type="checkbox"/> Perennial <input type="checkbox"/> Ephemeral <input checked="" type="checkbox"/> Intermittent	
		Upstream					
LAT							
LONG							
WEATHER Has there been a scouring rain in the last 14 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Now Past 24 hours <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input checked="" type="checkbox"/> Intermittent showers <input type="checkbox"/> Clear/sunny <input type="checkbox"/> Cloudy				
			LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use): <input type="checkbox"/> Surface Mining <input type="checkbox"/> Deep Mining <input type="checkbox"/> Oil Wells <input type="checkbox"/> Land Disposal <input checked="" type="checkbox"/> Residential <input type="checkbox"/> Construction <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> Row Crops <input type="checkbox"/> Forest <input type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Silviculture <input type="checkbox"/> Urban Runoff/Storm Sewers				
INSTREAM FEATURES Stream Width <u>3</u> ft Maximum Depth <u>1</u> ft Reach Length <u>30</u> m Riffle/Run/Pool Sequence (No. Sampled in Reach) <u>1</u> Riffle <u>0</u> Run <u>2</u> Pool		HYDRAULIC STRUCTURES <input type="checkbox"/> Dams <input checked="" type="checkbox"/> Bridge Abutments <input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input type="checkbox"/> Other:		STREAM FLOW <input checked="" type="checkbox"/> Dry <input type="checkbox"/> Pooled <input type="checkbox"/> Low <input type="checkbox"/> High <input type="checkbox"/> Normal			
		RIPARIAN VEGETATION Dominate Type: <input type="checkbox"/> Trees <input checked="" type="checkbox"/> Herbaceous <input type="checkbox"/> Grasses <input type="checkbox"/> Shrubs Number of strata ___ Dom. Tree/Shrub Taxa Dipsacus sp.		CHANNEL ALTERATIONS <input type="checkbox"/> Dredging <input checked="" type="checkbox"/> Channelization <input type="checkbox"/> Full <input type="checkbox"/> Partial			
P-CHEM Instrument Used: _____ Date Calibrated: _____ Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Cond. _____ Turb. _____							
Sample Collection Verification							
Algae		Sample: <input type="checkbox"/> QualMHC <input type="checkbox"/> Other		<input type="checkbox"/> Visual Assessment			
Fish		<input type="checkbox"/> BPEF <input type="checkbox"/> Seine <input type="checkbox"/> Other		Time: BPEF Seine			
Habitat		<input type="checkbox"/> RBP <input type="checkbox"/> Substrate <input type="checkbox"/> Other:		Lead Collector:			
Invertebrates		<input type="checkbox"/> 1m ² <input type="checkbox"/> Qual <input type="checkbox"/> Other:		Lead Collector:			
		<input type="checkbox"/> 20 Jab (#Jabs: Cobble _____ Snags _____ Veg. Banks _____ Sand _____ Macrophytes _____ Other _____)					
Tissue:		No. of Samples collected _____ Sp:		Lead Collector:			
Water Chem		<input type="checkbox"/> Acid/Alk <input type="checkbox"/> Bulk <input type="checkbox"/> Nutrients <input type="checkbox"/> Metals <input type="checkbox"/> Low Hg		Lead Collector:			
		<input type="checkbox"/> Herbicides <input type="checkbox"/> Pesticides <input type="checkbox"/> Ortho P <input type="checkbox"/> Other:					
Duplicate Samples Taken:							
Substrate Characterization							
Substrate <input checked="" type="checkbox"/> Est. <input type="checkbox"/> P.C.	Riffle ¹⁰ %	Run ⁰ %	Pool ⁹⁰ %	Reach Total			
Silt/Clay (<0.06 mm)				50			
Sand (0.06 – 2 mm)				10			
Gravel (2-64 mm)				20			
Cobble (64 – 256 mm)				15			
Boulders (>256 mm)				5			
Bedrock				0			

NOTES/COMMENTS:

SITE NOT SAMPLED:		
<input type="checkbox"/> Land owner denial	<input type="checkbox"/> Dry	<input type="checkbox"/> Too deep/Impounded
<input type="checkbox"/> Site not found/Secluded	<input type="checkbox"/> Unsafe	
<input type="checkbox"/> Other (indicate under comments)		

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RBP High Gradient Habitat

Habitat Parameter	Condition Category																				
	Optimal					Suboptimal					Marginal					Poor					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1. Epifaunal Substrate/ Available Cover Score 8	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.					
2. Embeddedness Score 6	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.					
3. Velocity/ Depth Regime Score 5	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)					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).					
4. Sediment Deposition Score 7	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; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
5. Channel Flow Status Score 6	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.					
6. Channel Alteration Score 3	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
7. Frequency of Riffles (or bends) Score 6	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); 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.					
Left/Right Bank	10	9				8	7	6			5	4	3			2	1				0
8. Bank Stability LB 3 RB 3	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.					
9. Vegetative Protection LB 8 RB 8	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the 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.					
10. Riparian Vegetative Zone Width LB 3 RB 3	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.					

Total Score

NOTES/COMMENTS:

69

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High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: S028			LOCATION: Bigbone, KY		
STATION #: N/A			COUNTY: Boone		PROGRAM: PROJECT:
INVESTIGATORS: SM, JF			DATE: 3/30/2016		TIME Start: (24hr) Finish:
Verify Site LAT/LONG vs GPS <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> N/A					
		Reach			
		Downstream		Upstream	
LAT				CANOPY COVER:: <input type="checkbox"/> Fully Exposed (0-25%) <input type="checkbox"/> Partially Exposed (25-50%) <input checked="" type="checkbox"/> Partially Shaded (50-75%) <input type="checkbox"/> Fully Shaded (75-100%)	
LONG				STREAM TYPE: <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Ephemeral <input type="checkbox"/> Intermittent	
WEATHER Has there been a scouring rain in the last 14 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):		
Now <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input checked="" type="checkbox"/> Intermittent showers <input checked="" type="checkbox"/> Clear/sunny <input type="checkbox"/> Cloudy			Past 24 hours <input type="checkbox"/> Surface Mining <input type="checkbox"/> Deep Mining <input type="checkbox"/> Oil Wells <input type="checkbox"/> Land Disposal <input checked="" type="checkbox"/> Residential		
			<input type="checkbox"/> Construction <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> Row Crops		
			<input type="checkbox"/> Forest <input type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Silviculture <input type="checkbox"/> Urban Runoff/Storm Sewers		
INSTREAM FEATURES Stream Width ¹⁰ _____ ft Maximum Depth ³ _____ ft Reach Length ¹⁸ _____ m		HYDRAULIC STRUCTURES <input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input checked="" type="checkbox"/> Other: Bridge culvert		STREAM FLOW <input type="checkbox"/> Dry <input type="checkbox"/> Pooled <input type="checkbox"/> Low <input type="checkbox"/> High <input checked="" type="checkbox"/> Normal	
Riffle/Run/Pool Sequence (No. Sampled in Reach) 2 Riffle 1 Run 1 Pool		RIPARIAN VEGETATION Dominate Type: <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Herbaceous <input type="checkbox"/> Grasses <input checked="" type="checkbox"/> Shrubs Number of strata <u>2</u> Dom. Tree/Shrub Taxa Acer negundo, Lonicera sp.		CHANNEL ALTERATIONS <input type="checkbox"/> Dredging <input checked="" type="checkbox"/> Channelization (<input type="checkbox"/> Full <input checked="" type="checkbox"/> Partial) Bridge	
P-CHEM Instrument Used: _____ Date Calibrated: _____					
Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Cond. _____ Turb. _____					
Sample Collection Verification					
Algae Sample: <input type="checkbox"/> QualMHC <input type="checkbox"/> Other <input type="checkbox"/> Visual Assessment Lead Collector: _____					
Fish <input type="checkbox"/> BPEF <input type="checkbox"/> Seine <input type="checkbox"/> Other Time: BPEF Seine Lead Collector: _____					
Habitat <input type="checkbox"/> RBP <input type="checkbox"/> Substrate <input type="checkbox"/> Other: _____ Lead Collector: _____					
Invertebrates <input type="checkbox"/> 1m ² <input type="checkbox"/> Qual <input type="checkbox"/> Other: _____ Lead Collector: _____ <input type="checkbox"/> 20 Jab (#Jabs: Cobble _____ Snags _____ Veg. Banks _____ Sand _____ Macrophytes _____ Other _____)					
Tissue: No. of Samples collected _____ Sp: _____ Lead Collector: _____					
Water Chem <input type="checkbox"/> Acid/Alk <input type="checkbox"/> Bulk <input type="checkbox"/> Nutrients <input type="checkbox"/> Metals <input type="checkbox"/> Low Hg Lead Collector: _____ <input type="checkbox"/> Herbicides <input type="checkbox"/> Pesticides <input type="checkbox"/> Ortho P <input type="checkbox"/> Other:					
Duplicate Samples Taken:					
Substrate Characterization					
Substrate <input type="checkbox"/> Est. <input type="checkbox"/> P.C.	Riffle ²⁵ %	Run ²⁵ %	Pool ⁵⁰ %	Reach Total	
Silt/Clay (<0.06 mm)				20	
Sand (0.06 – 2 mm)				20	
Gravel (2-64 mm)				15	
Cobble (64 – 256 mm)				20	
Boulders (>256 mm)				15	
Bedrock				10	

NOTES/COMMENTS:

SITE NOT SAMPLED:		
<input type="checkbox"/> Land owner denial	<input type="checkbox"/> Dry	<input type="checkbox"/> Too deep/Impounded
<input type="checkbox"/> Site not found/Secluded	<input type="checkbox"/> Unsafe	
<input type="checkbox"/> Other (indicate under comments)		

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RBP High Gradient Habitat

Habitat Parameter	Condition Category																					
	Optimal					Suboptimal					Marginal					Poor						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
1. Epifaunal Substrate/ Available Cover 8 Score	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.						
2. Embeddedness 7 Score	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.						
3. Velocity/ Depth Regime 15 Score	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)					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).						
4. Sediment Deposition 8 Score	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; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.						
5. Channel Flow Status 13 Score	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.						
6. Channel Alteration 13 Score	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.						
7. Frequency of Riffles (or bends) 13 Score	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); 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.						
Left/Right Bank	10		9		8		7		6		5		4		3		2		1		0	
8. Bank Stability LB 2 RB 5	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.						
9. Vegetative Protection 3 LB 5 RB 5	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the 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.						
10. Riparian Vegetative Zone Width LB 0 RB 10	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone.					Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.					Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.					Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.						

Total Score

NOTES/COMMENTS:

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High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: S031			LOCATION: Bigbone, KY				
STATION #: N/A			COUNTY: Boone		PROGRAM: PROJECT:		
INVESTIGATORS: SM, JF			DATE: 3/30/16		TIME Start: (24hr) Finish:		
Verify Site LAT/LONG vs GPS <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> N/A							
Station		Reach		CANOPY COVER:: <input checked="" type="checkbox"/> Fully Exposed (0-25%) <input type="checkbox"/> Partially Exposed (25-50%) <input type="checkbox"/> Partially Shaded (50-75%) <input type="checkbox"/> Fully Shaded (75-100%)			
		Downstream				STREAM TYPE: <input type="checkbox"/> Perennial <input type="checkbox"/> Ephemeral <input checked="" type="checkbox"/> Intermittent	
		Upstream					
LAT							
LONG							
WEATHER Has there been a scouring rain in the last 14 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use): <input type="checkbox"/> Surface Mining <input type="checkbox"/> Deep Mining <input type="checkbox"/> Oil Wells <input type="checkbox"/> Land Disposal <input checked="" type="checkbox"/> Residential <input type="checkbox"/> Construction <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> Row Crops <input type="checkbox"/> Forest <input checked="" type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Silviculture <input type="checkbox"/> Urban Runoff/Storm Sewers				
INSTREAM FEATURES Stream Width <u>8</u> ft Maximum Depth <u>0.5</u> ft Reach Length <u>18</u> m Riffle/Run/Pool Sequence (No. Sampled in Reach) 1 Riffle 1 Run 1 Pool		HYDRAULIC STRUCTURES <input type="checkbox"/> Dams <input checked="" type="checkbox"/> Bridge Abutments <input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input checked="" type="checkbox"/> Other: culvert		STREAM FLOW <input type="checkbox"/> Dry <input type="checkbox"/> Pooled <input checked="" type="checkbox"/> Low <input type="checkbox"/> High <input type="checkbox"/> Normal			
		RIPARIAN VEGETATION Dominate Type: <input type="checkbox"/> Trees <input type="checkbox"/> Herbaceous <input checked="" type="checkbox"/> Grasses <input type="checkbox"/> Shrubs Number of strata <u>2</u> Dom. Tree/Shrub Taxa <i>Dipsacus sp., Poa pratensis</i>		CHANNEL ALTERATIONS <input type="checkbox"/> Dredging <input checked="" type="checkbox"/> Channelization <input type="checkbox"/> Full <input checked="" type="checkbox"/> Partial Culverted			
P-CHEM Instrument Used: _____ Date Calibrated: _____ Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Cond. _____ Turb. _____							
Sample Collection Verification							
Algae		Sample: <input type="checkbox"/> QualMHC <input type="checkbox"/> Other <input type="checkbox"/> Visual Assessment		Lead Collector: _____			
Fish		Time: <input type="checkbox"/> BPEF <input type="checkbox"/> Seine <input type="checkbox"/> Other		Lead Collector: _____			
Habitat		<input type="checkbox"/> RBP <input type="checkbox"/> Substrate <input type="checkbox"/> Other:		Lead Collector: _____			
Invertebrates		<input type="checkbox"/> 1m ² <input type="checkbox"/> Qual <input type="checkbox"/> Other:		Lead Collector: _____			
		<input type="checkbox"/> 20 Jab (#Jabs: Cobble _____ Snags _____ Veg. Banks _____ Sand _____ Macrophytes _____ Other _____)					
Tissue:		No. of Samples collected _____ Sp: _____		Lead Collector: _____			
Water Chem		<input type="checkbox"/> Acid/Alk <input type="checkbox"/> Bulk <input type="checkbox"/> Nutrients <input type="checkbox"/> Metals <input type="checkbox"/> Low Hg <input type="checkbox"/> Herbicides <input type="checkbox"/> Pesticides <input type="checkbox"/> Ortho P <input type="checkbox"/> Other:		Lead Collector: _____			
Duplicate Samples Taken:							
Substrate Characterization							
Substrate <input type="checkbox"/> Est. <input type="checkbox"/> P.C.	Riffle <u>25</u> %	Run <u>25</u> %	Pool <u>50</u> %	Reach Total			
Silt/Clay (<0.06 mm)				30			
Sand (0.06 – 2 mm)				20			
Gravel (2-64 mm)				20			
Cobble (64 – 256 mm)				30			
Boulders (>256 mm)				0			
Bedrock				0			

NOTES/COMMENTS:

SITE NOT SAMPLED:		
<input type="checkbox"/> Land owner denial	<input type="checkbox"/> Dry	<input type="checkbox"/> Too deep/Impounded
<input type="checkbox"/> Site not found/Secluded	<input type="checkbox"/> Unsafe	
<input type="checkbox"/> Other (indicate under comments)		

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RBP High Gradient Habitat

Habitat Parameter	Condition Category																				
	Optimal					Suboptimal					Marginal					Poor					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1. Epifaunal Substrate/ Available Cover Score 5	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.					
2. Embeddedness Score 6	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.					
3. Velocity/ Depth Regime Score 8	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)					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).					
4. Sediment Deposition Score 8	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; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
5. Channel Flow Status Score 7	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.					
6. Channel Alteration Score 3	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
7. Frequency of Riffles (or bends) Score 5	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); 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.					
Left/Right Bank	10	9				8	7	6			5	4	3			2	1				0
8. Bank Stability LB 4 RB 6	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.					
9. Vegetative Protection LB 4 RB 4	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the 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.					
10. Riparian Vegetative Zone Width LB 1 RB 1	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.					

Total Score

NOTES/COMMENTS:

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High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: S033			LOCATION: Bigbone, KY		
STATION #: N/A			COUNTY: Boone		PROGRAM: PROJECT:
INVESTIGATORS: SM, JF			DATE: 3/31/2016		TIME Start: (24hr) Finish:
Verify Site LAT/LONG vs GPS <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> N/A					
Station			Reach		
		Downstream		Upstream	
LAT					
LONG					
CANOPY COVER:: <input type="checkbox"/> Fully Exposed (0-25%) <input checked="" type="checkbox"/> Partially Exposed (25-50%) <input type="checkbox"/> Partially Shaded (50-75%) <input type="checkbox"/> Fully Shaded (75-100%)			STREAM TYPE: <input type="checkbox"/> Perennial <input type="checkbox"/> Ephemeral <input checked="" type="checkbox"/> Intermittent		
WEATHER Has there been a scouring rain in the last 14 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Now: <input checked="" type="checkbox"/> Heavy rain, <input type="checkbox"/> Steady rain, <input type="checkbox"/> Intermittent showers, <input type="checkbox"/> Clear/sunny, <input type="checkbox"/> Cloudy Past 24 hours: <input type="checkbox"/> Heavy rain, <input type="checkbox"/> Steady rain, <input checked="" type="checkbox"/> Intermittent showers, <input type="checkbox"/> Clear/sunny, <input type="checkbox"/> Cloudy			LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use): <input type="checkbox"/> Surface Mining, <input type="checkbox"/> Deep Mining, <input type="checkbox"/> Oil Wells, <input type="checkbox"/> Land Disposal, <input checked="" type="checkbox"/> Residential <input type="checkbox"/> Construction, <input type="checkbox"/> Commercial, <input type="checkbox"/> Industrial, <input type="checkbox"/> Row Crops <input type="checkbox"/> Forest, <input type="checkbox"/> Pasture/Grazing, <input type="checkbox"/> Silviculture, <input type="checkbox"/> Urban Runoff/Storm Sewers		
INSTREAM FEATURES Stream Width <u>6</u> ft Maximum Depth <u>3</u> ft Reach Length <u>9</u> m Riffle/Run/Pool Sequence (No. Sampled in Reach) 1 Riffle 1 Run 2 Pool		HYDRAULIC STRUCTURES <input type="checkbox"/> Dams <input checked="" type="checkbox"/> Bridge Abutments <input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input checked="" type="checkbox"/> Other: Culverted		STREAM FLOW <input type="checkbox"/> Dry <input checked="" type="checkbox"/> Pooled <input type="checkbox"/> Low <input type="checkbox"/> High <input type="checkbox"/> Normal	
		RIPARIAN VEGETATION Dominate Type: <input checked="" type="checkbox"/> Trees <input checked="" type="checkbox"/> Herbaceous <input checked="" type="checkbox"/> Grasses <input type="checkbox"/> Shrubs Number of strata ___ Dom. Tree/Shrub Taxa Acer negundo, Taraxacum officinale		CHANNEL ALTERATIONS <input type="checkbox"/> Dredging <input checked="" type="checkbox"/> Channelization (Full <input type="checkbox"/> Partial)	
P-CHEM Instrument Used: _____ Date Calibrated: _____ Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Cond. _____ Turb. _____					
Sample Collection Verification					
Algae Sample: <input type="checkbox"/> QualMHC <input type="checkbox"/> Other <input type="checkbox"/> Visual Assessment Lead Collector: _____					
Fish <input type="checkbox"/> BPEF <input type="checkbox"/> Seine <input type="checkbox"/> Other Time: BPEF Seine Lead Collector: _____					
Habitat <input type="checkbox"/> RBP <input type="checkbox"/> Substrate <input type="checkbox"/> Other: _____ Lead Collector: _____					
Invertebrates <input type="checkbox"/> 1m ² <input type="checkbox"/> Qual <input type="checkbox"/> Other: _____ Lead Collector: _____ <input type="checkbox"/> 20 Jab (#Jabs: Cobble _____ Snags _____ Veg. Banks _____ Sand _____ Macrophytes _____ Other _____)					
Tissue: No. of Samples collected _____ Sp: _____ Lead Collector: _____					
Water Chem <input type="checkbox"/> Acid/Alk <input type="checkbox"/> Bulk <input type="checkbox"/> Nutrients <input type="checkbox"/> Metals <input type="checkbox"/> Low Hg <input type="checkbox"/> Herbicides <input type="checkbox"/> Pesticides <input type="checkbox"/> Ortho P <input type="checkbox"/> Other: _____ Lead Collector: _____					
Duplicate Samples Taken: _____					
Substrate Characterization					
Substrate <input type="checkbox"/> Est. <input type="checkbox"/> P.C.	Riffle ⁴⁰ %	Run ¹⁰ %	Pool ⁵⁰ %	Reach Total	
Silt/Clay (<0.06 mm)				40	
Sand (0.06 – 2 mm)				10	
Gravel (2-64 mm)				20	
Cobble (64 – 256 mm)				20	
Boulders (>256 mm)				10	
Bedrock				0	

NOTES/COMMENTS:

SITE NOT SAMPLED:		
<input type="checkbox"/> Land owner denial	<input type="checkbox"/> Dry	<input type="checkbox"/> Too deep/Impounded
<input type="checkbox"/> Site not found/Secluded	<input type="checkbox"/> Unsafe	
<input type="checkbox"/> Other (indicate under comments)		

CONFIDENTIAL PROPRIETARY TRADE SECRET

RBP High Gradient Habitat

Habitat Parameter	Condition Category																				
	Optimal					Suboptimal					Marginal					Poor					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1. Epifaunal Substrate/ Available Cover Score 12	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.					
2. Embeddedness Score 10	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.					
3. Velocity/ Depth Regime Score 9	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)					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).					
4. Sediment Deposition Score 10	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; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
5. Channel Flow Status Score 8	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.					
6. Channel Alteration Score 4	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
7. Frequency of Riffles (or bends) Score 13	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); 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.					
Left/Right Bank	10	9				8	7	6			5	4	3			2	1	0			
8. Bank Stability LB 5 RB 5	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.					
9. Vegetative Protection 5 LB RB 5	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the 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.					
10. Riparian Vegetative Zone Width LB 2 RB 2	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.					

Total Score

NOTES/COMMENTS:

90

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High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: S037			LOCATION: Bigbone, KY		
STATION #: N/A			COUNTY: Boone		PROGRAM: PROJECT:
INVESTIGATORS: SM, JF			DATE: 3/31/2016		TIME Start: (24hr) Finish:
Verify Site LAT/LONG vs GPS <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> N/A					
Station			Reach		
		Downstream		Upstream	
LAT					
LONG					
			CANOPY COVER::		STREAM TYPE:
			<input checked="" type="checkbox"/> Fully Exposed (0-25%)		<input type="checkbox"/> Perennial
			<input type="checkbox"/> Partially Exposed (25-50%)		<input type="checkbox"/> Ephemeral
			<input type="checkbox"/> Partially Shaded (50-75%)		<input type="checkbox"/> Intermittent
			<input type="checkbox"/> Fully Shaded (75-100%)		
WEATHER			LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):		
Has there been a scouring rain in the last 14 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			<input type="checkbox"/> Surface Mining <input type="checkbox"/> Deep Mining <input type="checkbox"/> Oil Wells <input type="checkbox"/> Land Disposal <input checked="" type="checkbox"/> Residential		
Now <input type="checkbox"/> Heavy rain Past 24 hours <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input checked="" type="checkbox"/> Clear/sunny <input type="checkbox"/> Cloudy			<input type="checkbox"/> Construction <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> Row Crops <input type="checkbox"/> Forest <input type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Silviculture <input type="checkbox"/> Urban Runoff/Storm Sewers		
INSTREAM FEATURES		HYDRAULIC STRUCTURES		RIPARIAN VEGETATION	
Stream Width <u>3</u> ft		<input type="checkbox"/> Dams		Dominate Type:	
Maximum Depth <u>1</u> ft		<input type="checkbox"/> Bridge Abutments		<input type="checkbox"/> Trees <input checked="" type="checkbox"/> Herbaceous	
Reach Length <u>18</u> m		<input type="checkbox"/> Island		<input type="checkbox"/> Grasses <input type="checkbox"/> Shrubs	
Riffle/Run/Pool Sequence (No. Sampled in Reach)		<input type="checkbox"/> Waterfalls		Number of strata <u> </u> Dom.	
<u>1</u> Riffle <u>0</u> Run <u>1</u> Pool		<input checked="" type="checkbox"/> Other: Culvert		Tree/Shrub Taxa	
				Taraxacum officinale	
				CHANNEL ALTERATIONS	
				<input type="checkbox"/> Dredging	
				<input checked="" type="checkbox"/> Channelization	
				<input type="checkbox"/> Full <input checked="" type="checkbox"/> Partial	
P-CHEM Instrument Used: _____ Date Calibrated: _____					
Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Cond. _____ Turb. _____					
Sample Collection Verification					
Algae Sample: <input type="checkbox"/> QualMHC <input type="checkbox"/> Other <input type="checkbox"/> Visual Assessment Lead Collector: _____					
Fish <input type="checkbox"/> BPEF <input type="checkbox"/> Seine <input type="checkbox"/> Other Time: BPEF Seine Lead Collector: _____					
Habitat <input type="checkbox"/> RBP <input type="checkbox"/> Substrate <input type="checkbox"/> Other: Lead Collector: _____					
Invertebrates <input type="checkbox"/> 1m ² <input type="checkbox"/> Qual <input type="checkbox"/> Other: Lead Collector: _____					
<input type="checkbox"/> 20 Jab (#Jabs: Cobble _____ Snags _____ Veg. Banks _____ Sand _____ Macrophytes _____ Other _____)					
Tissue: No. of Samples collected _____ Sp: _____ Lead Collector: _____					
Water Chem <input type="checkbox"/> Acid/Alk <input type="checkbox"/> Bulk <input type="checkbox"/> Nutrients <input type="checkbox"/> Metals <input type="checkbox"/> Low Hg Lead Collector: _____					
<input type="checkbox"/> Herbicides <input type="checkbox"/> Pesticides <input type="checkbox"/> Ortho P <input type="checkbox"/> Other: _____					
Duplicate Samples Taken: _____					
Substrate Characterization					
Substrate <input type="checkbox"/> Est. <input type="checkbox"/> P.C.	Riffle <u>50</u> %	Run <u>25</u> %	Pool <u>25</u> %	Reach Total	
Silt/Clay (<0.06 mm)				80	
Sand (0.06 – 2 mm)				5	
Gravel (2-64 mm)				10	
Cobble (64 – 256 mm)				5	
Boulders (>256 mm)				0	
Bedrock				0	

NOTES/COMMENTS:

SITE NOT SAMPLED:		
<input type="checkbox"/> Land owner denial	<input type="checkbox"/> Dry	<input type="checkbox"/> Too deep/Impounded
<input type="checkbox"/> Site not found/Secluded	<input type="checkbox"/> Unsafe	
<input type="checkbox"/> Other (indicate under comments)		

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RBP High Gradient Habitat

Habitat Parameter	Condition Category																				
	Optimal					Suboptimal					Marginal					Poor					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1. Epifaunal Substrate/ Available Cover Score 5	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.					
2. Embeddedness Score 5	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.					
3. Velocity/ Depth Regime Score 10	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)					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).					
4. Sediment Deposition Score 4	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; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
5. Channel Flow Status Score 11	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.					
6. Channel Alteration Score 9	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
7. Frequency of Riffles (or bends) Score 6	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); 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.					
8. Bank Stability LB 4 RB 4	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.					
9. Vegetative Protection LB 2 RB 2	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the 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.					
10. Riparian Vegetative Zone Width LB 1 RB 1	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.					

Total Score

NOTES/COMMENTS:

64

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High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: S039			LOCATION: Walton, KY		
STATION #: N/A			COUNTY: Boone		PROGRAM:
INVESTIGATORS: SM, JF			DATE: 3/31/2016		PROJECT:
Verify Site LAT/LONG vs GPS <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> N/A			TIME (24hr)		Start:
					Finish:
Station		Reach			
		Downstream	Upstream		
LAT				CANOPY COVER::	
LONG				<input checked="" type="checkbox"/> Fully Exposed (0-25%) <input type="checkbox"/> Partially Exposed (25-50%) <input type="checkbox"/> Partially Shaded (50-75%) <input type="checkbox"/> Fully Shaded (75-100%)	
			STREAM TYPE:		
			<input type="checkbox"/> Perennial <input type="checkbox"/> Ephemeral <input checked="" type="checkbox"/> Intermittent		
WEATHER			LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):		
Has there been a scouring rain in the last 14 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			<input type="checkbox"/> Surface Mining <input type="checkbox"/> Deep Mining <input type="checkbox"/> Oil Wells <input type="checkbox"/> Land Disposal <input checked="" type="checkbox"/> Residential		
Now <input type="checkbox"/> Past 24 hours <input checked="" type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input checked="" type="checkbox"/> Intermittent showers <input type="checkbox"/> Clear/sunny <input type="checkbox"/> Cloudy			<input type="checkbox"/> Construction <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> Row Crops		
			<input type="checkbox"/> Forest <input type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Silviculture <input type="checkbox"/> Urban Runoff/Storm Sewers		
INSTREAM FEATURES		HYDRAULIC STRUCTURES		RIPARIAN VEGETATION	
Stream Width <u>3</u> ft Maximum Depth <u>1.5</u> ft Reach Length <u>18</u> m Riffle/Run/Pool Sequence (No. Sampled in Reach) 1 Riffle 1 Run 3 Pool		<input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input checked="" type="checkbox"/> Other: Culverts		Dominate Type: <input type="checkbox"/> Trees <input checked="" type="checkbox"/> Herbaceous <input type="checkbox"/> Grasses <input type="checkbox"/> Shrubs Number of strata <u> </u> Dom. Tree/Shrub Taxa	
				CHANNEL ALTERATIONS	
				<input type="checkbox"/> Dredging <input checked="" type="checkbox"/> Channelization (Full <input type="checkbox"/> Partial)	
P-CHEM					
Instrument Used: _____ Date Calibrated: _____					
Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Cond. _____ Turb. _____					
Sample Collection Verification					
Algae Sample: <input type="checkbox"/> QualMHC <input type="checkbox"/> Other <input type="checkbox"/> Visual Assessment Lead Collector: _____					
Fish <input type="checkbox"/> BPEF <input type="checkbox"/> Seine <input type="checkbox"/> Other Time: BPEF Seine Lead Collector: _____					
Habitat <input type="checkbox"/> RBP <input type="checkbox"/> Substrate <input type="checkbox"/> Other: Lead Collector: _____					
Invertebrates <input type="checkbox"/> 1m ² <input type="checkbox"/> Qual <input type="checkbox"/> Other: Lead Collector: _____					
<input type="checkbox"/> 20 Jab (#Jabs: Cobble _____ Snags _____ Veg. Banks _____ Sand _____ Macrophytes _____ Other _____)					
Tissue: No. of Samples collected _____ Sp: _____ Lead Collector: _____					
Water Chem <input type="checkbox"/> Acid/Alk <input type="checkbox"/> Bulk <input type="checkbox"/> Nutrients <input type="checkbox"/> Metals <input type="checkbox"/> Low Hg Lead Collector: _____					
<input type="checkbox"/> Herbicides <input type="checkbox"/> Pesticides <input type="checkbox"/> Ortho P <input type="checkbox"/> Other: _____					
Duplicate Samples Taken:					
Substrate Characterization					
Substrate <input type="checkbox"/> Est. <input type="checkbox"/> P.C.	Riffle ¹⁰ %	Run ¹⁰ %	Pool ⁸⁰ %	Reach Total	
Silt/Clay (<0.06 mm)				80	
Sand (0.06 – 2 mm)				10	
Gravel (2-64 mm)				5	
Cobble (64 – 256 mm)				5	
Boulders (>256 mm)					
Bedrock					

NOTES/COMMENTS:

SITE NOT SAMPLED:	
<input type="checkbox"/> Land owner denial	<input type="checkbox"/> Dry <input type="checkbox"/> Too deep/Impounded
<input type="checkbox"/> Site not found/Secluded	<input type="checkbox"/> Unsafe
<input type="checkbox"/> Other (indicate under comments)	

CONFIDENTIAL PROPRIETARY TRADE SECRET

RBP High Gradient Habitat

Habitat Parameter	Condition Category																				
	Optimal					Suboptimal					Marginal					Poor					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1. Epifaunal Substrate/ Available Cover Score 6	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.					
2. Embeddedness Score 6	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.					
3. Velocity/ Depth Regime Score 7	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)					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).					
4. Sediment Deposition Score 9	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; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
5. Channel Flow Status Score 11	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.					
6. Channel Alteration Score 8	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
7. Frequency of Riffles (or bends) Score 11	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); 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.					
Left/Right Bank	10	9				8	7	6			5	4	3			2	1				0
8. Bank Stability LB 6 RB 6	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.					
9. Vegetative Protection 6 LB RB 6	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the 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.					
10. Riparian Vegetative Zone Width LB 0 RB 2	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.					

Total Score

NOTES/COMMENTS:

84

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High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: S044			LOCATION: Bigbone, KY						
STATION #: N/A			COUNTY: Boone		PROGRAM: PROJECT:				
INVESTIGATORS: SM, JF			DATE: 4/1/2016		TIME Start: (24hr) Finish:				
Verify Site LAT/LONG vs GPS <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> N/A									
		Reach							
		Station	Downstream	Upstream					
LAT					CANOPY COVER::				
LONG					<input type="checkbox"/> Fully Exposed (0-25%) <input checked="" type="checkbox"/> Partially Exposed (25-50%) <input type="checkbox"/> Partially Shaded (50-75%) <input type="checkbox"/> Fully Shaded (75-100%)				
			STREAM TYPE:						
			<input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Ephemeral <input type="checkbox"/> Intermittent						
WEATHER Has there been a scouring rain in the last 14 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Now Past 24 hours <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input type="checkbox"/> Clear/sunny <input checked="" type="checkbox"/> Cloudy			LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use): <input type="checkbox"/> Surface Mining <input type="checkbox"/> Deep Mining <input type="checkbox"/> Oil Wells <input type="checkbox"/> Land Disposal <input checked="" type="checkbox"/> Residential <input type="checkbox"/> Construction <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> Row Crops <input checked="" type="checkbox"/> Forest <input type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Silviculture <input type="checkbox"/> Urban Runoff/Storm Sewers			
INSTREAM FEATURES Stream Width <u>3</u> ft Maximum Depth <u>1</u> ft Reach Length <u>31</u> m Riffle/Run/Pool Sequence (No. Sampled in Reach) <u>3</u> Riffle <u>1</u> Run <u>2</u> Pool		HYDRAULIC STRUCTURES <input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input checked="" type="checkbox"/> Other: Culvert		STREAM FLOW <input type="checkbox"/> Dry <input type="checkbox"/> Pooled <input type="checkbox"/> Low <input checked="" type="checkbox"/> High <input type="checkbox"/> Normal		RIPARIAN VEGETATION Dominate Type: <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Herbaceous <input checked="" type="checkbox"/> Grasses <input type="checkbox"/> Shrubs Number of strata <u>2</u> Dom. Tree/Shrub Taxa <small>Juncus sp., Phalaris arundinacea, Acer rubrum</small>		CHANNEL ALTERATIONS <input type="checkbox"/> Dredging <input checked="" type="checkbox"/> Channelization <input type="checkbox"/> Full <input checked="" type="checkbox"/> Partial Culverted	
P-CHEM Instrument Used: _____ Date Calibrated: _____ Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Cond. _____ Turb. _____									
Sample Collection Verification									
Algae		Sample: <input type="checkbox"/> QualMHC <input type="checkbox"/> Other		<input type="checkbox"/> Visual Assessment		Lead Collector:			
Fish		<input type="checkbox"/> BPEF <input type="checkbox"/> Seine <input type="checkbox"/> Other		Time: BPEF Seine		Lead Collector:			
Habitat		<input type="checkbox"/> RBP <input type="checkbox"/> Substrate <input type="checkbox"/> Other:				Lead Collector:			
Invertebrates		<input type="checkbox"/> 1m ² <input type="checkbox"/> Qual <input type="checkbox"/> Other:				Lead Collector:			
		<input type="checkbox"/> 20 Jab (#Jabs: Cobble _____ Snags _____ Veg. Banks _____ Sand _____ Macrophytes _____ Other _____)							
Tissue:		No. of Samples collected _____ Sp:				Lead Collector:			
Water Chem		<input type="checkbox"/> Acid/Alk <input type="checkbox"/> Bulk <input type="checkbox"/> Nutrients <input type="checkbox"/> Metals <input type="checkbox"/> Low Hg				Lead Collector:			
		<input type="checkbox"/> Herbicides <input type="checkbox"/> Pesticides <input type="checkbox"/> Ortho P <input type="checkbox"/> Other:							
Duplicate Samples Taken:									
Substrate Characterization									
Substrate <input type="checkbox"/> Est. <input type="checkbox"/> P.C.	Riffle ⁴⁰ %	Run ²⁰ %	Pool ⁴⁰ %	Reach Total					
Silt/Clay (<0.06 mm)				60					
Sand (0.06 – 2 mm)				20					
Gravel (2-64 mm)				10					
Cobble (64 – 256 mm)				10					
Boulders (>256 mm)				0					
Bedrock				0					

NOTES/COMMENTS:

SITE NOT SAMPLED:		
<input type="checkbox"/> Land owner denial	<input type="checkbox"/> Dry	<input type="checkbox"/> Too deep/Impounded
<input type="checkbox"/> Site not found/Secluded	<input type="checkbox"/> Unsafe	
<input type="checkbox"/> Other (indicate under comments)		

CONFIDENTIAL PROPRIETARY TRADE SECRET

RBP High Gradient Habitat

Habitat Parameter	Condition Category																				
	Optimal					Suboptimal					Marginal					Poor					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1. Epifaunal Substrate/ Available Cover Score 10	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.					
2. Embeddedness Score 10	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.					
3. Velocity/ Depth Regime Score 11	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)					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).					
4. Sediment Deposition Score 7	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, 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
5. Channel Flow Status Score 13	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.					
6. Channel Alteration Score 10	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
7. Frequency of Riffles (or bends) Score 10	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); 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.					
Left/Right Bank	10	9				8	7	6			5	4	3			2	1				0
8. Bank Stability LB 4 RB 4	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.					
9. Vegetative Protection 8 LB RB 8	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the 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.					
10. Riparian Vegetative Zone Width LB 3 RB 3	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone.					Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.					Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.					Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.					

Total Score

NOTES/COMMENTS:

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High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: S046			LOCATION: Bigbone, KY		
STATION #: N/A			COUNTY: Boone		PROGRAM: PROJECT:
INVESTIGATORS: SM, JF			DATE: 4/1/2016		TIME Start: (24hr) Finish:
Verify Site LAT/LONG vs GPS <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> N/A					
		Reach			
		Downstream	Upstream		
LAT				CANOPY COVER::	
LONG				<input type="checkbox"/> Fully Exposed (0-25%) <input checked="" type="checkbox"/> Partially Exposed (25-50%) <input type="checkbox"/> Partially Shaded (50-75%) <input type="checkbox"/> Fully Shaded (75-100%)	
			STREAM TYPE:		
			<input type="checkbox"/> Perennial <input type="checkbox"/> Ephemeral <input checked="" type="checkbox"/> Intermittent		
WEATHER Has there been a scouring rain in the last 14 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use): <input type="checkbox"/> Surface Mining <input type="checkbox"/> Deep Mining <input type="checkbox"/> Oil Wells <input type="checkbox"/> Land Disposal <input type="checkbox"/> Residential <input type="checkbox"/> Construction <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> Row Crops <input type="checkbox"/> Forest <input checked="" type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Silviculture <input type="checkbox"/> Urban Runoff/Storm Sewers		
INSTREAM FEATURES Stream Width <u>2.5</u> ft Maximum Depth <u>1</u> ft Reach Length <u>18</u> m Riffle/Run/Pool Sequence (No. Sampled in Reach) <u>0</u> Riffle <u>1</u> Run <u>1</u> Pool		HYDRAULIC STRUCTURES <input type="checkbox"/> Dams <input type="checkbox"/> Bridge Abutments <input type="checkbox"/> Island <input type="checkbox"/> Waterfalls <input type="checkbox"/> Other:		STREAM FLOW <input type="checkbox"/> Dry <input type="checkbox"/> Pooled <input type="checkbox"/> Low <input type="checkbox"/> High <input checked="" type="checkbox"/> Normal	
		RIPARIAN VEGETATION Dominate Type: <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Herbaceous <input checked="" type="checkbox"/> Grasses <input checked="" type="checkbox"/> Shrubs Number of strata <u>3</u> Dom. Tree/Shrub Taxa Acer negundo, Festuca sp., Rosa sp.		CHANNEL ALTERATIONS <input type="checkbox"/> Dredging <input type="checkbox"/> Channelization <input type="checkbox"/> Full <input type="checkbox"/> Partial	
P-CHEM Instrument Used: _____ Date Calibrated: _____ Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Cond. _____ Turb. _____					
Sample Collection Verification					
Algae		Sample: <input type="checkbox"/> QualMHC <input type="checkbox"/> Other		<input type="checkbox"/> Visual Assessment	
Fish		<input type="checkbox"/> BPEF <input type="checkbox"/> Seine <input type="checkbox"/> Other		Time: BPEF _____ Seine _____	
Habitat		<input type="checkbox"/> RBP <input type="checkbox"/> Substrate <input type="checkbox"/> Other:		Lead Collector: _____	
Invertebrates		<input type="checkbox"/> 1m ² <input type="checkbox"/> Qual <input type="checkbox"/> Other:		Lead Collector: _____	
		<input type="checkbox"/> 20 Jab (#Jabs: Cobble _____ Snags _____ Veg. Banks _____ Sand _____ Macrophytes _____ Other _____)			
Tissue:		No. of Samples collected _____ Sp: _____		Lead Collector: _____	
Water Chem		<input type="checkbox"/> Acid/Alk <input type="checkbox"/> Bulk <input type="checkbox"/> Nutrients <input type="checkbox"/> Metals <input type="checkbox"/> Low Hg		Lead Collector: _____	
		<input type="checkbox"/> Herbicides <input type="checkbox"/> Pesticides <input type="checkbox"/> Ortho P <input type="checkbox"/> Other:			
Duplicate Samples Taken:					
Substrate Characterization					
Substrate <input type="checkbox"/> Est. <input type="checkbox"/> P.C.	Riffle ³⁵ %	Run ⁵ %	Pool ⁶⁰ %	Reach Total	
Silt/Clay (<0.06 mm)				50	
Sand (0.06 – 2 mm)				15	
Gravel (2-64 mm)				20	
Cobble (64 – 256 mm)				15	
Boulders (>256 mm)				0	
Bedrock				0	

NOTES/COMMENTS:

SITE NOT SAMPLED:		
<input type="checkbox"/> Land owner denial	<input type="checkbox"/> Dry	<input type="checkbox"/> Too deep/Impounded
<input type="checkbox"/> Site not found/Secluded	<input type="checkbox"/> Unsafe	
<input type="checkbox"/> Other (indicate under comments)		

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RBP High Gradient Habitat

Habitat Parameter	Condition Category																				
	Optimal					Suboptimal					Marginal					Poor					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1. Epifaunal Substrate/ Available Cover Score 12	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.					
2. Embeddedness Score 8	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.					
3. Velocity/ Depth Regime Score 10	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)					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).					
4. Sediment Deposition Score 10	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; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
5. Channel Flow Status Score 10	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.					
6. Channel Alteration Score 15	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
7. Frequency of Riffles (or bends) Score 16	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); 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.					
8. Bank Stability LB 6 RB 6	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.					
9. Vegetative Protection 8 LB 8 RB 8	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the 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.					
10. Riparian Vegetative Zone Width LB 2 RB 2	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.					

Total Score

NOTES/COMMENTS:

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Appendix C
Pond/Open Water Datasheets

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POND DATA SHEET	
FEATURE ID: P001	ASSOCIATED FEATURES: S031
SURVEY TYPE: waterbody	
DATE: 3/31/16	CLIENT/PROJECT NAME: Duke/ Walton to Big Bone MILEPOST:
INVESTIGATORS: S. Miloski and J. Freer	ROUTE: pipeline centerline
STATE/COUNTY: KY/ Boone	IS THIS A MAPPED NWI FEATURE?: Yes
WATERBODY CHARACTERISTICS	
WATERBODY TYPE:	pond
AVG. DEPTH:	>3 feet
AVG. WIDTH (WATER SURFACE):	150 feet
APPROXIMATE SIZE:	150X400 feet
QUALITATIVE ATTRIBUTES	
AVERAGE WATER APPEARANCE:	clear
PRIMARY SUBSTRATE (IF OBSERVED):	silt
POTENTIAL HABITAT FOR:	fish, waterfowl
SURROUNDING LAND USE:	residential/pasture
WETLAND FRINGE (IF PRESENT):	n/a few willow trees lining the pond
COMMENTS	

Appendix E
GAI Wetland and Stream Delineation Report



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Wetland Delineation and Stream Identification Report

Duke Energy
Walton to Big Bone Pipeline Project
Boone County, Kentucky

GAI Project Number: G141890.03
Duke Project: GD70.S587.69100.R2190
November 2015



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Wetland Delineation and Stream Identification Report

Duke Energy
Walton to Big Bone Pipeline Project
Boone County, Kentucky

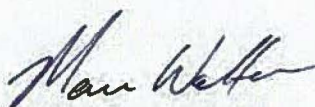
GAI Project Number: G141890.03
Duke Project: GD70.S587.69100.R2190

November 2015

Prepared for:
Duke Energy
1000 East Main Street
Plainfield, Indiana 46168

Prepared by:
GAI Consultants, Inc.
Indianapolis Office
6420 Castleway West Drive
Indianapolis, Indiana 46250

Author:



Marc Walters, MPA, CPESC
Environmental Manager

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Table 1 Waterbodies Identified within the Project Study Area
Waterbody Photographs

Figure 1 Project Overview

Figure 2 Resource Location

Appendix A High Gradient Bioassessment Stream Data Sheets

Appendix B Descriptions of Soils Found Within the Project Study Area

1.0 Introduction

Duke Energy is proposing to construct the Walton to Big Bone Pipeline Project (Project), located in Boone County, Kentucky (KY) (Figure 1). The proposed Project involves the construction of approximately 10.25 miles of eight-inch diameter pipeline and a 0.75-mile pipeline section also eight inches in diameter, as well as a 100-foot by 100-foot metering/valve station.

GAI Consultants, Inc. (GAI), on behalf of Duke Energy, conducted wetland delineations and stream investigations of the Project study areas in October 2015. GAI identified approximate boundaries of waterbodies and wetlands located within a 20-foot wide corridor centered on the existing centerline within road right-of-way (ROW) only. One non-road adjacent section of the provided alignment was not reviewed due to access restrictions. This report describes the methods and results of the environmental field survey within the Project study areas.

2.0 Methods

Wetland delineations were conducted in accordance with the 1987 United States Army Corps of Engineers (USACE) *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory, 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region* (Version 2.0) (USACE, 2012). Wetlands were classified using the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979). Classification of the indicator status of vegetation is based on *The National Wetland Plant List: 2014 Update of Wetland Ratings* (Lichvar, et al. 2014).

The Study Area was investigated for the presence of streams and wetlands. Each field-identified jurisdictional perennial and intermittent drainage was evaluated using the KY Site Characterization and High Gradient Habitat Assessment procedure as outlined in the *Standard Methods for Assessing Biological Integrity of Surface Waters in Kentucky* (KY Division of Water [KDOW], 2008) and in the *Methods for Assessing Habitat in Wadeable Waters* (KDOW, 2011). Both of these procedure revisions apply to the stream assessments in this region of Kentucky, and both utilize the same assessment form and criteria, with only minor differences. The completed High Gradient Bioassessment Stream Data Sheets are included in Appendix A.

The growing season in the Project area is generally between March and December in Boone County, KY (United States Department of Agriculture, Natural Resource Conservation [USDA-NRCS], 2014). Field observations were supplemented with an intensive review of United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) mapping, USDA-NRCS soils mapping, historical aerial photography (Google Earth), and local landscape topography/morphology to provide a determination of wetlands present within the study area. Professional judgment was used to determine whether hydrophytic vegetation and hydric soils existed within the identified wetlands if on-site data was ambiguous.

Each wetland and waterbody feature (if identified) was given a unique map designation and each boundary flag location was recorded using a Trimble GEO XH model global positioning system mapping grade unit with the capability of sub-meter accuracy. Judgmental upland and wetland soil test pits were taken within the study corridor at the discretion of the delineator to confirm the presence or absence of wetlands in areas with exhibiting wetland indicators. If identified, wetland boundaries and stream centerlines were mapped. Streams with a top-of-bank width of greater than 10 feet had a left and right top-of-bank mapped.

3.0 Regulatory Discussion

3.1 Waters of the United States

"Waters of the U.S." are within the jurisdiction of the USACE under the Clean Water Act (CWA). "Waters of the U.S." is a broad term, which includes waters that are used or could be used for interstate commerce. This includes wetlands, ponds, lakes, territorial seas, rivers, tributary streams including any definable intermittent waterways, and some ditches below the ordinary high water mark (OHWM). Also included are manmade waterbodies such as quarries and ponds, which are no longer actively being mined or constructed and are connected to other "waters". Wetlands, mudflats, vegetated shallows, riffle and pool complexes, coral reefs, sanctuaries, and refuges are all considered special aquatic sites which involve more rigorous regulatory permitting requirements. A specific, detailed definition of "Waters of the U.S." can be found in the Federal Register (33 CFR 328.3).

On January 9, 2001 the U.S. Supreme Court issued a decision, *Solid Waste Agency of Northern Cook County (SWANCC) v. U.S. Army Corps of Engineers* (No. 99-1178). The decision reduces the regulation of isolated wetlands under Section 404 of the CWA, which assigns the USACE authority to issue permits for the discharge of dredge or fill material into "Waters of the U.S." Prior to the SWANCC decision, the USACE had adopted a regulatory definition of "Waters of the U.S." that afforded federal protection for almost all of the nation's wetlands. The Supreme Court decision interpreted that the USACE's jurisdiction is restricted to navigable waters, their tributaries, and wetlands that are adjacent to these navigable waterways and tributaries. The decision leaves the majority of "isolated" wetlands unregulated by the CWA. Therefore, most wetlands that are not adjacent to, or contiguous with, any other "Waters of the U.S." via a surface drain such as a swale, ditch, or stream are considered isolated and thus no longer jurisdictional by the USACE.

On June 19, 2006, the U.S. Supreme Court issued decisions in regards to *John A. Rapanos v. United States* (No. 04-1034) and *June Carabell v. United States* (04-1384), et al. The plurality decision created two 'tests' for determining CWA jurisdiction: the permanent flow of water test (set out by Justice Scalia) and the "significant nexus" test (set out by Justice Kennedy). On June 5, 2007 the USACE and Environmental Protection Agency issued joint guidance on how to interpret and apply the Court's ruling. According to this guidance, the USACE will assert jurisdiction over traditionally navigable waters (TNWs), adjacent wetlands, and non-navigable tributaries of TNWs that have "relatively permanent" flow, and wetlands that border these waters, regardless of whether or not they are separated by roads, berms, and similar barriers. In addition, the USACE will use a case-by-case "significant nexus" analysis to determine whether waters and their adjacent wetlands are jurisdictional. A "significant nexus" can be found where waters, including adjacent wetlands, alter the physical, biological, or chemical integrity of the traditionally navigable water based on consideration of several factors.

3.2 Waters of the State

"Waters of the State" are within the jurisdiction of the KY Department for Environmental Protection, KDOW. They are generally defined as surface and underground waterbodies, which extend through or exist wholly in the State, which includes, but is not limited to, streams and both isolated and non-isolated wetlands. Private ponds, or any pond, reservoir, or facility built for reduction of pollutants prior to discharge are not included in this definition. In addition to "Waters of the U.S.", the KDOW also regulates and issues permits for isolated wetland impacts. The State relies on the USACE decision regarding wetland determinations and delineations including whether or not a wetland is isolated or non-isolated.

To evaluate potential streams within the Study Area, GAI first reviewed existing United States Geological Survey (USGS) topographic maps, aerial photography, National Hydrography Dataset stream

data, and site contour data, prior to the extensive field reconnaissance that was performed in October 2015.

The completed High Gradient Bioassessment Stream Data Sheets for each stream channel are provided in Appendix A. These forms were completed for perennial and intermittent streams only. A 50 foot survey reach was utilized as the survey could be viewed from road ROW. The mapped location of each jurisdictional channel is shown on Figure 2. Additionally, The Kentucky Administrative Regulation (KAR) *401 KAR 10:026 Designation of Uses of Surface Waters* database was searched to potentially identify any of the Study Area's streams as special use waters. The KAR states that "waters that are not specifically listed...are designated for the use of warm water aquatic habitat."

Regulatory activities under the CWA (1972) and amendments of 1977 provide authority for states to issue water quality standards for all waters of the United States including upstream to the highest reaches of tributary streams. In addition, the CWA amendments require knowledge of the potential fish or biological community that can be supported in a stream or river, including upstream headwaters. The High Gradient Bioassessment Stream Data Sheet content is designed to evaluate the quality of in-stream and riparian habitat based on specific features. The availability of quality habitat directly influences the biological integrity of a stream reach. Information obtained from the habitat assessment can generally be used to supplement biological and physiochemical data collected where necessary when determining the overall health of the stream reach and the stream-use designation. Biological and physiochemical sampling was not completed.

Two different habitat assessment field data sheets are used in the Kentucky stream assessment procedure. For streams where riffles should naturally be present (e.g. most stream reaches of the Central Appalachian, Western Allegheny, Southwestern Appalachian and Interior Plateau ecoregions would qualify), the high-gradient habitat assessment field data sheet should be used. In low-gradient streams where rocky riffles are not naturally present (e.g. most stream reaches in the Mississippi Valley Plain and the Interior River Lowland ecoregions would qualify), the low-gradient habitat assessment field data sheet should be used. The high gradient was determined to be the most suitable for the Study Area, which is located within the Outer Bluegrass Ecoregion.

The visually-based habitat evaluation consists of ten parameters that characterize in-stream habitat, channel morphology, bank stability, and riparian vegetation for each sampling location. For each parameter, the investigator determines which of the following conditions exist at the sampling reach: Optimal, Suboptimal, Marginal or Poor and assigns a parameter score within the condition category chosen above as follows: Optimal (20-16), Suboptimal (15-11), Marginal (10-6) or Poor (5-0). The investigator then totals all parameter ratings to obtain a final habitat ranking. Completed High Gradient Bioassessment Stream Data Sheets for the streams delineated during the field survey are provided in Appendix A.

4.0 Results

USGS mapping (USGS 1984, 1987, 1992) indicates that the western portion of the Project area (approximately from the Project's western terminus to the intersection of Beaver Road and United States Routes 127 and 42) is comprised of a dissected landscape of steep hillsides and the Big Bone Creek stream valley. The eastern portion of the Project area is flatter, consisting of low, rolling hills. Land use consists primarily of a rural landscape of forests, farms, and residential areas.

The Project study area is found within the following watersheds:

- ▶ Big Bone Creek (Hydrologic Unit Code [HUC] 050902031003); and
- ▶ Mud Lick Creek (050902031001).

The USFWS's NWI was reviewed for potential wetland locations. These maps identify potential wetlands on-site. The NWI maps were prepared from high altitude photography and in most cases were not field verified. As a result wetlands are sometimes erroneously identified, missed, or misidentified within this data set. The presence of an NWI wetland does not necessarily constitute the presence of a wetland meeting USACE criteria. The NWI map of the area (Figure 1) identified one feature (Freshwater Pond) crossed by the study area. The NWI classification crossed by the study area is PUBHh (Palustrine/Unconsolidated Bottom/Permanently Flooded/Diked/Impounded).

Twenty seven streams and no wetlands were identified within the study area (Figure 2).

Streams designated for special protection in Kentucky are known as "Special Waters" (Cold Water Aquatic Habitat, Exceptional Waters, Reference Reach Waters, Outstanding State Resource Waters, Outstanding National Resource Waters, State Wild Rivers, and Federal Wild and Scenic Rivers). One stream, Big Bone Creek (SKY-CDK-006) is designated as an Outstanding State Resource Water. There were no USACE Section 10 Waters listed as navigable.

In support of field findings, identified waterbodies are summarized in Table 1. Color photographs of each feature accompany the table. High Gradient Bioassessment Stream Data Sheets were completed during this investigation and are included as Appendix A. Additional data was recorded for all stream features including top of bank (TOB) width and depth and width and depth at OHWM. Additionally, the substrate characteristics and adjacent riparian buffer vegetation were documented for each stream feature on the recorded field sheets. Descriptions of the soils found within the study area are presented in Appendix B.

5.0 Conclusions

Wetland delineations and stream investigations of Duke Energy's Walton to Big Bone Pipeline Project study areas were conducted in October 2015 within a 20-foot wide corridor centered on the existing centerline. Twenty seven streams and no wetlands were identified within the study area. The results of the field study are provided in this report.

All statements in this document pertaining to the jurisdictional status of streams and wetlands with regard to USACE and state regulations represent the opinion of GAI and are based on present USACE guidance. The jurisdictional status of these features may be confirmed a USACE Jurisdictional Determination and/or by state agencies.

6.0 References

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TABLE 1
Waterbodies Identified
Within the Project Study Area

Table 1.
Waterbodies Identified within the Project Study Area

Feature Designation ¹	Latitude ²	Longitude ²	Name	Type	OHWM Width (ft)	OHWM Depth (ft)	TOB Width (ft)	TOB Depth (ft)	Length Within Study Area ³ (ft)	Kentucky or Federal Special Listing ⁴	Open Ended
SKY-CDK-001	38.88303	-84.71081	UNT to Big Bone Creek	Ephemeral	2	0.5	3	1	0.17	No	Y
SKY-CDK-002	38.882929	-84.710698	UNT to Big Bone Creek	Ephemeral	1.5	0.33	2	1.5	N/A	No	Y
SKY-CDK-003	38.883549	-84.712842	UNT to Big Bone Creek	Ephemeral	3	0.25	3	1.5	102.24	No	Y
SKY-CDK-004	38.883609	-84.71288	UNT to Big Bone Creek	Ephemeral	3	0.33	3	1.5	14.93	No	Y
SKY-CDK-005	38.884475	-84.716338	UNT to Big Bone Creek	Ephemeral	4	0.83	5	2.5	N/A	No	Y
SKY-CDK-006	38.884952	-84.729726	Big Bone Creek	Perennial	50	8	120	25	21.22	Yes - OSRW ⁵	Y
SKY-CDK-007	38.88496	-84.736193	UNT to Big Bone Creek	Perennial	8	2.5	10	3	11.23	No	Y
SKY-CDK-008	38.888311	-84.75515	Gum Branch	Perennial	20	10	50	15	20.92	No	Y
SKY-CDK-009	38.88786	-84.756352	UNT to Gum Branch	Ephemeral	2	0.33	3	2	79.42	No	Y
SKY-CDK-010	38.887878	-84.756212	UNT to Gum Branch	Perennial	8	2	10	6	7.16	No	Y
SKY-CDK-011	38.889099	-84.74891	UNT to Big Bone Creek	Intermittent	4	0.5	5	1.5	N/A	No	Y
SKY-CDK-012	38.879394	-84.701392	Beaver Branch	Perennial	7	0.25	9	3	7.75	No	Y
SKY-CDK-013	38.897369	-84.662568	UNT to Mud Lick Creek	Perennial	13	4	14	6	N/A	No	Y
SKY-CDK-014	38.893747	-84.673277	UNT to Mud Lick Creek	Perennial	4	1.16	5	2.5	N/A	No	Y
SKY-CDK-015	38.879982	-84.697841	UNT to Beaver Branch	Ephemeral	4	0.25	5	2	N/A	No	Y
SKY-CDK-016	38.888829	-84.685389	UNT to Mud Lick Creek	Perennial	11	2	12	2.5	17.47	No	Y
SKY-CDK-017	38.899087	-84.65313	Mud Lick Creek	Perennial	10	5	30	7	27.74	No	Y
SKY-CDK-018	38.898322	-84.650852	UNT to Mud Lick Creek	Perennial	25	5	30	6	22.83	No	Y
SKY-CDK-019	38.906064	-84.642176	UNT to Mud Lick Creek	Ephemeral	3	0.33	4	1.5	10.12	No	Y
SKY-CDK-020	38.895195	-84.648059	UNT to Mud Lick Creek	Perennial	9	1.16	12	5	13.43	No	Y
SKY-CDK-021	38.891331	-84.643072	UNT to Mud Lick Creek	Ephemeral	3	0.33	4	1.5	21.12	No	Y
SKY-CDK-022	38.889844	-84.640177	UNT to Mud Lick Creek	Perennial	12	0.41	14	1.5	12.20	No	Y
SKY-CDK-023	38.887761	-84.632876	UNT to Mud Lick Creek	Ephemeral	3	0.25	4	1	18.61	No	Y
SKY-CDK-024	38.889555	-84.626828	UNT to Mud Lick Creek	Intermittent	6	0.33	8	2	12.90	No	Y
SKY-CDK-025	38.88976	-84.62581	UNT to Mud Lick Creek	Ephemeral	6	0.25	7	1.5	6.54	No	Y
SKY-CDK-026	38.890126	-84.624155	UNT to Mud Lick Creek	Perennial	6	0.41	7	2	21.28	No	Y
SKY-CDK-027	38.890165	-84.623638	UNT to Mud Lick Creek	Intermittent	5	0.41	10	4	6.75638.8	No	Y
Total Stream within Study Area (feet)									456.04		

Notes:
¹ GAI map designation.
² Decimal degrees; Coordinates provided in NAD 83.
³ Extent of stream or open water within study area. Stream or open water may extend beyond these limits if noted as open ended. "N/A" in this column signifies that the stream is located outside of the study corridor and therefore, has no delineated length within the 20' study corridor.
⁴ KDOW Wild Rivers List for Kentucky. Kentucky Register 401 KAR 4:100. Accessed October 2015.
⁵ KDOW Outstanding State Resource Waters (OSRW) as shown on the KDOW Kentucky Watershed Viewer accessible at: <http://eppcgis.ky.gov/flexviewers/watershed/>. Accessed October 2015.

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WATERBODY PHOTOGRAPHS