

CONFIDENTIAL PROPRIETARY TRADE SECRET  
 High Gradient Bioassessment Stream Visit Sheet

|   |                        |  |   |   |                               |
|---|------------------------|--|---|---|-------------------------------|
| STREAM NAME: S023   |                        |  | LOCATION: Bigbone, KY   |   |                               |
| STATION #: N/A  |                        |  | COUNTY: Boone   |   | PROGRAM:<br>PROJECT:          |
| INVESTIGATORS: SM, JF   |                        |  | DATE: 3/30/2016   |   | TIME Start:<br>(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   |                        |  |   | CANOPY COVER:   |                               |
| LONG  |                        |  |   | <input checked="" type="checkbox"/> Fully Exposed (0-25%)<br><input type="checkbox"/> Partially Exposed (25-50%)<br><input type="checkbox"/> Partially Shaded (50-75%)<br><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?<br><input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  |                        |  | <input type="checkbox"/> Surface Mining<br><input type="checkbox"/> Deep Mining<br><input type="checkbox"/> Oil Wells<br><input type="checkbox"/> Land Disposal<br><input type="checkbox"/> Residential |   |                               |
| Now<br><input type="checkbox"/> Heavy rain<br><input type="checkbox"/> Steady rain<br><input checked="" type="checkbox"/> Intermittent showers<br><input checked="" type="checkbox"/> Clear/sunny<br><input type="checkbox"/> Cloudy  |                        |  | <input type="checkbox"/> Construction<br><input type="checkbox"/> Commercial<br><input type="checkbox"/> Industrial<br><input type="checkbox"/> Row Crops   |   |                               |
| Past 24 hours<br><input type="checkbox"/> Heavy rain<br><input type="checkbox"/> Steady rain<br><input checked="" type="checkbox"/> Intermittent showers<br><input checked="" type="checkbox"/> Clear/sunny<br><input type="checkbox"/> Cloudy  |                        |  | <input type="checkbox"/> Forest<br><input checked="" type="checkbox"/> Pasture/Grazing<br><input type="checkbox"/> Silviculture<br><input type="checkbox"/> Urban Runoff/Storm Sewers                   |   |                               |
| INSTREAM FEATURES   |                        | HYDRAULIC STRUCTURES   |   | RIPARIAN VEGETATION   |                               |
| Stream Width <u>3.5</u> ft<br>Maximum Depth <u>1.5</u> ft<br>Reach Length <u>18</u> m   |                        | <input type="checkbox"/> Dams<br><input type="checkbox"/> Bridge Abutments<br><input type="checkbox"/> Island<br><input type="checkbox"/> Waterfalls<br><input checked="" type="checkbox"/> Other: Culvert |   | Dominate Type:<br><input type="checkbox"/> Trees <input checked="" type="checkbox"/> Herbaceous<br><input checked="" type="checkbox"/> Grasses <input type="checkbox"/> Shrubs<br>Number of strata <u>    </u> Dom.<br>Tree/Shrub Taxa<br>Poa sp., Taraxacum officinale |                               |
| Riffle/Run/Pool Sequence (No. Sampled in Reach)<br>2 Riffle 1 Run 1 Pool  |                        | STREAM FLOW<br><input type="checkbox"/> Dry<br><input type="checkbox"/> Pooled<br><input type="checkbox"/> Low<br><input type="checkbox"/> High<br><input checked="" type="checkbox"/> Normal              |   | CHANNEL ALTERATIONS<br><input type="checkbox"/> Dredging<br><input checked="" type="checkbox"/> Channelization<br><input type="checkbox"/> Full <input checked="" type="checkbox"/> Partial<br>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 <sup>2</sup> <input type="checkbox"/> Qual <input type="checkbox"/> Other: Lead Collector: _____<br><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: _____<br><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 <sup>40</sup> % | Run <sup>30</sup> %  | Pool <sup>30</sup> %  | 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:

|  |                                 |   |
|--|---------------------------------|---|
| <b>SITE NOT SAMPLED:</b>                                 |                                 |   |
| <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<br>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 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<br>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<br>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<br>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<br>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<br>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)<br>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<br>LB 6<br>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<br>3<br>LB<br>RB<br>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<br>LB 0<br>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: <b>S025</b>   |                        |  | LOCATION: <b>Bigbone, KY</b>   |  |                     |
| STATION #: <b>N/A</b>  |                        |  | COUNTY: <b>Boone</b>   |  | PROGRAM: PROJECT:   |
| INVESTIGATORS: <b>SM, JF</b>   |                        |  | DATE: <b>3/30/2016</b>   |  | TIME Start: 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  |                        |  |  | CANOPY COVER:<br><input type="checkbox"/> Fully Exposed (0-25%)<br><input checked="" type="checkbox"/> Partially Exposed (25-50%)<br><input type="checkbox"/> Partially Shaded (50-75%)<br><input type="checkbox"/> Fully Shaded (75-100%) |                     |
| LONG   |                        |  |  | STREAM TYPE:<br><input type="checkbox"/> Perennial<br><input type="checkbox"/> Ephemeral<br><input checked="" type="checkbox"/> Intermittent   |                     |
| <b>WEATHER</b><br>Has there been a scouring rain in the last 14 days?<br><input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Now: <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input checked="" type="checkbox"/> Clear/sunny <input type="checkbox"/> Cloudy<br>Past 24 hours: <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input checked="" type="checkbox"/> Clear/sunny <input type="checkbox"/> Cloudy |                        |  | <b>LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):</b><br><input type="checkbox"/> Surface Mining <input type="checkbox"/> Construction <input type="checkbox"/> Forest<br><input type="checkbox"/> Deep Mining <input type="checkbox"/> Commercial <input type="checkbox"/> Pasture/Grazing<br><input type="checkbox"/> Oil Wells <input type="checkbox"/> Industrial <input type="checkbox"/> Silviculture<br><input type="checkbox"/> Land Disposal <input type="checkbox"/> Row Crops <input type="checkbox"/> Urban Runoff/Storm Sewers<br><input checked="" type="checkbox"/> Residential |  |                     |
| <b>INSTREAM FEATURES</b><br>Stream Width <u>3</u> ft<br>Maximum Depth <u>1</u> ft<br>Reach Length <u>30</u> m<br>Riffle/Run/Pool Sequence (No. Sampled in Reach)<br><u>1</u> Riffle <u>0</u> Run <u>2</u> Pool   |                        | <b>HYDRAULIC STRUCTURES</b><br><input type="checkbox"/> Dams<br><input checked="" type="checkbox"/> Bridge Abutments<br><input type="checkbox"/> Island<br><input type="checkbox"/> Waterfalls<br><input type="checkbox"/> Other:  |  | <b>STREAM FLOW</b><br><input type="checkbox"/> Dry<br><input checked="" type="checkbox"/> Pooled<br><input type="checkbox"/> Low<br><input type="checkbox"/> High<br><input type="checkbox"/> Normal                                       |                     |
|  |                        | <b>RIPARIAN VEGETATION</b><br>Dominate Type:<br><input type="checkbox"/> Trees <input checked="" type="checkbox"/> Herbaceous<br><input type="checkbox"/> Grasses <input type="checkbox"/> Shrubs<br>Number of strata ___ Dom.<br>Tree/Shrub Taxa<br><b>Dipsacus sp.</b>                                       |  | <b>CHANNEL ALTERATIONS</b><br><input type="checkbox"/> Dredging<br><input checked="" type="checkbox"/> Channelization (Full <input type="checkbox"/> Partial)  |                     |
| <b>P-CHEM</b> Instrument Used: _____ Date Calibrated: _____<br>Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Cond. _____ Turb. _____   |                        |  |  |  |                     |
| <b>Sample Collection Verification</b>  |                        |  |  |  |                     |
| <b>Algae</b>   |                        | Sample: <input type="checkbox"/> QualMHC <input type="checkbox"/> Other <input type="checkbox"/> Visual Assessment   |  | Lead Collector: _____  |                     |
| <b>Fish</b>  |                        | <input type="checkbox"/> BPEF <input type="checkbox"/> Seine <input type="checkbox"/> Other Time: BPEF Seine   |  | Lead Collector: _____  |                     |
| <b>Habitat</b>   |                        | <input type="checkbox"/> RBP <input type="checkbox"/> Substrate <input type="checkbox"/> Other:  |  | Lead Collector: _____  |                     |
| <b>Invertebrates</b>   |                        | <input type="checkbox"/> 1m <sup>2</sup> <input type="checkbox"/> Qual <input type="checkbox"/> Other:<br><input type="checkbox"/> 20 Jab (#Jabs: Cobble _____ Snags _____ Veg. Banks _____ Sand _____ Macrophytes _____ Other _____)  |  | Lead Collector: _____  |                     |
| <b>Tissue:</b>   |                        | No. of Samples collected _____ Sp: _____   |  | Lead Collector: _____  |                     |
| <b>Water Chem</b>  |                        | <input type="checkbox"/> Acid/Alk <input type="checkbox"/> Bulk <input type="checkbox"/> Nutrients <input type="checkbox"/> Metals <input type="checkbox"/> Low Hg<br><input type="checkbox"/> Herbicides <input type="checkbox"/> Pesticides <input type="checkbox"/> Ortho P <input type="checkbox"/> Other: |  | Lead Collector: _____  |                     |
| <b>Duplicate Samples Taken:</b>  |                        |  |  |  |                     |
| <b>Substrate Characterization</b>  |                        |  |  |  |                     |
| Substrate <input checked="" type="checkbox"/> Est. <input type="checkbox"/> P.C.   | Riffle <sup>10</sup> % | Run <sup>0</sup> %   | Pool <sup>90</sup> %   | 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:

|  |                                 |   |
|--|---------------------------------|---|
| <b>SITE NOT SAMPLED:</b>                                 |                                 |   |
| <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<br>SCORE                                       | Condition Category  |    |    |    |    |   |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
|--|---|----|----|----|----|---|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
|  | Optimal   |    |    |    |    | Suboptimal  |    |    |    |    | Marginal  |   |   |   |   | Poor  |   |   |   |   |
|  | 20  | 19 | 18 | 17 | 16 | 15  | 14 | 13 | 12 | 11 | 10  | 9 | 8 | 7 | 6 | 5   | 4 | 3 | 2 | 1 |
| <b>1. Epifaunal Substrate/ Available Cover</b><br><br>8<br>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.  |   |   |   |   |
| <b>2. Embeddedness</b><br><br>6<br>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.  |   |   |   |   |
| <b>3. Velocity/ Depth Regime</b><br><br>5<br>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).   |   |   |   |   |
| <b>4. Sediment Deposition</b><br><br>7<br>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.     |   |   |   |   |
| <b>5. Channel Flow Status</b><br><br>6<br>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.  |   |   |   |   |
| <b>6. Channel Alteration</b><br><br>3<br>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.   |   |   |   |   |
| <b>7. Frequency of Riffles (or bends)</b><br><br>6<br>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.   |   |   |   |   |
| <b>Left/Right Bank</b>   | 10  |    |    |    | 9  | 8   |    |    | 7  | 6  | 5   |   |   | 4 | 3 | 2   |   | 1 | 0 |   |
| <b>8. Bank Stability</b><br>LB 3<br>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.   |   |   |   |   |
| <b>9. Vegetative Protection</b><br>8<br>LB<br>RB<br>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. |   |   |   |   |
| <b>10. Riparian Vegetative Zone Width</b><br>LB 3<br>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



**CONFIDENTIAL PROPRIETARY TRADE SECRET**  
**High Gradient Bioassessment Stream Visit Sheet**

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

|  |                                 |   |
|--|---------------------------------|---|
| <b>SITE NOT SAMPLED:</b>                                 |                                 |   |
| <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<br>SCORE                                       | Condition Category  |    |    |    |    |   |    |    |    |    |   |   |   |   |   |   |   |   |   |   |   |
|--|---|----|----|----|----|---|----|----|----|----|---|---|---|---|---|---|---|---|---|---|---|
|  | Optimal   |    |    |    |    | Suboptimal  |    |    |    |    | Marginal  |   |   |   |   | Poor  |   |   |   |   |   |
|  | 20  | 19 | 18 | 17 | 16 | 15  | 14 | 13 | 12 | 11 | 10  | 9 | 8 | 7 | 6 | 5   | 4 | 3 | 2 | 1 | 0 |
| <b>1. Epifaunal Substrate/ Available Cover</b><br><br>8<br>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.  |   |   |   |   |   |
| <b>2. Embeddedness</b><br><br>7<br>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.  |   |   |   |   |   |
| <b>3. Velocity/ Depth Regime</b><br><br>15<br>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).   |   |   |   |   |   |
| <b>4. Sediment Deposition</b><br><br>8<br>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.     |   |   |   |   |   |
| <b>5. Channel Flow Status</b><br><br>13<br>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.  |   |   |   |   |   |
| <b>6. Channel Alteration</b><br><br>13<br>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.   |   |   |   |   |   |
| <b>7. Frequency of Riffles (or bends)</b><br><br>13<br>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.   |   |   |   |   |   |
| <b>Left/Right Bank</b>   | 10  | 9  |    |    |    | 8   | 7  | 6  |    |    | 5   | 4 | 3 |   |   | 2   | 1 | 0 |   |   |   |
| <b>8. Bank Stability</b><br>LB 2<br>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.   |   |   |   |   |   |
| <b>9. Vegetative Protection</b><br>3<br>LB<br>RB<br>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. |   |   |   |   |   |
| <b>10. Riparian Vegetative Zone Width</b><br>LB 0<br>RB 10       | 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:

102



CONFIDENTIAL PROPRIETARY TRADE SECRET  
 High Gradient Bioassessment Stream Visit Sheet

|  |                        |   |   |   |  |
|--|------------------------|---|---|---|--|
| STREAM NAME: S031  |                        |   | LOCATION: Bigbone, KY   |   |  |
| STATION #: N/A   |                        |   | COUNTY: Boone   |   | PROGRAM:<br>PROJECT:   |
| INVESTIGATORS: SM, JF  |                        |   | DATE: 3/30/16   |   | TIME Start:<br>(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:<br><input checked="" type="checkbox"/> Fully Exposed (0-25%)<br><input type="checkbox"/> Partially Exposed (25-50%)<br><input type="checkbox"/> Partially Shaded (50-75%)<br><input type="checkbox"/> Fully Shaded (75-100%)  |   | STREAM TYPE:<br><input type="checkbox"/> Perennial<br><input type="checkbox"/> Ephemeral<br><input checked="" type="checkbox"/> Intermittent |
| Station      Downstream      Upstream  |                        |   |   |   |  |
| LAT  |                        |   |   |   |  |
| LONG   |                        |   |   |   |  |
| <b>WEATHER</b><br>Has there been a scouring rain in the last 14 days?<br><input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>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<br>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 |                        |   | <b>LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):</b><br><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<br><input type="checkbox"/> Construction, <input type="checkbox"/> Commercial, <input type="checkbox"/> Industrial, <input type="checkbox"/> Row Crops<br><input type="checkbox"/> Forest, <input checked="" type="checkbox"/> Pasture/Grazing, <input type="checkbox"/> Silviculture, <input type="checkbox"/> Urban Runoff/Storm Sewers |   |  |
| <b>INSTREAM FEATURES</b><br>Stream Width <u>6</u> ft<br>Maximum Depth <u>0.5</u> ft<br>Reach Length <u>18</u> m<br>Riffle/Run/Pool Sequence (No. Sampled in Reach)<br><u>1</u> Riffle <u>1</u> Run <u>1</u> Pool   |                        | <b>HYDRAULIC STRUCTURES</b><br><input type="checkbox"/> Dams<br><input checked="" type="checkbox"/> Bridge Abutments<br><input type="checkbox"/> Island<br><input type="checkbox"/> Waterfalls<br><input checked="" type="checkbox"/> Other: culvert                                  |   | <b>STREAM FLOW</b><br><input type="checkbox"/> Dry<br><input type="checkbox"/> Pooled<br><input checked="" type="checkbox"/> Low<br><input type="checkbox"/> High<br><input type="checkbox"/> Normal            |  |
|  |                        | <b>RIPARIAN VEGETATION</b><br>Dominate Type:<br><input type="checkbox"/> Trees <input type="checkbox"/> Herbaceous<br><input checked="" type="checkbox"/> Grasses <input type="checkbox"/> Shrubs<br>Number of strata <u>2</u> Dom.<br>Tree/Shrub Taxa<br>Dipsacus sp., Poa pratensis |   | <b>CHANNEL ALTERATIONS</b><br><input type="checkbox"/> Dredging<br><input checked="" type="checkbox"/> Channelization<br><input type="checkbox"/> Full <input checked="" type="checkbox"/> Partial<br>Culverted |  |
| <b>P-CHEM</b> Instrument Used: _____ Date Calibrated: _____<br>Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Cond. _____ Turb. _____   |                        |   |   |   |  |
| <b>Sample Collection Verification</b>  |                        |   |   |   |  |
| <b>Algae</b> Sample: <input type="checkbox"/> QualMHC <input type="checkbox"/> Other <input type="checkbox"/> Visual Assessment Lead Collector: _____  |                        |   |   |   |  |
| <b>Fish</b> <input type="checkbox"/> BPEF <input type="checkbox"/> Seine <input type="checkbox"/> Other Time: BPEF Seine Lead Collector: _____   |                        |   |   |   |  |
| <b>Habitat</b> <input type="checkbox"/> RBP <input type="checkbox"/> Substrate <input type="checkbox"/> Other: Lead Collector: _____   |                        |   |   |   |  |
| <b>Invertebrates</b> <input type="checkbox"/> 1m <sup>2</sup> <input type="checkbox"/> Qual <input type="checkbox"/> Other: Lead Collector: _____<br><input type="checkbox"/> 20 Jab (#Jabs: Cobble _____ Snags _____ Veg. Banks _____ Sand _____ Macrophytes _____ Other _____)   |                        |   |   |   |  |
| <b>Tissue:</b> No. of Samples collected _____ Sp: _____ Lead Collector: _____  |                        |   |   |   |  |
| <b>Water Chem</b> <input type="checkbox"/> Acid/Alk <input type="checkbox"/> Bulk <input type="checkbox"/> Nutrients <input type="checkbox"/> Metals <input type="checkbox"/> Low Hg Lead Collector: _____<br><input type="checkbox"/> Herbicides <input type="checkbox"/> Pesticides <input type="checkbox"/> Ortho P <input type="checkbox"/> Other:   |                        |   |   |   |  |
| Duplicate Samples Taken: _____   |                        |   |   |   |  |
| <b>Substrate Characterization</b>  |                        |   |   |   |  |
| Substrate <input type="checkbox"/> Est. <input type="checkbox"/> P.C.  | Riffle <sup>25</sup> % | Run <sup>25</sup> %   | Pool <sup>50</sup> %  | 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:

|  |                                 |   |
|--|---------------------------------|---|
| <b>SITE NOT SAMPLED:</b>                                 |                                 |   |
| <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<br><br>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<br><br>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<br><br>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<br><br>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<br><br>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<br><br>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)<br><br>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<br>LB 4<br>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<br>LB 4<br>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<br>LB 1<br>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:

62



CONFIDENTIAL PROPRIETARY TRADE SECRET  
 High Gradient Bioassessment Stream Visit Sheet

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

|  |                                 |   |
|--|---------------------------------|---|
| <b>SITE NOT SAMPLED:</b>                                 |                                 |   |
| <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<br>SCORE                              | Condition Category  |    |    |    |    |   |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
|---|---|----|----|----|----|---|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
|   | Optimal   |    |    |    |    | Suboptimal  |    |    |    |    | Marginal  |   |   |   |   | Poor  |   |   |   |   |
|   | 20  | 19 | 18 | 17 | 16 | 15  | 14 | 13 | 12 | 11 | 10  | 9 | 8 | 7 | 6 | 5   | 4 | 3 | 2 | 1 |
| 1. Epifaunal Substrate/ Available Cover<br><br>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 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<br><br>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<br><br>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<br><br>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<br><br>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<br><br>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)<br><br>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<br>LB 5<br>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<br>5<br>LB<br>RB<br>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<br>LB 2<br>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



**CONFIDENTIAL PROPRIETARY TRADE SECRET**  
**High Gradient Bioassessment Stream Visit Sheet**

|  |  |                     |   |   |   |
|--|--|---------------------|---|---|---|
| STREAM NAME: <b>S037</b>   |  |                     | LOCATION: <b>Bigbone, KY</b>  |   |   |
| STATION #: <b>N/A</b>  |  |                     | COUNTY: <b>Boone</b>  |   | PROGRAM:<br>PROJECT:  |
| INVESTIGATORS: <b>SM, JF</b>   |  |                     | DATE: <b>3/31/2016</b>  | TIME (24hr):  | Start:<br>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  |  |                     |   | CANOPY COVER: <input checked="" type="checkbox"/> Fully Exposed (0-25%)<br><input type="checkbox"/> Partially Exposed (25-50%)<br><input type="checkbox"/> Partially Shaded (50-75%)<br><input type="checkbox"/> Fully Shaded (75-100%) |   |
| LONG   |  |                     |   | STREAM TYPE: <input type="checkbox"/> Perennial<br><input type="checkbox"/> Ephemeral<br><input checked="" type="checkbox"/> Intermittent   |   |
| WEATHER  |  |                     | LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):  |   |   |
| Has there been a scouring rain in the last 14 days?<br>Now: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Past 24 hours: <input type="checkbox"/> Heavy rain, <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 checked="" type="checkbox"/> Residential<br><input type="checkbox"/> Construction, <input type="checkbox"/> Commercial, <input type="checkbox"/> Industrial, <input type="checkbox"/> Row Crops<br><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<br>Maximum Depth <u>1</u> ft<br>Reach Length <u>18</u> m<br>Riffle/Run/Pool Sequence (No. Sampled in Reach)<br><u>1</u> Riffle <u>0</u> Run <u>1</u> Pool   |  |                     | <input type="checkbox"/> Dams, <input type="checkbox"/> Bridge Abutments, <input type="checkbox"/> Island, <input type="checkbox"/> Waterfalls, <input checked="" type="checkbox"/> Other: <b>Culvert</b>   |   | Dominate Type: <input type="checkbox"/> Trees <input checked="" type="checkbox"/> Herbaceous<br><input type="checkbox"/> Grasses <input type="checkbox"/> Shrubs<br>Number of strata ___ Dom.<br>Tree/Shrub Taxa<br><b>Taraxacum officinale</b> |
| P-CHEM   |  |                     | Instrument Used: _____  |   | Date Calibrated: _____  |
| Temp(°C) _____   |  |                     | D.O. (mg/l) _____   |   | %Saturation _____   |
|  |  |                     | pH(S.U.) _____  |   | Cond. _____   |
|  |  |                     | Turb. _____   |   |   |
| <b>Sample Collection Verification</b>  |  |                     |   |   |   |
| 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 <sup>2</sup> <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:                           |                     |   |   |   |
| <b>Duplicate Samples Taken:</b>  |  |                     |   |   |   |
| <b>Substrate Characterization</b>  |  |                     |   |   |   |
| Substrate <input type="checkbox"/> Est. <input type="checkbox"/> P.C.  | Riffle <sup>50</sup> %   | Run <sup>25</sup> % | Pool <sup>25</sup> %  | 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:

|  |                                 |   |
|--|---------------------------------|---|
| <b>SITE NOT SAMPLED:</b>                                 |                                 |   |
| <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<br>SCORE                            | Condition Category  |    |    |    |    |   |    |    |    |    |   |   |   |   |   |   |   |   |   |   |   |
|---|---|----|----|----|----|---|----|----|----|----|---|---|---|---|---|---|---|---|---|---|---|
|   | Optimal   |    |    |    |    | Suboptimal  |    |    |    |    | Marginal  |   |   |   |   | Poor  |   |   |   |   |   |
|   | 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<br>5<br>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<br>5<br>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<br>10<br>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<br>4<br>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<br>11<br>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<br>9<br>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)<br>6<br>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.   |   |   |   |   |   |
| 8. Bank Stability<br>LB 4<br>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<br>2<br>LB 2<br>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<br>LB 1<br>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



CONFIDENTIAL PROPRIETARY TRADE SECRET  
 High Gradient Bioassessment Stream Visit Sheet

|  |                        |  |  |  |   |
|--|------------------------|--|--|--|---|
| STREAM NAME: S039  |                        |  | LOCATION: Walton, KY   |  |   |
| STATION #: N/A   |                        |  | COUNTY: Boone  |  | PROGRAM:<br>PROJECT:  |
| INVESTIGATORS: SM, JF  |                        |  | DATE: 3/31/2016  |  | TIME Start:<br>(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:<br><input checked="" type="checkbox"/> Fully Exposed (0-25%)<br><input type="checkbox"/> Partially Exposed (25-50%)<br><input type="checkbox"/> Partially Shaded (50-75%)<br><input type="checkbox"/> Fully Shaded (75-100%)   |  | STREAM TYPE:<br><input type="checkbox"/> Perennial<br><input type="checkbox"/> Ephemeral<br><input checked="" type="checkbox"/> Intermittent                |
| Station  | Downstream             | Upstream   |  |  |   |
| LAT  |                        |  |  |  |   |
| LONG   |                        |  |  |  |   |
| <b>WEATHER</b><br>Has there been a scouring rain in the last 14 days?<br>Now: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Past 24 hours: <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 |                        |  | <b>LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):</b><br><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 |  |   |
| <b>INSTREAM FEATURES</b><br>Stream Width: 3 ft, Maximum Depth: 1.5 ft, Reach Length: 18 m<br>Riffle/Run/Pool Sequence (No. Sampled in Reach):<br>1 Riffle 1 Run 3 Pool   |                        | <b>HYDRAULIC STRUCTURES</b><br><input type="checkbox"/> Dams, <input type="checkbox"/> Bridge Abutments, <input type="checkbox"/> Island, <input type="checkbox"/> Waterfalls, <input checked="" type="checkbox"/> Other: Culverts | <b>STREAM FLOW</b><br><input type="checkbox"/> Dry, <input type="checkbox"/> Pooled, <input type="checkbox"/> Low, <input type="checkbox"/> High, <input checked="" type="checkbox"/> Normal   | <b>RIPARIAN VEGETATION</b><br>Dominate Type: <input type="checkbox"/> Trees <input checked="" type="checkbox"/> Herbaceous, <input type="checkbox"/> Grasses <input type="checkbox"/> Shrubs<br>Number of strata: ___ Dom. Tree/Shrub Taxa | <b>CHANNEL ALTERATIONS</b><br><input type="checkbox"/> Dredging, <input checked="" type="checkbox"/> Channelization (Full <input type="checkbox"/> Partial) |
| <b>P-CHEM</b> Instrument Used: _____ Date Calibrated: _____<br>Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Cond. _____ Turb. _____   |                        |  |  |  |   |
| <b>Sample Collection Verification</b>  |                        |  |  |  |   |
| <b>Algae</b> Sample: <input type="checkbox"/> QualMHC <input type="checkbox"/> Other <input type="checkbox"/> Visual Assessment Lead Collector: _____  |                        |  |  |  |   |
| <b>Fish</b> <input type="checkbox"/> BPEF <input type="checkbox"/> Seine <input type="checkbox"/> Other Time: BPEF Seine Lead Collector: _____   |                        |  |  |  |   |
| <b>Habitat</b> <input type="checkbox"/> RBP <input type="checkbox"/> Substrate <input type="checkbox"/> Other: Lead Collector: _____   |                        |  |  |  |   |
| <b>Invertebrates</b> <input type="checkbox"/> 1m <sup>2</sup> <input type="checkbox"/> Qual <input type="checkbox"/> Other: Lead Collector: _____<br><input type="checkbox"/> 20 Jab (#Jabs: Cobble ___ Snags ___ Veg. Banks ___ Sand ___ Macrophytes ___ Other ___)   |                        |  |  |  |   |
| <b>Tissue:</b> No. of Samples collected: ___ Sp: _____ Lead Collector: _____   |                        |  |  |  |   |
| <b>Water Chem</b> <input type="checkbox"/> Acid/Alk <input type="checkbox"/> Bulk <input type="checkbox"/> Nutrients <input type="checkbox"/> Metals <input type="checkbox"/> Low Hg Lead Collector: _____<br><input type="checkbox"/> Herbicides <input type="checkbox"/> Pesticides <input type="checkbox"/> Ortho P <input type="checkbox"/> Other:                         |                        |  |  |  |   |
| Duplicate Samples Taken:   |                        |  |  |  |   |
| <b>Substrate Characterization</b>  |                        |  |  |  |   |
| Substrate <input type="checkbox"/> Est. <input type="checkbox"/> P.C.  | Riffle <sup>10</sup> % | Run <sup>10</sup> %  | Pool <sup>80</sup> %   | 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:

|  |                                 |   |
|--|---------------------------------|---|
| <b>SITE NOT SAMPLED:</b>                                 |                                 |   |
| <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<br>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 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<br>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<br>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<br>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<br>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<br>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)<br>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<br>LB 6<br>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<br>6<br>LB<br>RB<br>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<br>LB 0<br>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



**CONFIDENTIAL PROPRIETARY TRADE SECRET**  
**High Gradient Bioassessment Stream Visit Sheet**

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

|  |                                 |   |
|--|---------------------------------|---|
| <b>SITE NOT SAMPLED:</b>                                 |                                 |   |
| <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<br><br>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<br><br>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<br><br>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<br><br>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<br><br>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<br><br>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)<br><br>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<br>LB 4<br>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<br>8<br>LB<br>RB<br>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<br>LB 3<br>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:

101



CONFIDENTIAL PROPRIETARY TRADE SECRET  
 High Gradient Bioassessment Stream Visit Sheet

|  |                        |   |                              |  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
|--|------------------------|---|------------------------------|--|-------------------------------|--|--|----------|-----|--|--|------|--|--|--|--|--|
| STREAM NAME: <b>S046</b>   |                        |   | LOCATION: <b>Bigbone, KY</b> |  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| STATION #: <b>N/A</b>  |                        |   | COUNTY: <b>Boone</b>         |  | PROGRAM:<br>PROJECT:          |  |  |          |     |  |  |      |  |  |  |  |  |
| INVESTIGATORS: <b>SM, JF</b>   |                        |   | DATE: <b>4/1/2016</b>        |  | TIME Start:<br>(24hr) Finish: |  |  |          |     |  |  |      |  |  |  |  |  |
| Verify Site LAT/LONG vs GPS <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> N/A   |                        |   |                              |  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:33%;"></td> <td style="width:33%; text-align: center;">Reach</td> <td style="width:33%;"></td> </tr> <tr> <td style="text-align: center;">Station</td> <td style="text-align: center;">Downstream</td> <td style="text-align: center;">Upstream</td> </tr> <tr> <td>LAT</td> <td></td> <td></td> </tr> <tr> <td>LONG</td> <td></td> <td></td> </tr> </table>   |                        |   |                              | Reach  |                               | Station  | Downstream   | Upstream | LAT |  |  | LONG |  |  | CANOPY COVER:<br><input type="checkbox"/> Fully Exposed (0-25%)<br><input checked="" type="checkbox"/> Partially Exposed (25-50%)<br><input type="checkbox"/> Partially Shaded (50-75%)<br><input type="checkbox"/> Fully Shaded (75-100%) |  | STREAM TYPE:<br><input type="checkbox"/> Perennial<br><input type="checkbox"/> Ephemeral<br><input checked="" type="checkbox"/> Intermittent |
|  | Reach                  |   |                              |  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| Station  | Downstream             | Upstream  |                              |  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| LAT  |                        |   |                              |  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| LONG   |                        |   |                              |  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| <b>WEATHER</b><br>Has there been a scouring rain in the last 14 days?<br><input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Now: <input type="checkbox"/> Heavy rain <input type="checkbox"/> Steady rain <input type="checkbox"/> Intermittent showers <input checked="" type="checkbox"/> Clear/sunny <input type="checkbox"/> Cloudy<br>Past 24 hours: <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 |                        | <b>LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):</b><br><input type="checkbox"/> Surface Mining <input type="checkbox"/> Deep Mining <input type="checkbox"/> Oil Wells <input type="checkbox"/> Land Disposal <input type="checkbox"/> Residential<br><input type="checkbox"/> Construction <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> Row Crops<br><input type="checkbox"/> Forest <input type="checkbox"/> Pasture/Grazing <input type="checkbox"/> Silviculture <input type="checkbox"/> Urban Runoff/Storm Sewers |                              |  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| <b>INSTREAM FEATURES</b><br>Stream Width <u>2.5</u> ft<br>Maximum Depth <u>1</u> ft<br>Reach Length <u>18</u> m<br>Riffle/Run/Pool Sequence (No. Sampled in Reach)<br>0 Riffle <u>1</u> Run <u>1</u> Pool  |                        | <b>HYDRAULIC STRUCTURES</b><br><input type="checkbox"/> Dams<br><input type="checkbox"/> Bridge Abutments<br><input type="checkbox"/> Island<br><input type="checkbox"/> Waterfalls<br><input type="checkbox"/> Other:  |                              | <b>STREAM FLOW</b><br><input type="checkbox"/> Dry<br><input type="checkbox"/> Pooled<br><input type="checkbox"/> Low<br><input type="checkbox"/> High<br><input checked="" type="checkbox"/> Normal |                               | <b>RIPARIAN VEGETATION</b><br>Dominate Type:<br><input checked="" type="checkbox"/> Trees <input type="checkbox"/> Herbaceous<br><input checked="" type="checkbox"/> Grasses <input checked="" type="checkbox"/> Shrubs<br>Number of strata <u>3</u> Dom. Tree/Shrub Taxa<br>Acer negundo, Festuca sp., Rosa sp. | <b>CHANNEL ALTERATIONS</b><br><input type="checkbox"/> Dredging<br><input type="checkbox"/> Channelization<br><input type="checkbox"/> Full <input type="checkbox"/> Partial |          |     |  |  |      |  |  |  |  |  |
| <b>P-CHEM</b> Instrument Used: _____ Date Calibrated: _____<br>Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Cond. _____ Turb. _____   |                        |   |                              |  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| <b>Sample Collection Verification</b>  |                        |   |                              |  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| <b>Algae</b>   |                        | Sample: <input type="checkbox"/> QualMHC <input type="checkbox"/> Other   |                              | <input type="checkbox"/> Visual Assessment   |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| <b>Fish</b>  |                        | <input type="checkbox"/> BPEF <input type="checkbox"/> Seine <input type="checkbox"/> Other   |                              | Time: BPEF Seine   |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| <b>Habitat</b>   |                        | <input type="checkbox"/> RBP <input type="checkbox"/> Substrate <input type="checkbox"/> Other:   |                              | Lead Collector:  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| <b>Invertebrates</b>   |                        | <input type="checkbox"/> 1m <sup>2</sup> <input type="checkbox"/> Qual <input type="checkbox"/> Other:  |                              | Lead Collector:  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
|  |                        | <input type="checkbox"/> 20 Jab (#Jabs: Cobble _____ Snags _____ Veg. Banks _____ Sand _____ Macrophytes _____ Other _____)   |                              |  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| <b>Tissue:</b>   |                        | No. of Samples collected _____ Sp: _____  |                              | Lead Collector:  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| <b>Water Chem</b>  |                        | <input type="checkbox"/> Acid/Alk <input type="checkbox"/> Bulk <input type="checkbox"/> Nutrients <input type="checkbox"/> Metals <input type="checkbox"/> Low Hg<br><input type="checkbox"/> Herbicides <input type="checkbox"/> Pesticides <input type="checkbox"/> Ortho P <input type="checkbox"/> Other:  |                              | Lead Collector:  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| <b>Duplicate Samples Taken:</b>  |                        |   |                              |  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| <b>Substrate Characterization</b>  |                        |   |                              |  |                               |  |  |          |     |  |  |      |  |  |  |  |  |
| Substrate <input type="checkbox"/> Est. <input type="checkbox"/> P.C.  | Riffle <sup>35</sup> % | Run <sup>5</sup> %  | Pool <sup>60</sup> %         | 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:

|  |                                 |   |
|--|---------------------------------|---|
| <b>SITE NOT SAMPLED:</b>                                 |                                 |   |
| <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<br><br>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 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<br><br>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<br><br>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<br><br>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<br><br>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<br><br>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)<br><br>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.   |   |   |   |   |   |
| Left/Right Bank   | 10  | 9  |    |    |    | 8   | 7  | 6  |    |    | 5   | 4 | 3 |   |   | 2   | 1 |   |   |   | 0 |
| 8. Bank Stability<br>LB 6<br>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<br>8<br>LB<br>RB<br>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<br>LB 2<br>RB 2      | 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:

113



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**Appendix C**  
**Pond/Open Water Datasheets**

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ch2m:

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



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**Appendix D**  
**Wetlands, Streams, and Ponds**  
**Photo Documentation**

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**CONFIDENTIAL PROPRIETARY TRADE SECRET**



**Photograph 1: Upstream view of stream S001**



**Photograph 2: Downstream view of stream S002**



**Photograph 3: Upstream view of stream S003**



**Photograph 4: Downstream view of stream S004**



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Photograph 5: Upstream view of stream S005



Photograph 6: Upstream view of stream S006



Photograph 7: Upstream view of stream S007



Photograph 8: Upstream view of stream S008



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Photograph 9: Downstream view of stream S009



Photograph 10: Downstream view of stream S010



Photograph 11: Downstream view of stream S011



Photograph 12: Upstream view of stream S012



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Photograph 13: Upstream view of stream S013



Photograph 14: Upstream view of stream S016



Photograph 15: Downstream view of stream S017



Photograph 16: Downstream view of stream S018



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Photograph 17: Downstream view of stream S019



Photograph 18: Upstream view of stream S020



Photograph 19: Upstream view of stream S021



Photograph 20: Upstream view of stream S022



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**Photograph 21: Downstream view of stream S023**



**Photograph 22: Upstream view of stream S024**



**Photograph 23: Upstream view of stream S025**



**Photograph 24: Upstream view of stream S026**



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Photograph 25: Upstream view of stream S027



Photograph 26: Upstream view of stream S028



Photograph 27: Downstream view of stream S029



Photograph 28: Downstream view of stream S030



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Photograph 29: Downstream view of stream S031



Photograph 30: Downstream view of stream S032



Photograph 31: Upstream view of stream S033



Photograph 32: Upstream view of stream S034



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Photograph 33: Upstream view of stream S035.



Photograph 34: Upstream view of stream S036



Photograph 35: Downstream view of stream S037



Photograph 36: Downstream view of stream S038



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Photograph 37: Downstream view of stream S040



Photograph 38: Upstream view of stream S041



Photograph 39: Downstream view of stream S042



Photograph 40: Upstream view of stream S043



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Photograph 41: Upstream view of stream S044



Photograph 42: Upstream view of stream S045



Photograph 43: Upstream view of stream S046



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Photograph 1: Palustrine Emergent (PEM) wetland W004.



Photograph 2: Palustrine Emergent (PEM) wetland W005.



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Photograph 3: Palustrine Emergent (PEM) wetland W006.



Photograph 4: Palustrine Emergent (PEM) wetland W007.



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Photograph 5: Palustrine Emergent (PEM) wetland W008.



Photograph 6: Palustrine Scrub Shrub (PSS) wetland W009.



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Photograph 7: Palustrine Emergent (PEM) wetland W010.



Photograph 8: Palustrine Emergent (PEM) wetland W011.



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Photograph 8: Palustrine Emergent (PEM) wetland W013.



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

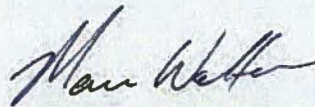
GAI Project Number: G141890.03  
Duke Project: GD70.S587.69100.R2190

November 2015

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