LITTLE WHITE OAK CREEK STREAM RESTORATION

POLK COUNTY, NORTH CAROLINA

CONTRACT # D06027-B

Prepared For:

Ecosystem Enhancement Program
Department of Environment and Natural Resources
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ANNUAL MONITORING REPORT (YEAR 1 OF 5)

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Owner

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1.0 Executive Summary

This annual monitoring report details the first year monitoring activities and their results for the Little White Oak Creek Stream Restoration Site (LWOC). All of the monitoring activities were conducted and the subsequent results are reported in accordance with the approved mitigation plan (Mulkey Engineers and Consultants, 2008) for LWOC. The content and format of this report were developed in accordance with the contract requirements for the Full Delivery RFP 16-D06027 (NCEEP, 2005). Accordingly, this report includes project background information, project monitoring results, and description of the project monitoring methodology.

Mulkey Engineers and Consultants (Mulkey) submitted LWOC for the Full Delivery RFP 16-D06027 to provide 18,200 Stream Mitigation Units (SMUs). Mulkey was awarded the stream restoration contract and began work on the project on May 16, 2007 The primary goals of LWOC were to improve water quality, to reduce bank erosion, to reestablish a floodplain along each of the stream reaches, and to improve the aquatic and terrestrial wildlife habitat. These goals were met through the following objectives:

- By using natural channel design to restore stable pattern, dimension, and profile for 18,290 linear feet of stream channel
- By establishing a conservation easement, which will protect the streams from cattle intrusion and future development activities
- By establishing a floodplain or reconnecting the stream back to its historic floodplain, or a combination of both, for each project stream reach
- By creating or restoring floodplain features such as vernal pools, off channel ponds, or riparian wetlands
- By increasing the amount of aquatic habitat through the addition of rock and wood structures
- By reestablishing native plant communities throughout the conservation easement, whereby reintroducing shading, cover areas, and travel corridors.

LWOC is located in Polk County, North Carolina near the Community of Mill Springs and is situated in the Broad River Basin. Past land use practices, including extensive cattle farming, stream channelization and dredging, and clearing of the riparian buffers resulted in substantial degradation of the stream systems at LWOC. LWOC is comprised of seven stream reaches totaling 18,290 feet of restored stream channel. All of the analyses, design, and restoration at LWOC were accomplished using natural stream channel design methods. In addition to stream channel restoration, the restored stream banks and the riparian and upland buffer areas along LWOC were also replanted with native species vegetation.

The survivability of the planted vegetation at LWOC will be monitored at representative vegetation plots as well as project-wide. Stem counts, photo documentation and comparison, and visual assessment will be utilized. Bare root stock were planted at a density of 680 stems per acre (8 foot by 8 foot spacing) and live stakes were planted on the stream banks at a density of 1,742 stems per acre (5 foot by 5 foot spacing). A total of 24 representative vegetation plots were installed at LWOC based on the recommendations set

forth by EEP regarding the acreage contained in the conservation easement. The survivability of the planted woody vegetation at LWOC will be monitored using annual stem counts at each of the plots. In addition to the stem counts, annual photos will be taken at each of the plots and also from 14 other permanent photo reference points. The vegetation plot photos will be used for photo documentation and comparison of the vegetation growth at each plot. The photo documentation at the reference points will be employed to assist in a project-wide visual assessment of the vegetation at LWOC. Survivability will be based on achieving a minimum of 320 stems per acre, the rate required to be present during the third year of monitoring, across the project site. The stem counts will be conducted during the latter part of the growing season months (August, September, and October) to insure survival throughout a complete growing season while still allowing for relative ease in identification. In late August 2008, the vegetation monitoring for Monitoring Year 1 was conducted using the methodologies described above, including stem counts, photo documentation, and visual assessment. The stem counts resulted in the 24 vegetation plots having a survivability of planted woody stems ranging from 438 to 1000 stems per acre, with an average survivability of 713 stems per acre. The results indicated the survivability of the planted woody vegetation at LWOC met the success criteria toward achieving at least 320 stems per acre at the third year of monitoring. The comparisons of the baseline and Monitoring Year 1 photos at both the 24 vegetation plot photo reference points and the 14 permanent photo reference points strongly complement this suggestion, as no concerns, problems, or negative trends were documented. The project-wide visual assessment provided further validation, as no vegetation problem areas were observed.

Stream dimension, pattern, profile, stream bed material, bank stability, and bankfull hydrology will be monitored to evaluate the success of stream restoration at LWOC. The limits of the project stream reaches to be monitored at LWOC were determined using the sampling rates outlined by the USACE *et al.* (2003). The monitoring will be conducted using annual field surveys, pebble counts, crest gage recordation, visual assessment and photo documentation. Baseline conditions for comparison of the stream parameters to be monitored were established from data gathered immediately after construction through the as-built survey process. Longitudinal profiles and Modified Wolman pebble counts were conducted for all reaches and a total of 13 permanent cross sections were surveyed and photo documented across LWOC. A total of eight crest gages across LWOC were installed for hydrologic monitoring to verify the occurrence of bankfull storm events. Annual photo documentation will used for stream monitoring to complement and validate the other stream monitoring practices from 14 permanent reference photo points. Annual project wide visual assessment will be conducted using field observation and pedestrian surveys to identify any specific problem areas. Since it is only required during Monitoring Year 3 and Monitoring Year 5, the BEHI information will only be collected during those years. Stream restoration success at LWOC will be evaluated by comparison of the annual monitoring results against those same parameters as predicted, specified, and required in the proposed design and as implemented during the construction process represented by the as-built or baseline conditions. Success is achieved when all such comparisons reveal positive trends toward overall stream stability. In late August 2008, the stream monitoring for Monitoring Year 1 was conducted using the methodologies described above. The results of the stream dimension, pattern, and profile monitoring demonstrated that all of the reaches were

experiencing the expected minor adjustments indicative of movement toward increased stream stability and are attributed to vegetation establishment and natural channel adjustments. Fluctuations in bed materials were expected to occur during the early years following construction. Fining of the bed materials was documented by the stream bed material monitoring. The stream systems at LWOC appear to be sand-dominated and therefore coarsening of the bed may not occur. However, the monitoring results do suggest that on-site sediment supply from LWOC has been greatly reduced as a result of the restoration. Fluctuations in bed materials are likely to continue and several years may be needed to observe a consistent bed material. Six of the eight crest gages recorded flood stages in excess of the bankfull stage. The evidence recorded by the crest gages indicates that a storm event producing a stage in excess of the bankfull storm occurred at LWOC during Monitoring Year 1. This documented the first of two required bankfull events over the five year monitoring period in order to achieve success with regards to hydrologic monitoring at LWOC. No stream problems were documented through the photo documentation comparison process. However, the project-wide visual assessment conducted along each of the project stream reaches revealed 12 specific stream problem areas which included in-stream structure failures and associated stream bank erosion, areas of floodplain and adjacent stream bank erosion, and an area of stream bank erosion. Mulkey elected to promptly address all of the observed stream problem areas and conducted construction repairs of each in October 2008. All of the in-stream structures and the areas of floodplain and stream bank erosion were repaired. The repairs to the all of these areas of eroded stream banks included re-grading, re-seeding with appropriate temporary and permanent seed, re-installing coir fiber matting, and re-planting with live stakes. Upon completion of the repair work, LWOC experienced no other stream problem areas and was deemed a success for Year 1 Monitoring.

Therefore, based on the positive results of both the vegetative and the stream monitoring for Monitoring Year 1 at LWOC, Mulkey does not propose any additional recommendations or actions other than to proceed with the annual stream monitoring.

2.0 Project Background

2.1 Project Location and Setting

The Little White Oak Creek Stream Restoration Site is located in Polk County, North Carolina approximately 2.5 miles east/southeast from the Community of Mill Springs along NC Highway 9 South, and approximately 0.5 mile northwest from the intersection of NC Highway 9 South and US Highway 74 (Figure 1). LWOC is situated in the Broad River Basin 8-digit cataloging unit of 03050105 and the 14-digit cataloging unit 03050105030010. Mulkey proposed to provide 18,200 Stream Mitigation Units (SMUs) with LWOC under the Full Delivery RFP 16-D06027 issued by the Ecosystem Enhancement Program Department of Environment and Natural Resources (NCEEP). Mulkey acquired and installed permanent fencing along an easement covering 55.3 acres, which encompasses the restored streams and associated buffers at LWOC.

2.2 Project Goals and Objectives

The primary goals of LWOC were to improve water quality, to reduce bank erosion, to reestablish a floodplain along each of the stream reaches, and to improve the aquatic and terrestrial wildlife habitat.

These goals were met through the following objectives:

- By using natural channel design to restore stable pattern, dimension, and profile for 18,290 linear feet of stream channel
- By establishing a conservation easement, which will protect the streams from cattle intrusion and future development activities
- By establishing a floodplain or reconnecting the stream back to its historic floodplain, or a combination of both, for each project stream reach
- By creating or restoring floodplain features such as vernal pools, off channel ponds, or riparian wetlands
- By increasing the amount of aquatic habitat through the addition of rock and wood structures
- By reestablishing native plant communities throughout the conservation easement, whereby reintroducing shading, cover areas, and travel corridors.

2.3 Project Restoration Approach and Mitigation Type

LWOC is comprised of three main reaches (R1, R2 Upper and R2 Lower) and four tributaries (R1A, R2A, R2B and R2D). Prior to construction, these seven reaches were identified and proposed for restoration due to their distinct stream characteristics and drainage areas. These seven existing reaches totaled approximately 15,487 linear feet. A total of 18,290 linear feet of stream channel was restored at LWOC within the 55.3 acre conservation easement.

Analyses, design, and restoration of the stream channels at LWOC was accomplished using Natural Stream Channel design methods developed by Rosgen (Rosgen, D. L., 1994, 1996, 1998). The proposed Rosgen channel type for two of the tributaries (R2A and R2B) was a C4 channel. The restoration of these tributaries was implemented using Priority Level I and II methodologies. The proposed stream classification for the majority of the reaches (R1, R1A, R2 Upper, and R2 Lower) was a C5 channel. A combination of Priority Level I and II methods were used to construct these reaches. The remaining reach (R2D) was proposed to be a C6 channel using the same methods previously mentioned.

The most significant stream restoration component at LWOC involved the reconstruction of each of the stream reaches such that stream flows greater than bankfull are allowed to access the restored stream's floodplain. Two different approaches were used to insure such floodplain access. The first approach involved relocating and raising the stream bed such that the historic floodplain is accessed by stream flows greater than bankfull (the sections of the project stream reaches that were restored using Priority Level I methodologies). A second approach was used where site constraints prevented such relocation and raising of

the stream bed. The second approach involved building a floodplain at a level lower than the historic floodplain through the construction of bankfull benches (the sections of the project stream reaches that were restored using Priority Level II methodologies). In-stream structures were installed along each of the stream reaches to provide grade control and stream bank protection, and to increase in-stream habitat diversity. The in-stream structures that were installed included rock cross vanes, j-hook rock vanes, rock vanes, constructed riffles, and root wads. Stream banks were further stabilized through the installation of coir fiber erosion control matting, temporary and permanent seeding, and the installation of native species vegetation in the form of transplants, live stakes, and bare root seedlings. All areas of the site that were disturbed during construction activities were stabilized using temporary and permanent seeding. The riparian and upland buffer communities along LWOC were also restored with native species vegetation using a target community which will emulate the Piedmont/Low Mountain Alluvial Forest described by Shafale and Weakley (1990). The conservation easement was fenced to permanently protect the restored stream and buffer areas. Information regarding the restoration approach and mitigation type for each of the seven project stream reaches is detailed in Table 1.

2.4 Project History

The existing conditions at LWOC prior to restoration were a result of cattle use for the past 50 years. When Mulkey initially became involved with this project, there were approximately 200 livestock (cattle and horses) currently utilizing the pastures. The livestock had never been fenced from any of the stream channels within LWOC. This continual livestock access to the streams resulted in substantial erosion along the stream banks, incision of the channels, channel widening in some areas, and heavy siltation throughout LWOC, as well as reduced water quality due to large quantities of fecal matter into the stream system. Based on information gained from the property owner, it was determined that many of the streams at the LWOC, particularly the smaller tributaries, were historically maintained through channelization, dredging, and clearing of the riparian buffer. As a result of these land and water quality issues, Mulkey submitted LWOC for the Full Delivery RFP 16-D06027 to provide 18,200 Stream Mitigation Units (SMUs). Mulkey was awarded the stream restoration contract by the NCEEP and began work on the project on May 16, 2007. The project activity and reporting history are detailed in Table II. Table III lists the contacts for the designer, contractor, relevant suppliers, and monitoring firm for LWOC. Table IV provides a complete listing of project background information.

2.5 Project Monitoring Plan View

Mulkey conducted monitoring baseline surveys along the entire length of each of the restored project stream reaches using total station survey equipment. These surveys were conducted to establish and document baseline conditions for the newly restored stream channels for future monitoring activities. As-built drawings were developed using the results of the monitoring baseline surveys. These drawing depicted the post construction condition of LWOC and are included in Appendix A. The as-built drawings consisted of plan sheets that include the following:

- Title sheet
- Legend sheet
- As-built planimetric drawing developed from aerial photography of LWOC after the completion of construction
- As-built planimetric drawings and profiles developed from the baseline monitoring field surveys

The as-built drawings illustrate the location of all major project elements, including, but not limited to the:

- Restored stream channel thalweg, normal edges of water, constructed bankfull channel limits, and the constructed cut slope limits
- Conservation easement boundaries
- Permanent fencing limits
- Topography
- In-stream structures
- Photo points
- Crest gages
- Vegetation plots locations
- Permanent cross sections
- Project survey control
- Monitoring profile survey limits
- Relevant structures and utilities

3.0 Project Condition and Monitoring Results

3.1 Project Vegetation Monitoring

3.1.1 Vegetation Monitoring Methodology

The survivability of the planted vegetation at LWOC, including both woody and herbaceous species, will be monitored at representative vegetation plots as well as project-wide. Monitoring at representative vegetation plots will focus primarily on planted woody vegetation and will be conducted using stem counts and photo documentation. Project-wide monitoring of planted vegetation will include both woody and herbaceous species and will be accomplished using visual assessment as well as photo documentation.

Major grading and channel construction was completed during the last week of November 2007. Throughout construction, appropriate temporary and permanent seeding was conducted to stabilize areas disturbed during construction. Appropriate existing native species vegetation was also salvaged, where feasible, in the form of transplants and live stakes, throughout the construction process. Immediately following the completion of the major grading and channel construction activities, all remaining plant material was installed during the months of November and December 2007. These remaining plant materials consisted of native species bare root seedlings and live stakes and were installed, as

appropriate, to restore the riparian and upland buffer communities along LWOC within the conservation easement area. A complete listing of the planting zones, their corresponding acreages, and the corresponding vegetation species was included in the approved mitigation report (Mulkey Engineers and Consultants, 2008). The bare root stock were planted at a density of 680 stems per acre (8 foot by 8 foot spacing) and the lives stakes were planted on the stream banks at a density of 1,742 stems per acre (5 foot by 5 foot spacing).

As-Built Surveys were initiated immediately following the installation of plant materials. In December 2007, during the as-built surveys and after the completion of planting, a total of 24 representative vegetation plots (vegetation plots 1 through 24) were installed randomly across LWOC. An iron pipe was installed at each plot corner for monumentation and a polyvinyl chloride (PVC) pipe, along with a label specifying the plot number, was also installed at one of the corners of each plot. The plot corners were strategically located such that each plot has a total area of approximately 100 square meters. Between January and February 2008, after the establishment of the plots, the species of each planted stem in each plot was identified. Each of these stems was then tallied, by species, and marked with loosely tied survey flagging (on lateral branches) to facilitate future identification. The survivability of the planted woody vegetation at LWOC will be monitored using annual stem counts at each of the plots. During the Year 1 Monitoring annual stem count, the planted stems will be re-flagged as required to insure that all planted stems were accounted for and considered in the survivability calculations. In addition to the stem counts, photos will be taken at each of the plots. Where necessary, the corner of each plot will be remarked with the PVC pipe and the plot number relabeled. This PVC plot corner will be used as the reference point from which the annual vegetation plot photos were taken from the same orientation for each plot. The photos will be compared to the photos from the previous year to validate and document vegetation success. In addition to the photo reference points established at each of the vegetation plots, a total of 11 additional permanent photo reference points were installed across LWOC. Subsequently, three additional photo points (photo points 2.5Y1, 3.5Y1, and 8.5Y1) were added during the Year 1 monitoring period to insure adequate photo documentation would be conducted within the monitoring limits of the project stream reaches. These additional photo reference points were monumented using steel rebar and PVC pipe and will be used for additional photo documentation of vegetation growth across LWOC. Photos will be taken from each of the 14 permanent photo reference points with the same orientation each year and used for photo documentation and annual comparison of the vegetation growth across LWOC. This exercise will help to further validate and document vegetation success at LWOC. Between January and February 2008, after installation of the described 11 photo reference points, photos were taken from each of the photo reference points to document the baseline conditions at LWOC with regards to planted vegetation. Monitoring Year 1 photos were taken from all 14 photo points during the visit in August 2008. Project-wide visual assessment will also be used for vegetation monitoring at LWOC. A visual assessment will be conducted using annual field observation and pedestrian surveys to identify any specific vegetation problem areas at LWOC during the monitoring period. Any problem areas where vegetation is lacking or exotic vegetation is present, will be identified and categorized as bare bank, bare bench, bare floodplain, or invasive population. Such areas will be documented using representative photos and their locations will be mapped.

3.1.2 Vegetation Monitoring Success Criteria

Vegetation success at LWOC will be measured by stem survivability. Survivability will be based on achieving at least 320 stems per acre, the rate required to be present during Year 3 Monitoring. The stem counts will be conducted during the latter part of the growing season months (August, September, and October) to insure survival throughout a complete growing season while still allowing for relative ease in identification As described above, photo documentation and visual assessment will be used to complement the stem counts as part of the vegetation monitoring protocol at LWOC. If during any given year, the planted species are not anticipated to meet final criteria established for vegetation; supplemental plantings will be considered. In the event that this occurs, a remedial planting plan will be developed that achieves the survivability goals established for Years 3 and 5.

3.1.3 Vegetation Monitoring Results for Year 1 of 5

In late August 2008, the vegetation monitoring for Monitoring Year 1 was conducted. The methodologies described in the Vegetation Monitoring Methodology Section above were used for the vegetation monitoring at LWOC for Monitoring Year 1. Stem counts were conducted at each of the 24 vegetation plots. Table V presents the results of these stem counts for each of the plots. This table includes and compares the results of the initial stem counts from the original planting and the results of the Monitoring Year 1 stem counts. Photos were taken from the photo reference points at each of the 24 vegetation plots. Appendix B compares these photos with the initial baseline photos taken from the photo reference points at each of the 24 vegetation plots. Photos were also taken from each of the 14 permanent photo reference points. Appendix C compares these photos with the initial baseline photos taken from the original 11 permanent photo reference points and provided the baseline photos for the 3 points installed during the Monitoring Year 1. A project-wide visual assessment was also conducted to identify any specific vegetation problem areas. Table VI summarizes the results of the project-wide vegetation visual assessment. The results of the Monitoring Year 1 stem counts show that the 24 vegetation plots had successfully achieved the survivability of planted woody vegetation with stem counts ranging from 438 to 1000 stems per acre, with an average survivability of 713 stems per acre. The results indicate that the survivability of the planted woody vegetation at LWOC will meet the success criteria of achieving at least 320 stems per acre after three years and 260 stems per acre after five years at LWOC. The comparisons of the baseline and Monitoring Year 1 photos at both the 24 vegetation plot photo reference points and the 14 permanent photo reference points strongly complement this suggestion, as no concerns, problems, or negative trends were documented. The project-wide visual assessment provides further validation, as no vegetation problem areas were observed. No significant volunteer woody species were observed at any of the 24 vegetation plots. Based on the results of the vegetation monitoring for Monitoring Year 1 at LWOC, Mulkey does not propose any additional recommendations or actions other than to proceed with the annual vegetation monitoring.

3.2 Project Stream Monitoring

3.2.1 Stream Monitoring Methodology

Stream dimension, pattern, profile, stream bed material, bank stability, and bankfull hydrology will be monitored to evaluate the success of the stream restoration activities at LWOC. The monitoring of stream dimension, pattern, and profile, or morphometric monitoring, along with the monitoring of stream bed material, will be conducted using annual field surveys along with visual assessment. The morphometric, stream bed material, and stream bank stability monitoring will be conducted along representative sections of the project stream reaches. Hydrologic monitoring will consist of field measurements of bankfull events using crest gages. Project-wide stream monitoring will be accomplished using visual assessment as well as photo documentation.

Major grading and channel construction were completed during the last week of November 2007. Immediately following the completion of the major grading and channel construction activities, all remaining plant material was installed during the months of November and December 2007. The as-built surveys of all of the stream reaches at LWOC were initiated immediately following the installation of plant materials and were conducted utilizing aerial photography and total station surveys while following the protocols set forth by the 2003 USACE Stream Mitigation guidelines (USACE *et al.*, 2003). In addition to documenting the construction of LWOC for comparison to the proposed design, the results of the as-built surveys were also used to establish baseline morphology for the proposed monitoring. This information is presented in Table VII. A summary of the restored stream channel lengths is outlined in Table I. A complete set of As-Built Drawings including a monitoring plan view and longitudinal profile for the as-built conditions of the restored channels can be found in Appendix A. After the completion of the as-built surveys, the limits and corresponding lengths of the project stream reaches to be monitored at LWOC were determined using the sampling rates outlined by the USACE *et al.* (2003). A total of 5,893 linear feet (32%) of all restored stream channels will be surveyed annually during the monitoring period. Based on these the sampling rates, the limits of the project stream reaches to be surveyed annually for monitoring are as follows:

Reach R1 – 1,974 Linear Feet Total (Stations 14+00-R1- through 33+74-R1-)
Reach R1A – 500 Linear Feet Total (Stations 0+00-R1A- through 5+00-R1A-)
Reach R2 – 2,047 Linear Feet Total (Stations 25+13-R2- through 45+60-R2-)
Reach R2A – 326 Linear Feet Total (Stations 0+00-R2A- through 3+26-R2A-)
Reach R2B – 551 Linear Feet Total (Stations 9+35-R2B- through 14+86-R2B-)
Reach R2D – 495 Linear Feet Total (Stations 2+84-R2D- through 7+79-R2D-)

The upstream and downstream limits of these reaches were monumented in the field using steel rebar/PVC pin. Each pin was also labeled with an aluminum tag identifying the respective reach and the correct descriptor ("begin" or "end").

A total of 13 permanent cross sections, consisting of both riffles and pools, were established across LWOC and surveyed during the as-built surveys. The number of cross sections was

determined using the sampling rates outlined by the USACE *et al.* (2003). The left and right ends of each cross section were monumented with a steel rebar pin and PVC pipe. An aluminum tag identifying the cross section number was also installed at the pin on the left side of the channel. In addition to the cross section surveys, photos were taken at each of the 13 cross sections, looking across the stream from left to right, to document the baseline conditions at each respective cross section. Specific stations along each permanent cross section were established during the as-built surveys to promote replication and consistency during the subsequent annual cross section surveys. The stationing for each cross section was established to always begin on the left side of the channel, facing downstream, at the left rebar/PVC pin, and to continue across the stream channel to the rebar/PVC pin on the right side. The as-built surveys of the 13 cross sections established the baseline conditions with regards to stream dimension. All of the 13 cross sections will be surveyed each year during the five-year monitoring period and the resulting parameters will be compared annually. The parameters to be monitored include bankfull width, floodprone width, bankfull cross sectional area, bankfull mean depth, bankfull max depth, width to depth ratio, entrenchment ratio, wetted perimeter, and hydraulic radius. Photos will be taken annually at each of the 13 cross sections, with the same orientation, looking across the stream from left to right and will be compared annually to the photos from the previous year to document stream condition at each respective cross section.

The pattern for all of the stream reaches was surveyed and baseline conditions were established as part of the as-built surveys. Monitoring surveys for stream pattern will be limited to the project stream reaches specified above for annual monitoring surveys. The stream pattern parameters resulting form the annual monitoring surveys will include sinuosity, belt width, radii of curvature, meander wavelength, and meander width ratio. These parameters will be compared annually.

The as-built surveys included longitudinal profile survey along the entire length of all restored stream reaches. Longitudinal profiles were surveyed by identifying each stream feature (riffle, run, pool, or glide) and surveying specific points at each feature. These specific locations included top of bank, bankfull, water's edge or surface, and thalweg). The as-built surveys were used to establish the baseline conditions with regards to longitudinal profile. The longitudinal profiles surveys conducted each year will be limited to the project stream reaches specified above for annual monitoring surveys. The parameters resulting from the yearly surveys of the longitudinal profile will be compared on an annual basis. The parameters to be monitored will include bankfull slope, riffle length, riffle slope, pool length, and pool to pool spacing.

During the as-built surveys, Modified Wolman pebble counts were conducted at each of the project stream reaches to classify the stream bed materials. The pebble counts for the larger project stream reaches (R1 and R2) were conducted at each of the permanent cross sections by performing an equal number of counts at each cross section and then combining the results into a reach-wide count. A minimum of 100 counts were made for each of these larger reaches. Reach-wide pebble counts were conducted along the smaller project stream reaches (R1A, R2A, R2B, and R2D). A minimum of 50 counts were made for each of these smaller reaches. The stream bed materials will be monitored at LWOC by repeating these

same pebble count procedures on an annual basis. The results of the pebble counts for each specified project stream reach will be compared on an annual basis.

BEHI information was collected during the existing condition surveys and sediment transport rates were subsequently developed. The resulting information served as baseline data for stream bank stability at LWOC. Stream bank stability monitoring using these parameters is required in Monitoring Year 3 and 5. Data collected during these years will be compared with pre-construction conditions to determine the change in bank erosion hazard indices and sediment export rates for each reach assessed. Positive change, namely reduction, in both the stream bank erosion rates and sediment transport rates at LWOC are expected as a result of restoration and will be documented as described to demonstrate success.

During the as-built surveys, a total of eight crest gages were installed across LWOC, with one at each reach and one at the confluence of Reaches R1 and R2. At the base of each crest gage a permanent vertical datum was installed. The locations of each crest gage along with the elevation of the permanent vertical datum were surveyed during the as-built surveys. The crest gages will be used for the hydrologic monitoring at LWOC to verify the occurrence of bankfull storm events. Each crest gage was set during its initial installation and baseline photos were taken. The crest gages will be checked annually and the flood stage(s) recorded by each gage and measured relative to the permanent vertical datum of the respective gage. The results of these measurements will be used to document the occurrence of significant storm events, with the goal of specifically documenting the occurrence of bankfull and larger stream flow events.

Photo documentation and project-wide visual assessment will be used for stream monitoring at LWOC to complement the other stream monitoring practices. A total of 14 permanent reference photo points were installed across LWOC (11 during the as-built surveys and 3 during the Year 1 monitoring period as described above). These photo points were monumented using steel rebar/PVC pins. Photos were taken at that time to provide photo documentation of baseline stream conditions. Photos will be taken from each of the 14 permanent photo reference points with the same orientation each year and will be used for photo documentation and annual comparison of the stream conditions across LWOC. This exercise will help to further validate and document stream restoration success at LWOC. The visual assessment will be conducted using annual field observation and pedestrian surveys to identify any specific problem areas along the streams at LWOC during the monitoring period. Any such problem areas will be identified and organized under appropriate categories. Such areas will be documented using representative photos, where applicable, and their locations will be mapped. The suspected cause and appropriate remedial action for each problem will be determined. If during any given year, the streams are not anticipated to meet the final established monitoring criteria, corrective actions will be considered. Such modifications will be documented and discussed with EEP.

3.2.2 Stream Monitoring Success Criteria

Stream dimension, pattern, profile, stream bed material, bank stability, and bankfull hydrology will be monitored annually for the project stream reaches as described in detail above. Stream restoration success at LWOC will be evaluated by comparison of those annual results against those same parameters as predicted, specified, and required in proposed design. Success will be achieved when all such comparisons reveal positive trends toward overall stream stability. The stream monitoring results should show that the stream channels at LWOC are of the proposed stream channel type (Rosgen 1994).

Stream dimension parameters including bankfull width, floodprone width, bankfull cross sectional area, bankfull mean depth, bankfull max depth, width to depth ratio, entrenchment ratio, wetted perimeter, and hydraulic radius will be measured and/or calculated for each of the permanent cross sections. The described dimension parameters are expected to remain consistent from year to year and should fall within the ranges established by the original proposed design parameters. It is expected and acceptable that minor adjustments in dimension will occur such as the development of point bars and the subsequent deepening of pools. As vegetation becomes established and the stream banks are stabilized, the anticipation is that the width depth ratios will decrease and the entrenchment ratios will increase slightly, both within the normal ranges for C and E stream channel types (Rosgen, 1994).

Stream pattern parameters including sinuosity, belt width, radii of curvature, meander wavelength, and meander width ratio will be measured and/or calculated. Stream pattern measurements are expected to remain consistent from year to year and to fall within the originally proposed design parameters. As vegetation becomes established and the stream banks are stabilized, it is anticipated that the sinuosity of the streams will also adjust, likely becoming more sinuous with time.

Stream longitudinal profile parameters including bankfull slope, riffle length, riffle slope, pool length, and pool to pool spacing will be measured. Longitudinal profiles parameters are expected to remain relatively consistent from year to year. The stream profiles should not show aggrading or degrading conditions during the five-year monitoring period, however, minor profile adjustments such as deepening of pools is expected.

Stream bed material will be monitored using the described Modified Wolman pebble counts. The success criteria for the bed material will be determined at the end of the five-year monitoring period when data can be reviewed and compared to the proposed channel material types. Fluctuations in bed materials will likely occur during the early years following construction and several years may be needed to observe a consistent bed material. Bed materials should ultimately reflect the proposed design conditions for each reach at LWOC.

Stream bank stability will be monitored using BEHI and sediment transport estimates during Monitoring Years 3 and 5. Data collected during these years will be compared with pre-construction conditions to determine the change in bank erosion hazard indices and sediment

export rates for each reach assessed. Positive change, namely reduction, in both stream bank erosion rates and sediment transport rates at LWOC are expected as a result of restoration and will be documented as described to demonstrate success.

Hydrologic monitoring success will be based on the ability to document the occurrence of bankfull storm events at LWOC. A minimum of two bankfull events, each occurring in two separate monitoring years, are required to be documented within the five-year monitoring period. The described crest gauges will be used to determine and document the occurrence of these bankfull events.

As described above, photo documentation and visual assessment will be used to complement the other stream monitoring practices as part of the stream monitoring protocol at LWOC. If during any given year, the streams are not anticipated to meet the final established monitoring criteria, corrective actions will be considered. Such modifications will be documented and discussed with EEP.

3.2.3 Stream Monitoring Results for Year 1 of 5

In late August 2008, the stream monitoring for Monitoring Year 1 was conducted. The methodologies described in the Stream Monitoring Methodology Section above were used for the stream monitoring at LWOC for Monitoring Year 1. Detailed surveys were conducted along the project stream reaches specified to be surveyed for annual monitoring as described in detail above. The results of these surveys were used as the basis for the morphometric monitoring, including stream dimension, patter and profile.

All of the 13 cross sections were surveyed to measure the bankfull width, floodprone width, bankfull cross sectional area, bankfull mean depth, bankfull max depth, width to depth ratio, entrenchment ratio, wetted perimeter, and hydraulic radius. The results of the cross section surveys are presented in Table VIII. Appendix D compares photos taken during Monitoring Year 1 with the initial baseline photos at each of the 13 cross sections. Appendix E provides an overlay of the Monitoring Year 1 and baseline conditions along with the raw data for each cross section. The comparison of the baseline and Monitoring Year 1 stream dimension morphometric data for each of the project stream reaches showed very positive results, all of which were comparable to the originally proposed design parameters. The results showed that all of the reaches were experiencing the expected minor adjustments including decreasing width to depth ratios, increasing entrenchment ratios, and minor increases in depth. Each of these trends was indicative of movement toward increased stream stability and was attributed to vegetation establishment and natural channel adjustments. The comparison of the Year 1 Monitoring cross section photos to the as-built cross section photos strongly complement these suggestions, as no concerns, problems, or negative trends were documented.

The pattern for all of the stream reaches was surveyed to measure the parameters of sinuosity, belt width, radii of curvature, meander wavelength, and meander width ratio. The results of the pattern surveys are presented in Table VIII. The comparison of the baseline and Monitoring Year 1 stream pattern morphometric data for each of the project stream

reaches showed very positive results, all of which were comparable to the originally proposed design parameters. The results showed that all of the reaches were experiencing the expected minor adjustment attributed to vegetation establishment and natural channel adjustments. This adjustment included slightly increasing radii of curvature, indicative of movement toward increased stream stability. These minor adjustments can be viewed through the overlays included in Appendix A.

Longitudinal profile surveys were conducted along each of the project stream reaches specified for annual monitoring surveys. The surveys were performed to measure the parameters of bankfull slope, riffle length, riffle slope, pool length, and pool to pool spacing. The results of the longitudinal profile surveys are presented in Table VIII. The comparison of the baseline and Monitoring Year 1 longitudinal profiles for each of the monitored project stream reaches showed very positive results, all of which were comparable to the originally proposed design parameters. The results showed that all of the reaches were experiencing the expected minor adjustment attributed to vegetation establishment and natural channel adjustments. This adjustment included deepening of pools. The comparison of the baseline and Monitoring Year 1 longitudinal profiles did not show excessive aggrading or degrading. Overlays can be found in Appendix E along with the raw data from both the baseline and Monitoring Year 1 conditions.

Modified Wolman pebble counts were repeated at each of the project stream reaches to classify the stream bed materials for comparison to the baseline conditions. The results of the pebble counts are presented in Table VIII while the raw data and overlays of the percent accumulation graphs can be viewed in Appendix E. Fluctuations in bed materials were expected to occur during the early years following construction. This expectation was observed in comparing the results of the baseline and Monitoring Year 1 pebble counts. Specifically, the bed material d50 and d84 for each of the stream reaches decreased. This trend may be observed during the five-year monitoring period. At this time it is believed that the original assumption that the stream bed materials would coarsen after restoration may have been incorrect. The stream systems at LWOC appear to be sand-dominated and therefore coarsening of the bed may not occur. The monitoring results do suggest, however that on-site sediment supply from LWOC is being greatly reduced as a result of the restoration. As noted earlier, the success criteria for the bed material will be determined at the end of the five-year monitoring period when data can be reviewed and compared to the proposed channel material types. Fluctuations in bed materials will likely continue to occur and several years may be needed to observe a consistent bed material.

Stream bank stability monitoring was not conducted, as this monitoring practice is scheduled to be performed using BEHI and sediment transport estimates during Monitoring Years 3 and 5. BEHI information was collected during the existing condition surveys and sediment transport rates were subsequently developed. The resulting information will serve as baseline data for stream bank stability at LWOC and is presented in Table IX. The raw data for this table can be viewed in Appendix E.

Each of the eight crest gages were checked during the Monitoring Year 1 surveys to monitor hydrology at LWOC. Six of the eight crest gages recorded flood stages in excess of the

bankfull stage. The two crest gages that did not record flood stages in excess of the bankfull stage were the crest gages at Reaches R2A and R2D. The crest gage at Reach R2A apparently did not record evidence of a flood stage event. The crest gage at Reach R2D recorded a flood stage that was 0.26 feet below the bankfull stage. Each of the crest gages was reset after checking stage measurements to record future events. Table X lists the information related to the verification of bankfull events at LWOC for Monitoring Year 1 while the raw data can be found in Appendix E. The evidence recorded by the crest gages indicated a storm event producing a stage in excess of the bankfull storm occurred at LWOC during Monitoring Year 1. This documentation of the first bankfull event at LWOC during the monitoring period suggests success with regards to hydrologic monitoring at LWOC.

Photo documentation and project-wide visual assessment were used to complement the other Monitoring Year 1 stream monitoring practices. Photos were taken from each of the original 11 permanent photo reference points. Three additional photo points (photo points 2.5Y1, 3.5Y1, and 8.5Y1) were also added to insure that adequate photo documentation would be conducted within the monitoring limits of the project stream reaches. Photo point 2.5Y1 was added for Reach R2, photo point 3.5Y1 for Reach R2B, and photo point 8.5Y1 for Reach R1A. After installation, photos were taken at each of the three added photo points. Appendix C includes all of the described photos and provides comparison of the photos with the initial baseline photos taken from the 11 permanent photo reference points. The new photos taken at three additional photo points will serve as supplemental baseline condition photos and subsequent photos at these same locations will be compared in Monitoring Years 2 through 5. No stream problems were documented through the photo comparison process. A project-wide visual assessment was conducted along each of the project stream reaches to identify any specific stream problem areas. Table XI presents the results of the project-wide visual assessment. The project-wide visual assessment revealed 12 specific stream problem areas. Each of these stream problem areas, including their description, location, and suspected cause, are listed in Table XII. The stream problem areas included eight in-stream structure failures and associated stream bank erosion, three areas of floodplain and adjacent stream bank erosion, and one area of stream bank erosion. Mulkey elected to promptly address all of the stream problem areas and conducted construction repairs of each in October 2008. The eight stream problem areas categorized as failures of in-stream structures and were determined to be caused by incorrect construction of the given in-stream structure. The failed in-stream structures included j-hook rock vanes and rock cross vanes. All eight of the structures and the associated areas of stream bank erosion were repaired. Several of the j-hook rock vanes were converted to rock vanes during the said repairs to prevent future point bar erosion. The three stream problem areas categorized as floodplain and adjacent stream bank erosion were determined to be attributed to the incorrect installation of floodplain interceptors. All three of the eroded areas were repaired and floodplain interceptors were installed using both rock and log materials. The remaining stream problem area categorized as stream bank erosion was determined to be caused by a minor field adjustment made to the stream alignment in order to save an existing mature tree at the request of the landowner. This area of stream bank erosion was also repaired. The repairs to the all of the areas of eroded stream banks included re-grading, re-seeding with appropriate temporary and permanent seed, and re-installing coir fiber matting. Black willow (*Salix nigra*) and/or silky dogwood (*Cornus amomum*) live stakes were harvested on-

site and were installed at the repaired stream banks. Please note that the results shown in Table XI were updated such that the repairs to the stream problem areas described above are included. Based on the results of the stream monitoring for Monitoring Year 1 at LWOC, as well as the subsequent corrective actions taken, Mulkey does not propose any additional recommendations or actions other than to proceed with the annual stream monitoring.

4.0 Project Monitoring Methodology

Success criteria for stream mitigation sites are based on guidelines established by the USACE, US Environmental Protection Agency (USEPA), NC Wildlife Resources Commission (NCWRC) and the NCDWQ (USACE *et. al,* 2003). These guidelines establish criteria for monitoring both hydrologic conditions and vegetation survival. These same guidelines were used to develop the monitoring methods, frequencies, and success criteria discussed herein for LWOC and further described in detail in the approved mitigation report (Mulkey Engineers and Consultants, 2008). LWOC site conditions will be monitored annually during the latter part of the growing season months (August, September, and October) over the five-year monitoring period. This monitoring period complies with the requirements set fourth in the Full Delivery RFP 16-D06027. Monitoring results will be documented on an annual basis, with the associated reports submitted to the NCEEP as evidence that the established project goals and objectives are being achieved. The results of annual monitoring will be used to evaluate the degree of success LWOC has achieved in meeting the said goals and objectives. In the event that goals are not being met, Mulkey will coordinate with the NCEEP to develop a plan for ameliorating the areas of concern.

5.0 References

Mulkey Engineers and Consultants. 2008. Little White Oak Creek Stream Restoration Mitigation Report. August 2008.

NCEEP. 2005. Content, Format, and Data Requirements for EEP Monitoring Reports. Version 1.1, September 16, 2005. NCDENR, NCEEP. 17 pp.

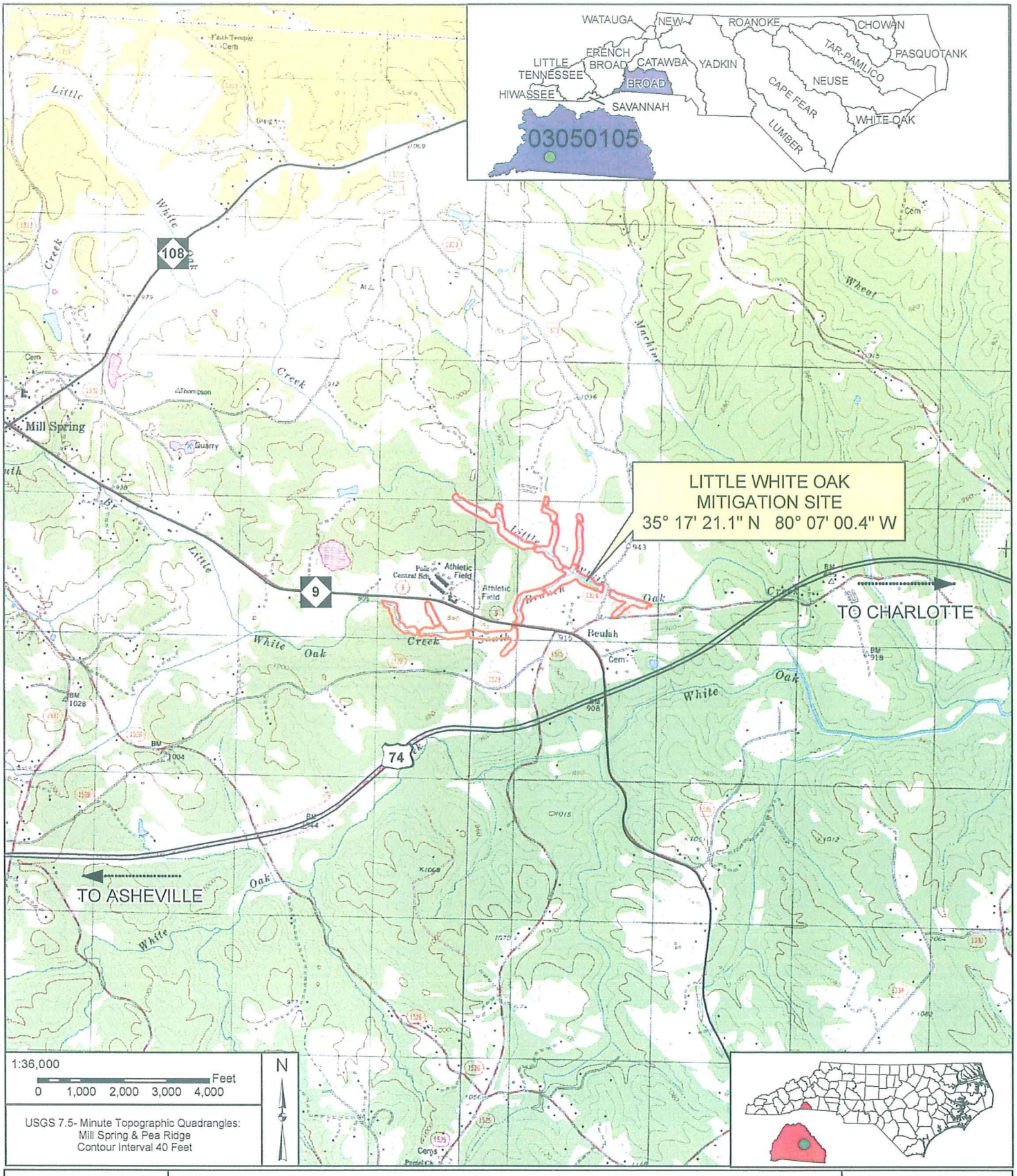
Rosgen, D.L. 1994. A Classification of Natural Rivers. Catena, 22:169-199.

Rosgen, D.L. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.

Rosgen, D.L. 1998. The Reference Reach – A Blueprint for Natural Channel Design. From Proceedings of the Wetlands and Restoration Conference, March 1998, Denver CO. Wildland Hydrology, Pagosa Springs, CO.

Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina, Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, N.C. Department of Environment, Health and Natural Resources.

USACE, USEPA, NCWRC, and NCDWQ. 2003. Stream Mitigation Guidelines. April 2003.



LOCATION MAP

LITTLE WHITE OAK STREAM RESTORATION

POLK COUNTY, NORTH CAROLINA

March 20, 2008

Figure 1

Ecosystem Enhancement

MULKEY ENGINEERS & CONSULTANTS

PROJECT NO. D06027-B

Table I. Project Restoration Approach and Mitigation Type Little White Oak Creek Stream Restoration / D06027-B					
Stream Reach ID	**Restoration Approach**	**Mitigation Type**	**Linear Footage**	**Stationing**	**Comments**
R1	P2	R	7,543	0+00 – 75+43	Channel relocation with floodplain excavation
R1A	P1/P2	R	1,040	0+00 – 10+40	Includes 850 feet of P1 and 190 feet of P2 channel relocation
R2 (Upper and Lower)	P2	R	7,107	0+00 – 71+07	Channel relocation with floodplain excavation
R2A	P2	R	336	0+00 – 3+36	Channel relocation with floodplain excavation
R2B	P1/P2	R	1,474	0+00 – 14+74	Includes 250 feet of P1 and 1224 feet of P2 channel relocation
R2D	P1/P2	R	790	0+00 – 7+90	Includes 100 feet of P1 and 690 feet of P2 channel relocation

R = Restoration
EI = Enhancement I
EII = Enhancement II
S = Stabilization
P1 = Priority I
P2 = Priority II
P3 = Priority III
SS = Stream Banks Stabilization

Table II. Project Activity and Reporting History Little White Oak Creek Stream Restoration / D06027-B			
Activity or Report	**Scheduled Completion**	**Data Collection Completion**	**Actual Completion or Delivery**
Restoration Plan Prepared	Oct-06	Aug-06	12-Feb-07
Restoration Plan Approved	Nov-06	N/A	30-Mar-07
Final Design - 90%	Dec-06	N/A	16-May-07
Construction	Jun-07	N/A	13-Nov-07
Temporary S&E mix applied to entire project area	Jun-07	N/A	13-Nov-07
Permanent seed mix applied to entire project area	Jun-07	N/A	13-Nov-07
Planting live stakes	Dec-07	N/A	11-Jan-08
Planting bare roots	Dec-07	N/A	11-Jan-08
End of Construction	Dec-07	N/A	11-Jan-08
Survey of As-built conditions (Year 0 Monitoring - Baseline)	Jan-08	Jan-08	9-Jan-08
Monitoring			
Year 1 - 2008	Dec-08	Sep-08	Dec-08
Year 2 - 2009	Dec-09	N/A	N/A
Year 3 - 2010	Dec-10	N/A	N/A
Year 4 - 2011	Dec-11	N/A	N/A
Year 5 - 2012	Dec-12	N/A	N/A

Bolded items represent those events or deliverables that are variable. Non-bolded items represent events that are standard components over the course of a typical project.

Table III. Project Contacts Little White Oak Creek Stream Restoration / D06027-B		
Designer		
	Mulkey Engineers and Consultants	6750 Tryon Road Cary, NC 27518 Contact: William Scott Hunt, III Tel. 919.858.1825
Construction Contractor		
	Vaughan Contracting, LLC	P.O. Box 796 Wadesboro, NC 28170 Contact: Tommy Vaughan Tel. 704.694.6450
Planting Coordinator		
	Bruton Nurseries and Landscapes	150 Black Creek Road Fremont, NC 27830 Contact: Charles Bruton, Jr. Tel. 919.242.6555
Seeding Contractor		
	Vaughan Contracting, LLC	P.O. Box 796 Wadesboro, NC 28170 Contact: Tommy Vaughan Tel. 704.694.6450
Seed Mix Sources		
	Evergreen Seed	P.O. Box 669 Willow Spring, NC 27592 Contact: Wister Heald Tel. 919.567.1333
Nursery Stock Suppliers		
	International Paper South Carolina SuperTree Nursery	5594 Highway 38 South Blenheim, SC 29516 Contact: Geoffrey Hill Tel. 803.528.3203
	North Carolina Forestry Service Claridge Nursery	762 Claridge Nursery Road Goldsboro, NC 27530 Contact: James West Tel. 919.731.7988
Monitoring Performers		
	Mulkey Engineers and Consultants	6750 Tryon Road Cary, NC 27518 Contact: William Scott Hunt, III Tel. 919.858.1825

Table IV. Project Background Little White Oak Creek Stream Restoration / D06027-B	
Project County	Polk County, North Carolina
Drainage Area [sq. mi(acres)]	
R1	4.46 (2854)
R1A	0.11 (70)
R2	10.85 (6944)
R2A	0.54 (355)
R2B	0.12 (77)
R2D	0.05 (32)
Drainage Impervious cover estimate (%)	
R1	2
R1A	2
R2	2
R2A	2
R2B	2
R2D	2
Stream Order	
R1	3
R1A	1
R2	3,4
R2A	2
R2B	1
R2D	1
Physiographic Region	Piedmont
Ecoregion	Southern Inner Piedmont
Rosgen Classification (As-built)	
R1, R1A, R2	C5
R2A, R2B	C4
R2D	C6
Cowardin Classification	R3UB2*
Dominat Soil Types	Riverview-Chewacla-Buncombe
Reference Site ID	UT to Ostin Creek
USGS HUC for Project and Reference	
Project	03050105
Reference	03050105
NCDWQ Sub-basin for Project and Reference	
Project	03-08-02 (Broad)
Reference	03-08-03 (Borad)
NCDWQ Classification for Project and Reference	
Project	C
Reference	C,Tr
Any portion of any project segement 303d?	No
Any portion of any project segement upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	N/A
Percent of project easement fenced	100

*(R) Riverine (3) Upper Perennial (UB) Unconsolidated Bottom (2) Sand

Table V. Stem Counts Monitoring Year 1 for Each Species Arranged by Plot
Little White Oak Creek Stream Restoration / D06027-B

Species	Plots																								Initial Totals	Initial Totals (Adjusted) [A]	Year 1 Totals	Survival %
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Shrubs																												
Cephalanthus occidentalis																4			1				3		9	9	8	89%
Cornus amomum		2					8	2		1		1		2						1					15	17	17	100%
Sambucus canadensis													2												2	2	2	100%
Trees																												
Alnus serrulata																									0	0	0	n/a
Betula nigra	1	8				4	7	5		1				2				1		2			6		41	40	37	93%
Cornus florida															1						1				2	2	2	100%
Corylus americana										0				4					0				0		17	5	4	80%
Diospyros virginiana			1								4	2					2							7	19	19	16	84%
Fraxinus pennsylvanica					1			4		1			7	1	1	3		4	2	1		9	1		37	35	35	100%
Juglans nigra			2								1										1			2	7	7	6	86%
Pinus echinata			1	5	3				2		1	1					2								28	26	15	58%
Pinus strobus			2	1	1				2		1				4		1				1			5	20	21	18	86%
Pinus virginiana			1	1	2				3		1				1										12	13	9	69%
Prunus serotina			1		2						1	1			1						1				6	7	7	100%
Plantanus occidentalis							2	2		5		7				5		2	5	16			1		45	45	45	100%
Quercus alba			6	5	3				4		1	1	1	1	1		8		1		1			6	35	43	39	91%
Quercus falcata			0	2	0				3	1	5	1			9		2				7				41	36	30	83%
Quercus michauxii	8	2						2		1			9	3		4		1	2	4		5	4		47	46	45	98%
Quercus nigra	8	2			1	10																			34	23	21	91%
Quercus phellos	7	5			1	6																			9	19	19	100%
Salix nigra							1																		1	1	1	100%
Ulmus americana								4		7				2		4		3	9			9	4		26	43	42	98%
Totals	24	19	14	14	14	20	18	19	14	17	15	14	19	15	18	20	15	11	20	24	12	23	19	20	453	459	418	91%
																									Stems Per Acre Summary			
Plot Acreage	0.024	0.023	0.025	0.025	0.024	0.024	0.025	0.025	0.025	0.025	0.024	0.024	0.024	0.024	0.025	0.024	0.025	0.025	0.025	0.024	0.025	0.025	0.025	0.025	Min	Ave	Max	
Stems/Acre	996	823	571	571	576	826	709	763	562	694	615	581	795	615	729	826	598	438	813	1000	484	924	776	816	438	713	1000	

Notes: [A] Initial Totals (Adjusted) represents the most accurate species occurrence, following corrections for misidentification and other issues during the initial counting process.

Table VI. Vegetative Problem Areas Little White Oak Creek Stream Restoration / D06027-B			
Feature/Issue	**Station / Range**	**Probable Cause**	**Photo No. (If Available)**
No vegetative problem areas observed	All project reaches	N/A	N/A

Table VII. Baseline Morphology and Hydraulic Summary
Little White Oak Creek Stream Restoration / D06027-B
Reach R1 (7543 ft)

PARAMETERS	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension - Riffle	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BKF Width (ft)	--	--	--	15	43	25	16.6	20.3	18.4	16.0	20.6	18.5	--	--	25.7	--	--	33.0
Floodprone Width (ft)	--	--	--	--	--	--	69.6	118.6	94.1	67.2	72.8	67.2	90.8	113.6	98.4	--	--	79.6
BKF Cross Sectional Area (sq. ft.)	--	--	--	30	110	60	52.9	69.7	61.3	27.4	33.4	30.3	--	--	52.0	--	--	40.1
BKF Mean Depth (ft)	--	--	--	1.5	3.8	2.5	3.20	3.43	3.32	1.57	1.72	1.64	--	--	2.02	--	--	1.22
BKF Max Depth (ft)	--	--	--	--	--	--	2.37	5.00	3.69	1.54	2.36	1.90	1.90	2.91	2.34	--	--	2.78
Width/Depth Ratio	--	--	--	--	--	--	5.2	5.9	5.6	9.3	12.7	11.3	--	--	12.7	--	--	27.0
Entrenchment Ratio	--	--	--	--	--	--	4.2	5.8	5.0	3.5	4.4	3.8	3.5	4.4	3.8	--	--	2.4
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	25.4	--	--	20.8	--	--	29.7	--	--	49.1
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	2.8	--	--	1.4	--	--	1.8	--	--	1.2
Pattern	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	--	--	--	--	--	--	22.0	61.6	39.8	36.0	150.0	67.0	77.1	208.1	92.9	40.6	135.8	87.7
Radius of Curvature (ft)	--	--	--	--	--	--	23.4	63.8	37.7	19.0	115.0	49.0	38.5	159.5	68.0	35.5	108.4	58.1
Meander Wavelength (ft)	--	--	--	--	--	--	107.0	189.3	135.7	33.0	155.0	94.0	45.8	215.0	130.4	178.0	258.9	210.9
Meander Width Ratio	--	--	--	--	--	--	1.2	3.3	2.2	1.9	8.1	3.6	1.9	8.1	3.6	1.2	4.1	2.7
Profile	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	14.3	43.1	27.5
Riffle Slope (ft/ft)	--	--	--	--	--	--	0.001	0.117	0.010	0.006	0.066	0.028	0.002	0.021	0.009	0.003	0.027	0.010
Pool Length (ft)	--	--	--	--	--	--	11.4	87.9	39.3	18.3	62.9	35.1	25.4	87.2	48.7	22.4	53.7	40.7
Pool Spacing (ft)	--	--	--	--	--	--	50.6	402.6	140.9	50.3	105.8	78.9	69.8	146.8	109.4	113.3	323.8	193.5
Substrate																		
d50 (mm)		--			--			8			3			8			0.5	
d84 (mm)		--			--			19			105			19			4.4	
Additional Reach Parameters																		
Bankfull Slope (ft/ft)		--			--			0.0028			0.0090			0.0028			0.0025	
Channel Length(ft)		--			--			6530			590			7643			7543	
Valley Length (ft)		--			--			5717			404			5717			5717	
Sinuosity		--			--			1.14			1.46			1.34			1.32	
Rosgen Classification		--			--			Degraded E5			C4/1			C5			C5	

Table VII. cont. Baseline Morphology and Hydraulic Summary
Little White Oak Creek Stream Restoration / D06027-B
Reach R1A (1040 ft)

PARAMETERS	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BKF Width (ft)	--	--	--	6	21	12	4.5	10.9	7.7	16.0	20.6	18.5	--	--	8.0	--	--	7.8
Floodprone Width (ft)	--	--	--	--	--	--	8.6	19.1	13.8	67.2	72.8	67.2	28.2	35.2	30.5	--	--	125.0
BKF Cross Sectional Area (sq. ft.)	--	--	--	9	37	19	1.6	5.9	3.7	27.4	33.4	30.3	--	--	5.0	--	--	3.5
BKF Mean Depth (ft)	--	--	--	0.9	2.1	1.6	0.36	0.54	0.45	1.57	1.72	1.64	--	--	0.63	--	--	0.45
BKF Max Depth (ft)	--	--	--	--	--	--	0.54	1.18	0.86	1.54	2.36	1.90	0.59	0.90	0.73	--	--	0.79
Width/Depth Ratio	--	--	--	--	--	--	12.5	20.2	16.4	9.3	12.7	11.3	--	--	12.7	--	--	17.2
Entrenchment Ratio	--	--	--	--	--	--	1.7	1.9	1.8	3.5	4.4	3.8	3.5	4.4	3.8	--	--	16.1
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	4.7	--	--	20.8	--	--	9.3	--	--	8.1
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	0.3	--	--	1.4	--	--	0.5	--	--	0.4
Pattern	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	--	--	--	--	--	--	--	--	--	36.0	150.0	67.0	23.8	64.5	28.8	16.4	39.7	24.4
Radius of Curvature (ft)	--	--	--	--	--	--	--	--	--	19.0	115.0	49.0	12.0	49.5	21.1	10.0	21.0	14.7
Meander Wavelength (ft)	--	--	--	--	--	--	--	--	--	33.0	155.0	94.0	14.2	66.7	40.4	61.5	85.7	68.8
Meander Width Ratio	--	--	--	--	--	--	--	--	--	1.9	8.1	3.6	1.9	8.1	3.6	2.1	5.1	3.1
Profile	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8.0	26.0	14.5
Riffle Slope (ft/ft)	--	--	--	--	--	--	--	--	--	0.006	0.066	0.028	0.007	0.070	0.030	0.004	0.046	0.019
Pool Length (ft)	--	--	--	--	--	--	--	--	--	18.3	62.9	35.1	7.9	27.1	15.1	7.5	30.7	18.5
Pool Spacing (ft)	--	--	--	--	--	--	--	--	--	50.3	105.8	78.9	21.6	45.5	33.9	15.0	52.3	32.0
Substrate																		
d50 (mm)	--			--			0			3			0			0.28		
d84 (mm)	--			--			6			105			6			1		
Additional Reach Parameters																		
Bankfull Slope (ft/ft)	--			--			0.0122			0.0090			0.0096			0.0115		
Channel Length(ft)	--			--			906			590			1225			1040		
Valley Length (ft)	--			--			854			404			854			854		
Sinuosity	--			--			1.06			1.46			1.43			1.22		
Rosgen Classification	--			--			Degraded B6c			C4/1			C5			C5		

Table VII. cont. Baseline Morphology and Hydraulic Summary
Little White Oak Creek Stream Restoration / D06027-B
Reach R2 (7107 ft)

PARAMETERS	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BKF Width (ft)	--	--	--	18	50	29	24.3	24.5	24.4	16.0	20.6	18.5	--	--	31.1	33.1	50.2	40.4
Floodprone Width (ft)	--	--	--	--	--	--	77.1	251.0	164.0	67.2	72.8	67.2	109.8	137.4	119.0	92.0	120.0	108.1
BKF Cross Sectional Area (sq. ft.)	--	--	--	40	150	85	76.1	76.7	76.4	27.4	33.4	30.3	--	--	76.0	62.6	73.8	66.7
BKF Mean Depth (ft)	--	--	--	1.8	4	2.9	3.13	3.14	3.14	1.57	1.72	1.64	--	--	2.45	1.27	1.94	1.70
BKF Max Depth (ft)	--	--	--	--	--	--	3.61	4.94	4.10	1.54	2.36	1.90	2.30	3.52	2.83	2.95	4.40	3.68
Width/Depth Ratio	--	--	--	--	--	--	7.7	7.8	7.8	9.3	12.7	11.3	--	--	12.7	17.5	39.5	25.5
Entrenchment Ratio	--	--	--	--	--	--	3.1	10.3	6.7	3.5	4.4	3.8	3.5	4.4	3.8	2.4	3.0	2.7
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	28.0	--	--	20.8	--	--	35.9	34.0	51.5	41.7
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	2.7	--	--	1.4	--	--	2.1	1.2	1.9	1.7
Pattern	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	--	--	--	--	--	--	15.2	48.7	32.8	36.0	150.0	67.0	60.4	251.6	112.4	40.6	169.2	105.1
Radius of Curvature (ft)	--	--	--	--	--	--	19.7	124.4	45.8	19.0	115.0	49.0	31.9	192.9	82.2	38.1	155.1	61.8
Meander Wavelength (ft)	--	--	--	--	--	--	85.8	165.1	118.2	33.0	155.0	94.0	55.4	260.0	157.7	179.3	296.1	248.4
Meander Width Ratio	--	--	--	--	--	--	3.5	6.8	4.9	1.9	8.1	3.6	1.9	8.1	3.6	1.0	4.2	2.6
Profile	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	23.6	66.1	44.2
Riffle Slope (ft/ft)	--	--	--	--	--	--	0.001	0.008	0.003	0.006	0.066	0.028	0.001	0.014	0.006	0.001	0.002	0.001
Pool Length (ft)	--	--	--	--	--	--	8.5	137.1	42.0	18.3	62.9	35.1	30.8	105.5	58.9	18.9	84.9	52.3
Pool Spacing (ft)	--	--	--	--	--	--	38.7	442.4	205.7	50.3	105.8	78.9	84.4	177.5	132.3	132.2	264.4	183.0
Substrate																		
d50 (mm)	--			--			0.8			3			0.8			0.6		
d84 (mm)	--			--			5.4			105			5.4			4.7		
Additional Reach Parameters																		
Bankfull Slope (ft/ft)	--			--			0.0021			0.0090			0.0019			0.0017		
Channel Length(ft)	--			--			5978			590			7337			7107		
Valley Length (ft)	--			--			5255			404			5255			5255		
Sinuosity	--			--			1.14			1.46			1.40			1.35		
Rosgen Classification	--			--			Degraded E5			C4/1			C5			C5		

Table VII. cont. Baseline Morphology and Hydraulic Summary
Little White Oak Creek Stream Restoration / D06027-B
Reach R2A (336 ft)

PARAMETERS	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BKF Width (ft)	--	--	--	5.5	20	11	11.2	11.2	11.2	16.0	20.6	18.5	--	--	11.7	--	--	13.9
Floodprone Width (ft)	--	--	--	--	--	--	16.0	19.1	17.5	67.2	72.8	67.2	42.4	51.9	44.9	--	--	40.5
BKF Cross Sectional Area (sq. ft.)	--	--	--	6.5	28	16	10.8	16.8	13.8	27.4	33.4	30.3	--	--	11.0	--	--	15.8
BKF Mean Depth (ft)	--	--	--	0.65	1.9	1.3	0.97	1.50	1.24	1.57	1.72	1.64	--	--	0.94	--	--	1.14
BKF Max Depth (ft)	--	--	--	--	--	--	0.95	2.23	1.48	1.54	2.36	1.90	0.88	1.35	1.09	--	--	1.80
Width/Depth Ratio	--	--	--	--	--	--	7.5	11.5	9.5	9.3	12.7	11.3	--	--	12.5	--	--	12.2
Entrenchment Ratio	--	--	--	--	--	--	1.4	1.7	1.6	3.5	4.4	3.8	3.5	4.4	3.7	--	--	2.9
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	13.2	--	--	20.8	--	--	13.6	--	--	14.7
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	1.3	--	--	1.4	--	--	0.8	--	--	1.1
Pattern	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	--	--	--	--	--	--	20.2	20.2	20.2	36.0	150.0	67.0	22.8	95.0	42.4	32.2	49.3	40.0
Radius of Curvature (ft)	--	--	--	--	--	--	8.8	31.4	21.1	19.0	115.0	49.0	12.0	72.8	31.0	17.6	27.2	22.9
Meander Wavelength (ft)	--	--	--	--	--	--	76.7	76.7	76.7	33.0	155.0	94.0	20.9	98.1	59.5	99.4	107.1	102.9
Meander Width Ratio	--	--	--	--	--	--	1.8	1.8	1.8	1.9	8.1	3.6	1.9	8.1	3.6	2.3	3.6	2.9
Profile	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.8	46.8	23.1
Riffle Slope (ft/ft)	--	--	--	--	--	--	0.004	0.024	0.011	0.006	0.066	0.028	0.006	0.066	0.029	0.011	0.131	0.046
Pool Length (ft)	--	--	--	--	--	--	17.2	65.4	31.8	18.3	62.9	35.1	11.6	39.8	22.2	16.6	42.1	29.5
Pool Spacing (ft)	--	--	--	--	--	--	83.1	165.7	113.2	50.3	105.8	78.9	31.8	67.0	49.9	61.7	72.9	65.7
Substrate																		
d50 (mm)	--			--			20			3			20			0.5		
d84 (mm)	--			--			50			105			50			27.5		
Additional Reach Parameters																		
Bankfull Slope (ft/ft)	--			--			0.0107			0.0090			0.0091			0.0150		
Channel Length(ft)	--			--			377			590			379			336		
Valley Length (ft)	--			--			319			404			246			246		
Sinuosity	--			--			1.18			1.46			1.54			1.36		
Rosgen Classification	--			--			Degraded E4			C4/1			C4			C5		

Table VII. cont. Baseline Morphology and Hydraulic Summary
Little White Oak Creek Stream Restoration / D06027-B
Reach R2B (1474 ft)

PARAMETERS	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BKF Width (ft)	--	--	--	3	11	6	4.5	6.4	5.5	16.0	20.6	18.5	--	--	8.0	13.1	19.8	15.6
Floodprone Width (ft)	--	--	--	--	--	--	5.4	195.3	100.4	67.2	72.8	67.2	28.2	35.2	30.5	26.0	75.0	49.1
BKF Cross Sectional Area (sq. ft.)	--	--	--	2	9	4.5	5.9	8.7	7.3	27.4	33.4	30.3	--	--	5.0	5.2	10.2	7.2
BKF Mean Depth (ft)	--	--	--	0.45	1.2	0.8	1.31	1.35	1.33	1.57	1.72	1.64	--	--	0.63	0.39	0.52	0.45
BKF Max Depth (ft)	--	--	--	--	--	--	1.70	1.80	1.75	1.54	2.36	1.90	0.59	0.90	0.73	0.93	1.48	1.13
Width/Depth Ratio	--	--	--	--	--	--	3.4	4.8	4.1	9.3	12.7	11.3	--	--	12.7	31.7	38.1	34.4
Entrenchment Ratio	--	--	--	--	--	--	1.2	30.3	15.8	3.5	4.4	3.8	3.5	4.4	3.8	2.0	5.4	3.2
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	6.4	--	--	20.8	--	--	9.3	13.4	20.6	16.1
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	0.9	--	--	1.4	--	--	0.5	0.4	0.5	0.4
Pattern	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	--	--	--	--	--	--	--	--	--	36.0	150.0	67.0	15.5	64.5	28.8	8.0	37.1	22.6
Radius of Curvature (ft)	--	--	--	--	--	--	--	--	--	19.0	115.0	49.0	8.2	49.5	21.1	7.9	31.0	15.3
Meander Wavelength (ft)	--	--	--	--	--	--	--	--	--	33.0	155.0	94.0	14.2	66.7	40.4	56.1	70.8	63.6
Meander Width Ratio	--	--	--	--	--	--	--	--	--	1.9	8.1	3.6	1.9	8.1	3.6	0.5	2.4	1.4
Profile	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.7	17.0	10.1
Riffle Slope (ft/ft)	--	--	--	--	--	--	--	--	--	0.006	0.066	0.028	0.008	0.083	0.036	--	--	--
Pool Length (ft)	--	--	--	--	--	--	--	--	--	18.3	62.9	35.1	7.9	27.1	15.1	10.5	31.5	16.6
Pool Spacing (ft)	--	--	--	--	--	--	--	--	--	50.3	105.8	78.9	21.6	45.5	33.9	15.5	105.3	35.6
Substrate																		
d50 (mm)	--			--			4.9			3			4.9			0.1		
d84 (mm)	--			--			28			105			28			6.2		
Additional Reach Parameters																		
Bankfull Slope (ft/ft)	--			--			0.0145			0.0090			0.0113			0.0139		
Channel Length(ft)	--			--			1385			590			1654			1474		
Valley Length (ft)	--			--			1264			404			1091			1091		
Sinuosity	--			--			1.10			1.46			1.52			1.35		
Rosgen Classification	--			--			G5c			C4/1			C4			C5		

Table VII. cont. Baseline Morphology and Hydraulic Summary
Little White Oak Creek Stream Restoration / D06027-B
Reach R2D (790 ft)

PARAMETERS	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension - Riffle	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BKF Width (ft)	--	--	--	--	--	3.3	3.8	7.2	5.5	16.0	20.6	18.5	--	--	8.0	--	--	15.0
Floodprone Width (ft)	--	--	--	--	--	--	8.4	12.6	10.5	67.2	72.8	67.2	28.2	35.2	30.5	--	--	70.0
BKF Cross Sectional Area (sq. ft.)	--	--	--	--	--	2.7	2.7	5.8	4.3	27.4	33.4	30.3	--	--	5.0	--	--	6.3
BKF Mean Depth (ft)	--	--	--	--	--	0.6	0.70	0.80	0.75	1.57	1.72	1.64	--	--	0.63	--	--	0.42
BKF Max Depth (ft)	--	--	--	--	--	--	1.12	1.65	1.40	1.54	2.36	1.90	0.59	0.90	0.73	--	--	1.02
Width/Depth Ratio	--	--	--	--	--	--	5.3	8.8	7.1	9.3	12.7	11.3	--	--	12.7	--	--	35.7
Entrenchment Ratio	--	--	--	--	--	--	1.8	2.2	2.0	3.5	4.4	3.8	3.5	4.4	3.8	--	--	4.7
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	--	--	--	20.8	--	--	9.3	--	--	15.5
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	--	--	--	1.4	--	--	0.5	--	--	0.4
Pattern	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	--	--	--	--	--	--	--	--	--	36.0	150.0	67.0	15.5	64.5	28.8	8.6	42.0	24.8
Radius of Curvature (ft)	--	--	--	--	--	--	--	--	--	19.0	115.0	49.0	8.2	49.5	21.1	8.2	20.1	13.3
Meander Wavelength (ft)	--	--	--	--	--	--	--	--	--	33.0	155.0	94.0	14.2	66.7	40.4	47.7	68.6	61.8
Meander Width Ratio	--	--	--	--	--	--	--	--	--	1.9	8.1	3.6	1.9	8.1	3.6	0.6	2.8	1.7
Profile	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.2	26.4	13.4
Riffle Slope (ft/ft)	--	--	--	--	--	--	--	--	--	0.006	0.066	0.028	0.008	0.083	0.036	0.008	0.062	0.028
Pool Length (ft)	--	--	--	--	--	--	--	--	--	18.3	62.9	35.1	7.9	27.1	15.1	10.1	23.3	15.9
Pool Spacing (ft)	--	--	--	--	--	--	--	--	--	50.3	105.8	78.9	21.6	45.5	33.9	31.8	90.7	51.9
Substrate																		
d50 (mm)	--			--			0.06			3			0.06			0.32		
d84 (mm)	--			--			0.21			105			0.21			0.5		
Additional Reach Parameters																		
Bankfull Slope (ft/ft)	--			--			0.0111			0.0090			0.0079			0.0105		
Channel Length(ft)	--			--			549			590			860			790		
Valley Length (ft)	--			--			486			404			571			571		
Sinuosity	--			--			1.13			1.46			1.51			1.38		
Rosgen Classification	--			--			Degraded E6			C4/1			C6			C5		

Table VIII. Morphology and Hydraulic Monitoring Summary
Little White Oak Creek Stream Restoration / D06027-B
Reach R1 (7543 ft)

PARAMETERS	Cross Section 9 Pool					Cross Section 10 Pool					Cross Section 11 Pool					Cross Section 12 Riffle														
Dimension	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
BKF Width (ft)	24.7					18.9					42.9					24.4														
Floodprone Width (ft)	77.2					104.9					129.3					74.9														
BKF Cross Sectional Area (sq. ft.)	40.9					40.7					63.7					48.9														
BKF Mean Depth (ft)	1.66					2.15					1.48					2.00														
BKF Max Depth (ft)	3.71					3.70					6.32					3.22														
Width/Depth Ratio	14.9					8.8					29.0					12.2														
Entrenchment Ratio	3.13					5.55					3.01					3.07														
Wetted Perimeter (ft)	26.6					22.5					47.5					26.8														
Hydraulic Radius (ft)	1.54					1.81					1.34					1.82														

PARAMETERS	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	50.2	134.8	95.3												
Radius of Curvature (ft)	44.9	73.6	54.0												
Meander Wavelength (ft)	186.6	240.2	210.4												
Meander Width Ratio	2.1	5.5	3.9												
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	21.8	47.5	29.3												
Riffle Slope (ft/ft)	0.001	0.015	0.006												
Pool Length (ft)	25.7	85.0	43.0												
Pool Spacing (ft)	49.4	138.4	85.7												
Substrate															
d50 (mm)		0.23													
d84 (mm)		0.73													
Additional Reach Parameters															
Bankfull Slope (ft/ft)		0.0020													
Monitored Channel Length (ft)		2022													
Monitored Valley Length (ft)		1277													
Sinuosity		1.58													
Total Channel Length (ft)		7543													
Rosgen Classification		C5													

Table VIII. Morphology and Hydraulic Monitoring Summary
Little White Oak Creek Stream Restoration / D06027-B
Reach R1A (1040 ft)

PARAMETERS	Cross Section 13 Riffle																											
Dimension	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
BKF Width (ft)	7.8																													
Floodprone Width (ft)	124.2																													
BKF Cross Sectional Area (sq. ft.)	4.2																													
BKF Mean Depth (ft)	0.54																													
BKF Max Depth (ft)	0.82																													
Width/Depth Ratio	14.5																													
Entrenchment Ratio	15.85																													
Wetted Perimeter (ft)	8.1																													
Hydraulic Radius (ft)	0.52																													

PARAMETERS	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	16.7	28.1	23.4												
Radius of Curvature (ft)	8.1	20.1	13.8												
Meander Wavelength (ft)	60.6	70.0	66.1												
Meander Width Ratio	2.1	3.6	3.0												
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	6.8	23.7	15.8												
Riffle Slope (ft/ft)	0.012	0.050	0.023												
Pool Length (ft)	12.1	29.1	15.9												
Pool Spacing (ft)	32.5	55.2	43.1												
Substrate															
d50 (mm)	0.14														
d84 (mm)	0.44														
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0114														
Monitored Channel Length (ft)	501														
Monitored Valley Length (ft)	380														
Sinuosity	1.32														
Total Channel Length (ft)	1040														
Rosgen Classification	C6														

Table VIII. Morphology and Hydraulic Monitoring Summary
Little White Oak Creek Stream Restoration / D06027-B
Reach R2 (7107 ft)

PARAMETERS	Cross Section 1 Riffle					Cross Section 2 Pool					Cross Section 3 Pool					Cross Section 4 Riffle					Cross Section 5 Pool									
Dimension	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
BKF Width (ft)	34.0					44.2					43.8					26.1					22.5									
Floodprone Width (ft)	99.7					118.8					150.2					120.4					104.6									
BKF Cross Sectional Area (sq. ft.)	64.1					53.2					54.4					52.1					36.1									
BKF Mean Depth (ft)	1.89					1.20					1.24					1.99					1.60									
BKF Max Depth (ft)	3.23					4.23					3.49					3.25					2.74									
Width/Depth Ratio	18.0					36.9					35.3					13.1					14.1									
Entrenchment Ratio	2.94					2.69					3.43					4.61					4.65									
Wetted Perimeter (ft)	34.9					47.2					46.3					27.5					23.8									
Hydraulic Radius (ft)	1.84					1.13					1.18					1.90					1.51									

PARAMETERS	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	62.5	141.1	110.6												
Radius of Curvature (ft)	41.9	79.3	54.7												
Meander Wavelength (ft)	183.6	258.7	236.1												
Meander Width Ratio	2.1	4.7	3.7												
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	29.7	79.1	44.7												
Riffle Slope (ft/ft)	0.002	0.013	0.005												
Pool Length (ft)	35.6	94.9	57.7												
Pool Spacing (ft)	108.7	264.9	176.3												
Substrate															
d50 (mm)		0.25													
d84 (mm)		0.76													
Additional Reach Parameters															
Bankfull Slope (ft/ft)		0.0014													
Monitored Channel Length (ft)		2093													
Monitored Valley Length (ft)		1392													
Sinuosity		1.50													
Total Channel Length (ft)		7107													
Rosgen Classification		C5													

Table VIII. Morphology and Hydraulic Monitoring Summary
Little White Oak Creek Stream Restoration / D06027-B
Reach R2A (336 ft)

PARAMETERS	Cross Section 6 Riffle																													
Dimension	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
BKF Width (ft)	16.06																													
Floodprone Width (ft)	40.35																													
BKF Cross Sectional Area (sq. ft.)	16.17																													
BKF Mean Depth (ft)	1.01																													
BKF Max Depth (ft)	1.89																													
Width/Depth Ratio	15.9																													
Entrenchment Ratio	2.51																													
Wetted Perimeter (ft)	16.66																													
Hydraulic Radius (ft)	0.97																													

PARAMETERS	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	33.9	47.2	39.4												
Radius of Curvature (ft)	21.3	26.8	23.7												
Meander Wavelength (ft)	98.3	105.2	100.6												
Meander Width Ratio	2.1	2.9	2.4												
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	19.2	24.6	22.0												
Riffle Slope (ft/ft)	0.007	0.020	0.013												
Pool Length (ft)	18.3	45.0	31.7												
Pool Spacing (ft)	71.8	133.0	102.4												
Substrate															
d50 (mm)	0.24														
d84 (mm)	11.3														
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0108														
Monitored Channel Length (ft)	320														
Monitored Valley Length (ft)	246														
Sinuosity	1.30														
Total Channel Length (ft)	336														
Rosgen Classification	C5														

Table VIII. Morphology and Hydraulic Monitoring Summary
Little White Oak Creek Stream Restoration / D06027-B
Reach R2B (1474 ft)

PARAMETERS	Cross Section 7 Riffle																													
Dimension	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
BKF Width (ft)	8.7																													
Floodprone Width (ft)	25.46																													
BKF Cross Sectional Area (sq. ft.)	4.5																													
BKF Mean Depth (ft)	0.52																													
BKF Max Depth (ft)	0.89																													
Width/Depth Ratio	16.73																													
Entrenchment Ratio	2.93																													
Wetted Perimeter (ft)	9.0																													
Hydraulic Radius (ft)	0.50																													

PARAMETERS	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	16.9	31.6	22.8												
Radius of Curvature (ft)	9.4	22.2	16.7												
Meander Wavelength (ft)	59.4	68.7	64.2												
Meander Width Ratio	1.9	3.6	2.6												
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	--	--	--												
Riffle Slope (ft/ft)	--	--	--												
Pool Length (ft)	9.6	18.6	15.0												
Pool Spacing (ft)	24.8	60.2	44.0												
Substrate															
d50 (mm)	0.04														
d84 (mm)	0.38														
Additional Reach Parameters															
Bankfull Slope (ft/ft)	Measure Bank slope?														
Monitored Channel Length (ft)	528														
Monitored Valley Length (ft)	387														
Sinuosity	1.36														
Total Channel Length (ft)	1474														
Rosgen Classification	C6														

Table VIII. Morphology and Hydraulic Monitoring Summary
Little White Oak Creek Stream Restoration / D06027-B
Reach R2D (790 ft)

PARAMETERS	Cross Section 13 Riffle																											
Dimension	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
BKF Width (ft)	11.72																													
Floodprone Width (ft)	69.62																													
BKF Cross Sectional Area (sq. ft.)	6.7																													
BKF Mean Depth (ft)	0.57																													
BKF Max Depth (ft)	1.04																													
Width/Depth Ratio	20.56																													
Entrenchment Ratio	5.94																													
Wetted Perimeter (ft)	12.1																													
Hydraulic Radius (ft)	0.55																													

PARAMETERS	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	12.0	30.9	23.7												
Radius of Curvature (ft)	12.4	20.4	15.1												
Meander Wavelength (ft)	49.7	67.7	61.6												
Meander Width Ratio	1.0	2.6	2.0												
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	--	--	--												
Riffle Slope (ft/ft)	--	--	--												
Pool Length (ft)	12.2	19.7	16.32												
Pool Spacing (ft)	42.22	51.13	44.63												
Substrate															
d50 (mm)		0.14													
d84 (mm)		0.41													
Additional Reach Parameters															
Bankfull Slope (ft/ft)		0.0105													
Monitored Channel Length (ft)		463													
Monitored Valley Length (ft)		346													
Sinuosity		1.34													
Total Channel Length (ft)		790													
Rosgen Classification		C5													

Exhibit Table IX. BEHI and Sediment Export Estimates Little White Oak Creek Stream Restoration / D06027-B															
Time Point	**Segment / Reach**	**Linear Footage or Acreage**	**Extreme**		**Very High**		**High**		**Moderate**		**Low**		**Very Low**		**Sediment Export**
			ft	%	ft	%	ft	%	ft	%	ft	%	ft	%	tons/yr
Preconstruction 2006	R1	6530			5877	90									455
	R1A	906	906	100											229
	R2	5979	5381	90											767
	R2A	625			625	100									32
	R2B	1713					1713	100							120
	R2D	526	526	100											250
	TOTAL	16279	6813	42	6502	40	1713	11	0	0	0	0	0	0	1853
Monitoring Y3 2010 **(NOT APPLICABLE)**	R1	7543													
	R1A	1040													
	R2	7107													
	R2A	336													
	R2B	1474													
	R2D	790													
	TOTAL	18290	0	0	0	0	0	0	0	0	0	0	0	0	0
Monitoring Y5 2012 **(NOT APPLICABLE)**	R1	7543													
	R1A	1040													
	R2	7107													
	R2A	336													
	R2B	1474													
	R2D	790													
	TOTAL	18290	0	0	0	0	0	0	0	0	0	0	0	0	0

Exhibit Table X. Verification of Bankfull Events Little White Oak Creek Stream Restoration / D06027-B			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo No. (If Available)**
8/25/08-8/27/08	Unknown	Crest Guage	N/A

Table XI. Categorical Stream Feature Visual Stability Assessment Little White Oak Creek Stream Restoration / D06027-B						
Reach R1 (7543ft)						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
Riffles	100%	100%				
Pools	100%	100%				
Thalwegs	100%	100%				
Meanders	100%	100%				
Bed General	100%	100%				
Structures	100%	100%				
Rootwads	100%	100%				
Reach R1A (1040ft)						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
Riffles	100%	100%				
Pools	100%	100%				
Thalwegs	100%	100%				
Meanders	100%	100%				
Bed General	100%	100%				
Structures	100%	100%				
Rootwads	100%	100%				
Reach R2 (7107ft)						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
Riffles	100%	100%				
Pools	100%	100%				
Thalwegs	100%	100%				
Meanders	100%	100%				
Bed General	100%	100%				
Structures	100%	100%				
Rootwads	100%	100%				
Reach R2A (336ft)						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
Riffles	100%	100%				
Pools	100%	100%				
Thalwegs	100%	100%				
Meanders	100%	100%				
Bed General	100%	100%				
Structures	100%	100%				
Rootwads	100%	100%				
Reach R2B (1474ft)						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
Riffles	100%	100%				
Pools	100%	100%				
Thalwegs	100%	100%				
Meanders	100%	100%				
Bed General	100%	100%				
Structures	100%	100%				
Rootwads	100%	100%				
Reach R2D (790ft)						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
Riffles	100%	100%				
Pools	100%	100%				
Thalwegs	100%	100%				
Meanders	100%	100%				
Bed General	100%	100%				
Structures	100%	100%				
Rootwads	100%	100%				

Notes: The results shown above for each reach for MY-01 reflect the repairs made in October 2008 to the stream problem areas described for MY-01 in Table XII. Stream Problem Areas.

Table XII. Stream Problem Areas Little White Oak Creek Stream Restoration / D06027-B			
Feature/Issue	**Station / Range**	**Probable Cause**	**Photo No. (If Available)**
In-stream structure failure and associated stream bank erosion	J-Hook Rock Vane Structure Number 9, approximate station 12+43 -R1-	Incorrect structure construction	N/A
In-stream structure failure and associated stream bank erosion	J-Hook Rock Vane Structure Number 78, approximate station 3+54 -R2-	Incorrect structure construction	N/A
In-stream structure failure and associated stream bank erosion	J-Hook Rock Vane Structure Number 99, approximate station 23+35 -R2-	Incorrect structure construction	N/A
In-stream structure failure and associated stream bank erosion	Rock Cross Vane Structure Number 123, approximate station 46+61 -R2-	Incorrect structure construction	N/A
In-stream structure failure and associated stream bank erosion	J-Hook Rock Vane Structure Number 129 approximate station 52+65 -R2-	Incorrect structure construction	N/A
In-stream structure failure and associated stream bank erosion	J-Hook Rock Vane Structure Number 130 approximate station 54+24 -R2-	Incorrect structure construction	N/A
In-stream structure failure and associated stream bank erosion	Rock Cross Vane Structure Number 131, approximate station 54+89 -R2-	Incorrect structure construction	N/A
In-stream structure failure and associated stream bank erosion	J-Hook Rock Vane Structure Number 132 approximate station 56+08 -R2-	Incorrect structure construction	N/A
Floodplain and adjacent stream bank erosion	Approximate station 3+12 -R1-	Floodplain interceptor not installed	N/A
Floodplain and adjacent stream bank erosion	Approximate station 35+75 -R1-	Floodplain interceptor not installed	N/A
Floodplain and adjacent stream bank erosion	Approximate station 48+00 -R1-	Floodplain interceptor not installed	N/A
Stream bank erosion	Approximate station 61+50 -R1-	Field adjustment of the stream alignment to save an existing mature tree per landowner request	N/A

Repairs to all of the stream problem areas listed in the above table were conducted in October 2008.

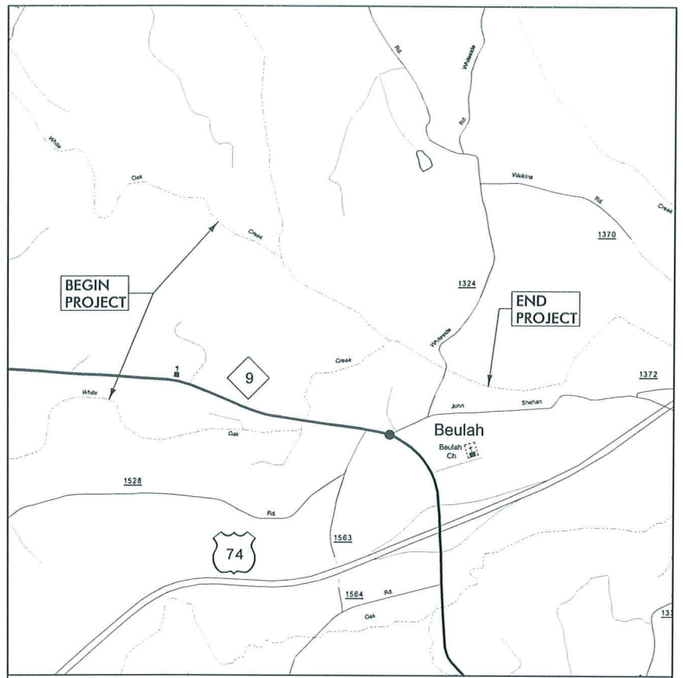
SCO ID NO. D06027-B

POLK COUNTY

LITTLE WHITE OAK CREEK STREAM RESTORATION SITE

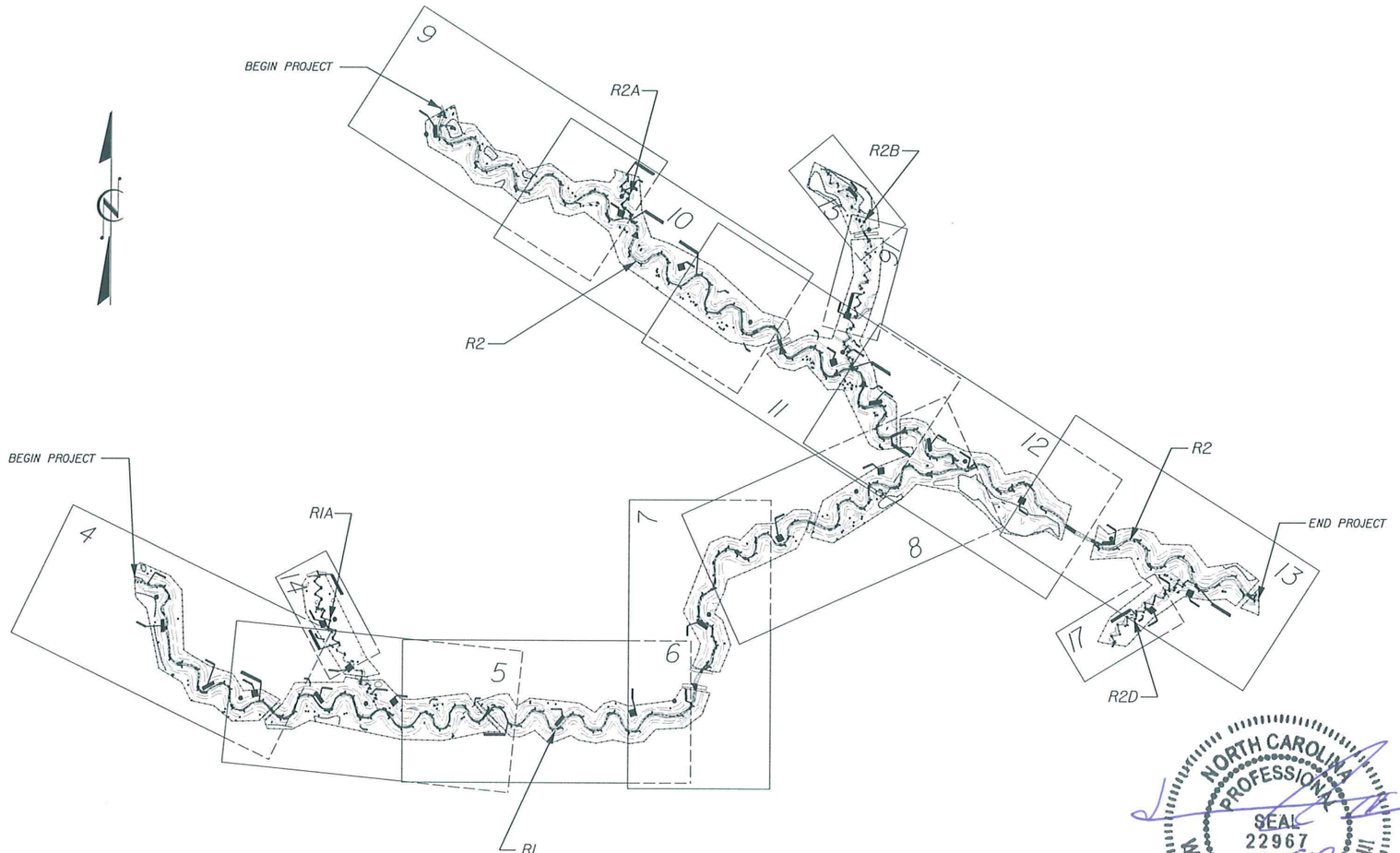
LOCATION: NORTHEAST OF THE INTERSECTION OF NC 9 AND US 74 (EXIT 167)

YEAR 1 MONITORING



VICINITY MAP

NOT TO SCALE



NOT TO SCALE

INDEX OF SHEETS

SHEET NUMBER	SHEET
1	TITLE SHEET
2	LEGEND
3	PROJECT OVERVIEW
4 – 19	YEAR 1 MONITORING OVERLAY

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III

01.05.09

REVISIONS

DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

SCALE AS SHOWN

DATE: 3/14/08
DESIGNED: WSH
DRAWN: JTL
CHECKED: WSH
APPROVED: WSH

MULKEY PROJECT NUMBER
2006237.00

PLANS PREPARED BY:

MULKEY ENGINEERS & CONSULTANTS
PO Box 33127
RALEIGH, N.C. 27636
(919) 851-1912
(919) 851-1918 (FAX)
WWW.MULKEYINC.COM

MULKEY PROJECT MANAGER
WENDEE B. SMITH

MULKEY SENIOR ENGINEER
WILLIAM SCOTT HUNT, III, PE

MULKEY SENIOR SCIENTIST
THOMAS BARRETT, RF

PROJECT ENGINEER

TITLE SHEET

NOTE: NOT TO SCALE
Not all symbols used in plans

LEGEND

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III 01.05.09

REVISIONS		
DATE	BY	DESCRIPTION
3/14/08	JTL	AS-BUILT DRAWINGS

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	2

LEGEND

MULKEY
ENGINEERS & CONSULTANTS
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Raleigh, N.C. 27636
(919) 851-1912
(919) 851-1918 (FAX)
WWW.MULKEYINC.COM

BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin (EIP)
- Property Corner
- Property Monument (ECM)
- Existing Fence
- Temporary Fence
- Proposed Woven Wire Fence
- Proposed Chain Link Fence
- Proposed Barbed Wire Fence
- Tree Protection Fence
- Wetland Boundary
- Proposed Oxbow Wetland Boundary (WLB)
- Conservation Easement
- Construction Limits
- Limits Of Disturbance
- Proposed Gate (G)
- Bench Mark
- Control Point

BUILDINGS AND OTHER CULTURE:

- Sign (S)
- Foundation
- Area Outline
- Building
- School
- Church

HYDROLOGY:

- Hydro, Pool or Reservoir
- River Basin Buffer (RBB)
- Flow Arrow
- Disappearing Stream
- Spring
- Thalweg
- Top Of Bank
- Swamp Marsh
- Proposed Lateral, Tail, Head Ditch (PDH)
- Bedrock

RAILROADS:

- Standard Guage (CSX TRANSPORTATION)
- RR Signal Milepost (MILEPOST 35)
- Switch (SWITCH)
- RR Abandoned

ROADS AND RELATED FEATURES:

- Existing Edge of Pavement
- Existing Curb
- Existing Soil Road
- Existing Metal Guardrail
- Existing Cable Guiderail

VEGETATION:

- Single Tree
- Single Shrub
- Hedge
- Woods Line
- Orchard
- Vineyard (Vineyard)

EXISTING STRUCTURES:

MAJOR:
- Bridge, Tunnel or Box Culvert (CONC)
- Bridge Wing Wall, Head Wall and End Wall (CONC WW)

MINOR:
- Head and End Wall (CONC HW)
- Pipe Culvert
- Footbridge
- Drainage Box: Catch Basin, DI or JB (CB)
- Paved Ditch Gutter
- Storm Sewer Manhole (S)
- Storm Sewer (S)

UTILITIES:

POWER:
- Existing Power Pole
- Existing Joint Use Pole
- Power Manhole (P)
- Power Line Tower
- Power Transformer
- U/G Power Cable Hand Hole (HH)
- H-Frame Pole
- Recorded U/G Power Line (P)

GAS:
- Gas Meter
- Recorded U/G Gas Line (G)
- Above Ground Gas Line (A/G Gas)

TELEPHONE:
- Existing Telephone Pole
- Telephone Manhole (T)
- Telephone Booth
- Telephone Pedestal (T)
- Telephone Cell Tower
- U/G Telephone Cable Hand Hole (HH)
- Recorded U/G Telephone Cable (T)
- Recorded U/G Telephone Conduit (TC)
- Recorded U/G Fiber Optics Cable (T FO)

WATER:
- Water Manhole (W)
- Water Valve
- Water Hydrant
- Recorded U/G Water Line (W)
- Above Ground Water Line (A/G Water)

TV:
- TV Satellite Dish
- TV Pedestal (C)
- TV Tower
- U/G TV Cable Hand Hole (HH)
- Recorded U/G TV Cable (TV)
- Recorded U/G Fiber Optic Cable (TV FO)

MISCELLANEOUS:
- Utility Pole
- Utility Pole with Base
- Utility Located Object
- Utility Traffic Signal Box (S)
- Utility Unknown U/G Line (?UTL)
- U/G Tank; Water, Gas, Oil
- A/G Tank; Water, Gas, Oil
- Abandoned According to Utility Records (AATUR)
- End of Information (E.O.I.)

SANITARY SEWER:
- Sanitary Sewer Manhole (S)
- Sanitary Sewer Cleanout
- U/G Sanitary Sewer Line (SS)
- Above Ground Sanitary Sewer (A/G Sanitary Sewer)
- Recorded SS Forced Main Line (FSS)

PROPOSED STREAM WORK:

STREAM STRUCTURES:
- Rock Crossvane
- Rock Vane
- J Hook Rock Vane
- Flood Plane Interceptor
- Constructed Riffle
- Root Wad
- Structure Number
- Constructed Flood Plane Interceptor

STREAM FEATURES:
- Constructed Bankfull/Top Of Bank
- Old Top Of Bank
- Constructed Thalweg
- Proposed Thalweg
- Waters Edge
- Old Waters Edge
- Vernal Pool
- Surface Water
- Staging Area
- Impervious Dike
- Permanent Improved Gravel Road
- Temporary Gravel Road
- Stone Outlet Sediment Trap
- Impervious Stream Channel Plug
- Fill Existing Stream Channel
- Vegetation Plot

MISCELLANEOUS:

- Photo Point (PP #1)
- Cross Section
- Crest Gauge

Easement

Restored Streams

Monitored Sections

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

1" = 400'

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	3

YEAR 1 MONITORING

MULKEY
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NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
12.15.09

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	4

YEAR 1 MONITORING

MULKEY
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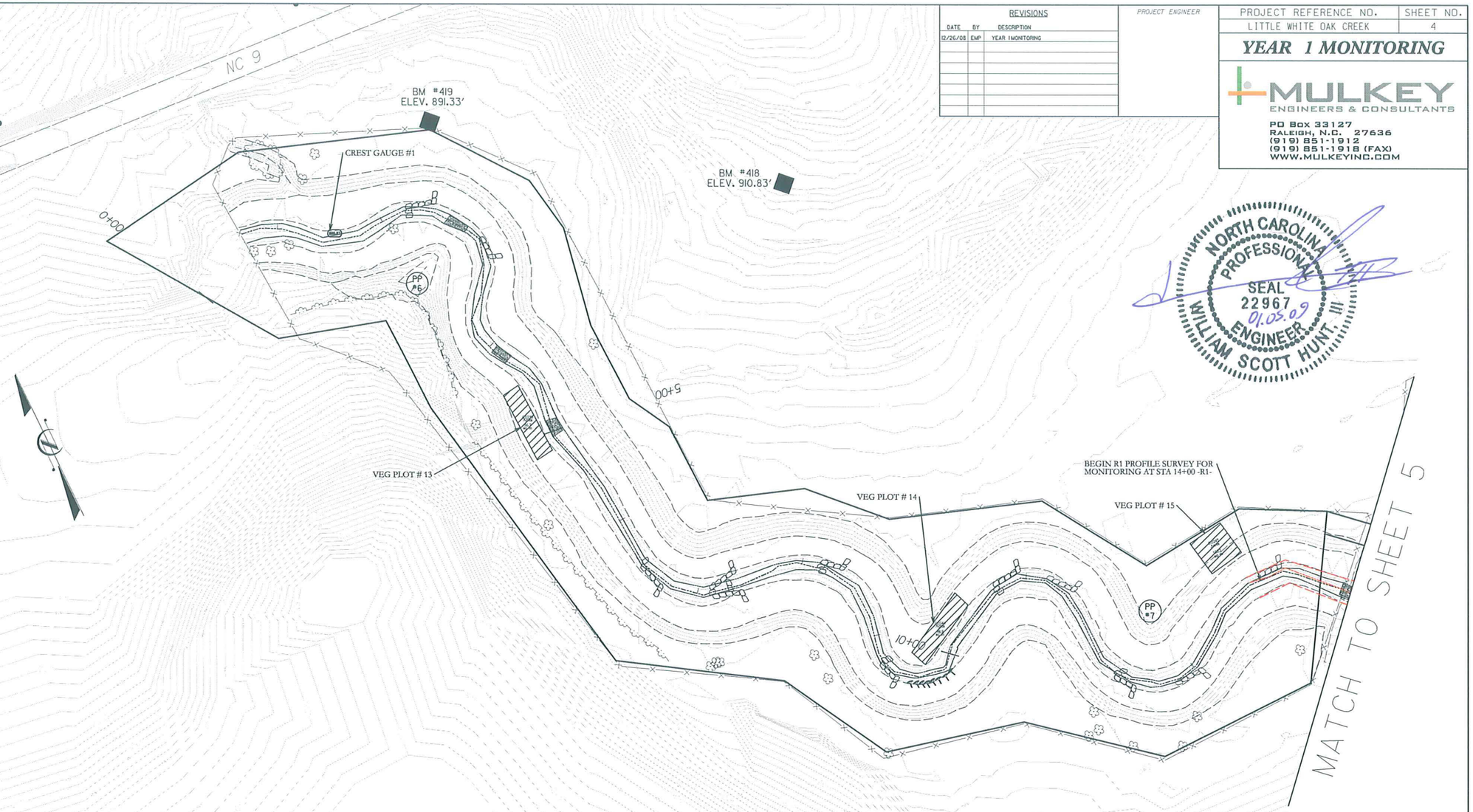
WWW.MULKEYINC.COM

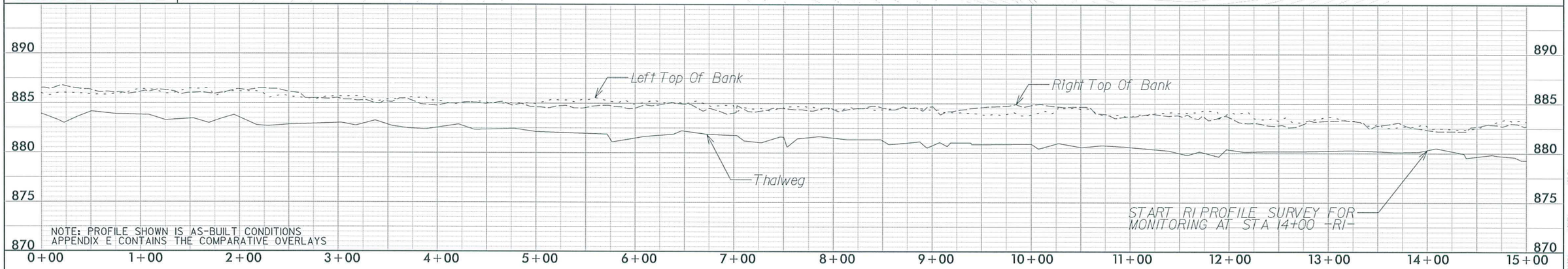
NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
01.05.09



PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
400	576422.038	1068186.054	880.06
401	575893.793	1068722.918	876.57
402	575553.812	1069205.512	874.33
403	575226.901	1069762.056	876.08
404	574837.941	1070257.372	871.64
405	575926.913	1069945.053	897.4
406	576477.612	1069949.267	923.13
407	574324.856	1071064.416	871.26
408	574308.473	1071397.857	869.04
409	573967.988	1071422.762	869.21
410	574222.858	1069493.135	884.97
411	574100.263	1068841.141	891.49
412	573828.028	1068325.712	899.29
413	573310.368	1068220.815	880.95
414	573357.513	1067646.732	883.68
415	573584.485	1067315.797	884.12
416	573948.599	1066938.639	893.06
417	573625.298	1066619.236	887.85
418	573993.945	1066024.951	910.83
419	574181.189	1065763.288	891.33

RED DENOTES YEAR 1 MONITORING

50 0 100



NOTE: PROFILE SHOWN IS AS-BUILT CONDITIONS
APPENDIX E CONTAINS THE COMPARATIVE OVERLAYS

RED DENOTES YEAR 1 MONITORING

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	5

YEAR 1 MONITORING

MULKEY
ENGINEERS & CONSULTANTS
PO Box 33127
Raleigh, N.C. 27636
(919) 851-1912
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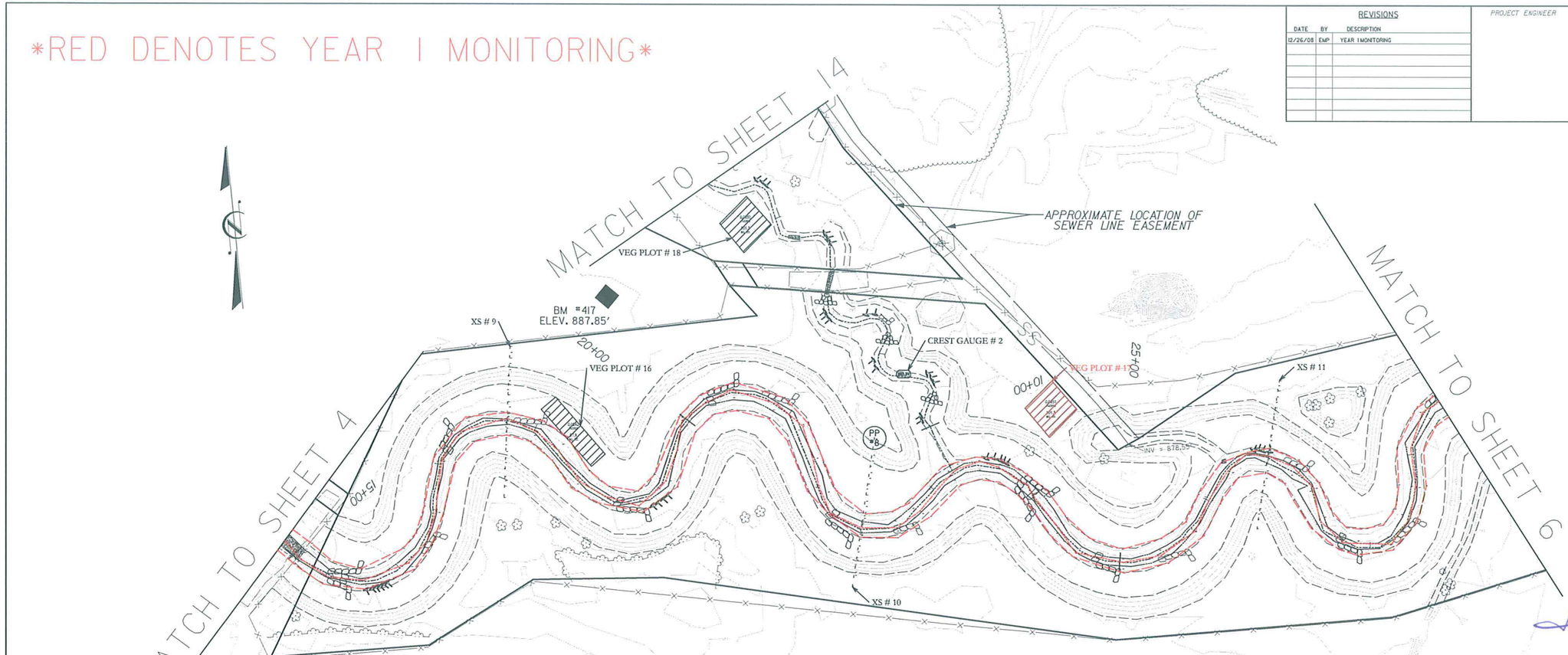
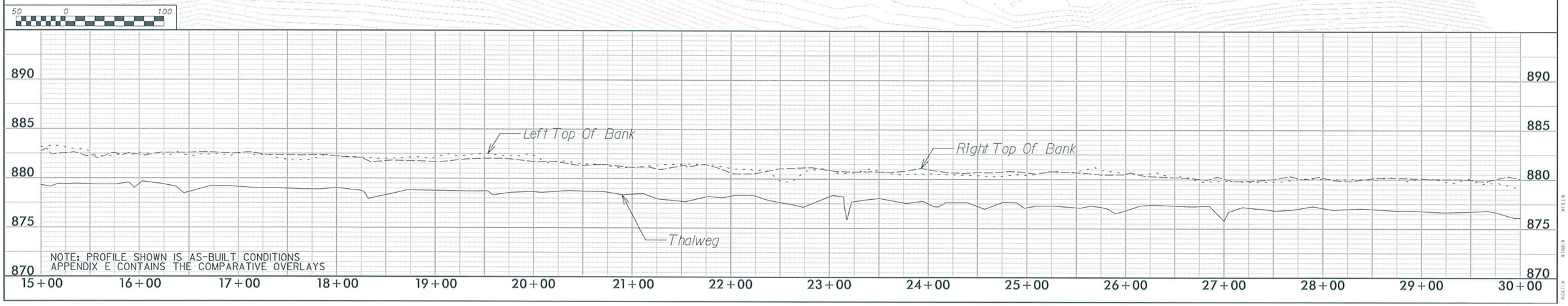
PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
400	576422.038	1068186.054	880.06
401	575893.793	1068722.918	876.57
402	575553.812	1069205.512	874.33
403	575226.901	1069762.056	876.08
404	574837.941	1070257.372	871.64
405	575926.913	1069945.053	897.4
406	576477.612	1069949.267	923.13
407	574324.856	1071064.416	871.26
408	574308.473	1071397.857	869.04
409	573967.988	1071422.762	869.21
410	574222.858	1069493.135	884.97
411	574100.263	1068841.141	891.49
412	573828.028	1068325.712	899.29
413	573310.368	1068220.815	880.95
414	573357.513	1067646.732	883.68
415	573584.485	1067315.797	884.12
416	573948.599	1066938.639	893.06
417	573625.298	1066619.236	887.85
418	573993.945	1066024.951	910.83
419	574181.189	1065763.288	891.33





REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	6

YEAR 1 MONITORING

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NORTH CAROLINA PROFESSIONAL SEAL 22961 ENGINEER WILLIAM SCOTT HUNT, III
01.05.09

PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
400	576422.038	1068186.054	880.06
401	575893.793	1068722.918	876.57
402	575553.812	1069205.512	874.33
403	575226.901	1069762.056	876.08
404	574837.941	1070257.372	871.64
405	575926.913	1069945.053	897.4
406	576477.612	1069949.267	923.13
407	574324.856	1071064.416	871.26
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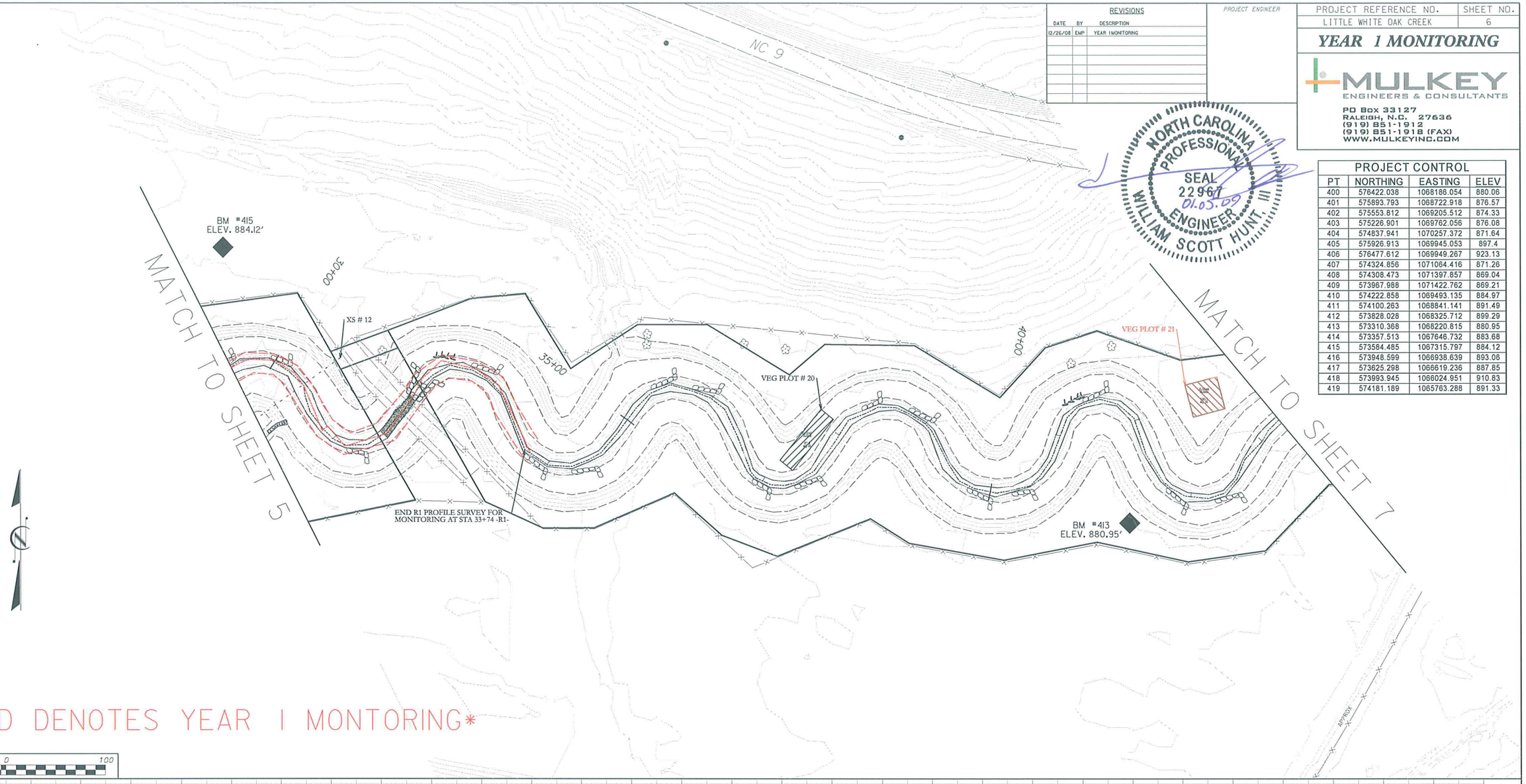
414	573357.513	1067646.732	883.68
415	573584.485	1067315.797	884.12
416	573948.599	1066938.639	893.06
417	573625.298	1066619.236	887.85
418	573993.945	1066024.951	910.83
419	574181.189	1065763.288	891.33



RED DENOTES YEAR 1 MONTORING

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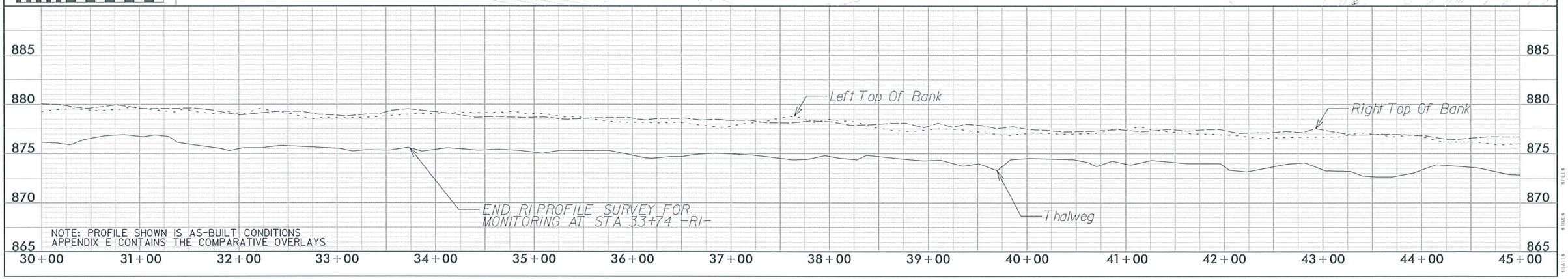

NOTE: PROFILE SHOWN IS AS-BUILT CONDITIONS
APPENDIX E CONTAINS THE COMPARATIVE OVERLAYS

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	7

YEAR 1 MONITORING

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RED DENOTES YEAR 1 MONITORING

MATCH TO SHEET 6

VEG PLOT # 21

45+00

PP #9

CREST GAUGE #3

APPROX.

NC 9

BM #412
ELEV. 899.29'

50+00

VEG PLOT #22

55+00

PP #10

BM #411
ELEV. 891.49'

MATCH TO SHEET 8

PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
400	576422.038	1068186.054	880.06
401	575893.793	1068722.918	876.57
402	575553.812	1069205.512	874.33
403	575226.901	1069762.056	876.08
404	574837.941	1070257.372	871.64
405	575926.913	1069945.053	897.4
406	576477.612	1069949.267	923.13
407	574324.856	1071064.416	871.26
408	574308.473	1071397.857	869.04
409	573967.988	1071422.762	869.21
410	574222.858	1069493.135	884.97
411	574100.263	1068841.141	891.49
412	573828.028	1068325.712	899.29
413	573310.368	1068220.815	880.95
414	573357.513	1067646.732	883.68
415	573584.485	1067315.797	884.12
416	573948.599	1066938.639	893.06
417	573625.298	1066619.236	887.85
418	573993.945	1066024.951	910.83
419	574181.189	1065763.288	891.33

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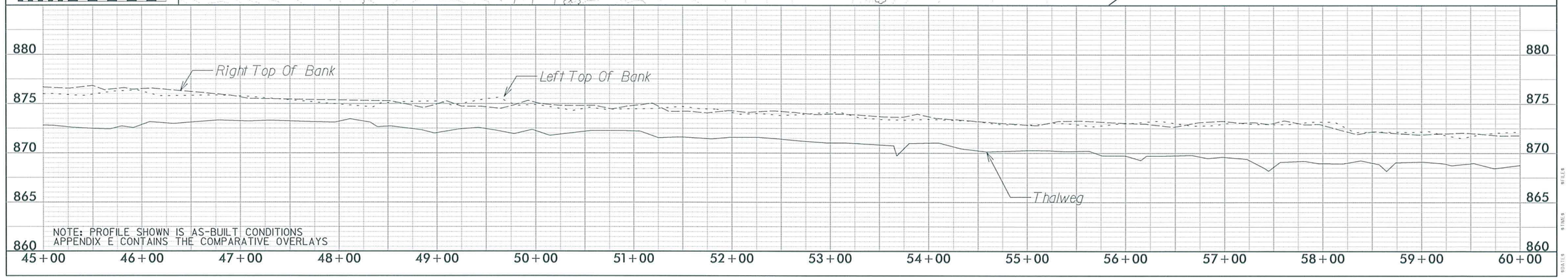
NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
01.05.09



NOTE: PROFILE SHOWN IS AS-BUILT CONDITIONS
APPENDIX E CONTAINS THE COMPARATIVE OVERLAYS

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	8

YEAR 1 MONITORING

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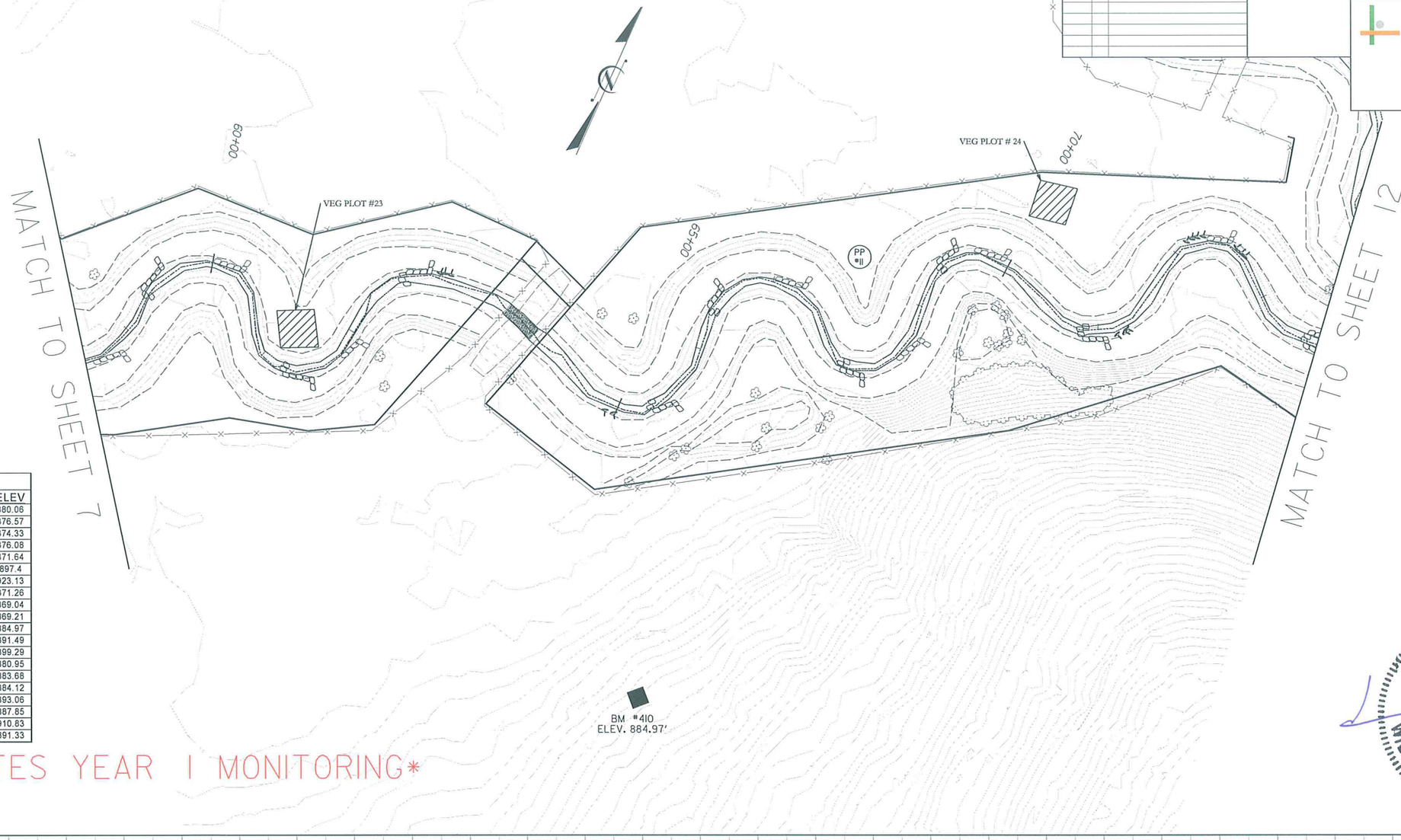

PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
400	576422.038	1068186.054	880.06
401	575893.793	1068722.918	876.57
402	575553.812	1069205.512	874.33
403	575226.901	1069762.056	876.08
404	574837.941	1070257.372	871.64
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419	574181.189	1065763.288	891.33

RED DENOTES YEAR 1 MONITORING

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III

01.07.09

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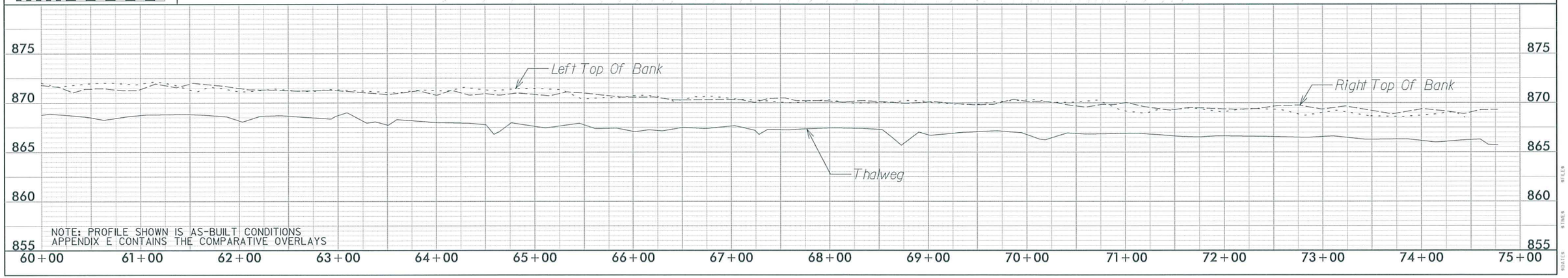

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	9

YEAR 1 MONITORING

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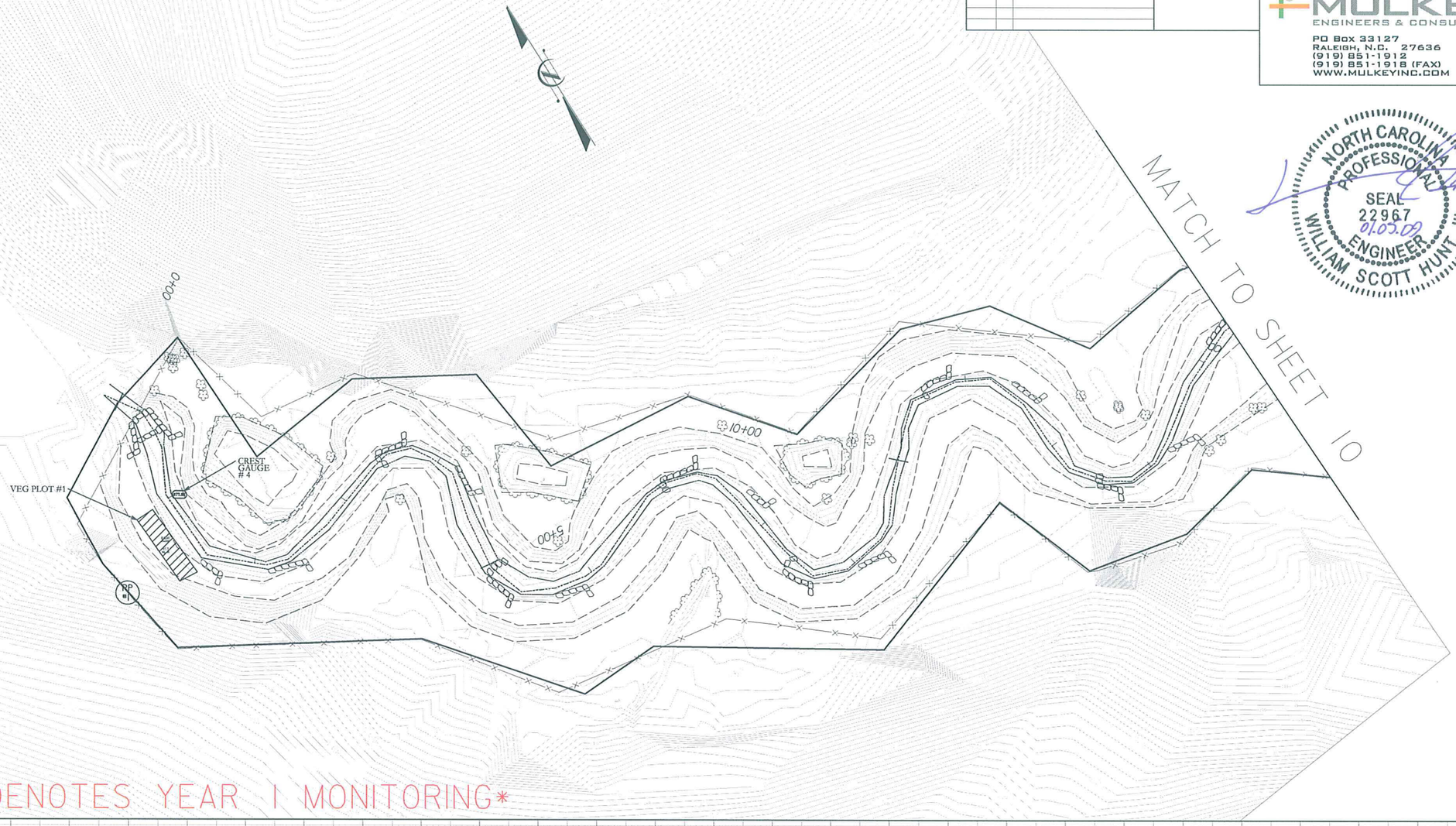
NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III 01.05.09



PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
400	576422.038	1068186.054	880.06
401	575893.793	1068722.918	876.57
402	575553.812	1069205.512	874.33
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412	573828.028	1068325.712	899.29
413	573310.368	1068220.815	880.95
414	573357.513	1067646.732	883.68
415	573584.485	1067315.797	884.12
416	573948.599	1066938.639	893.06
417	573625.298	1066619.236	887.85
418	573993.945	1066024.951	910.83
419	574181.189	1065763.288	891.33

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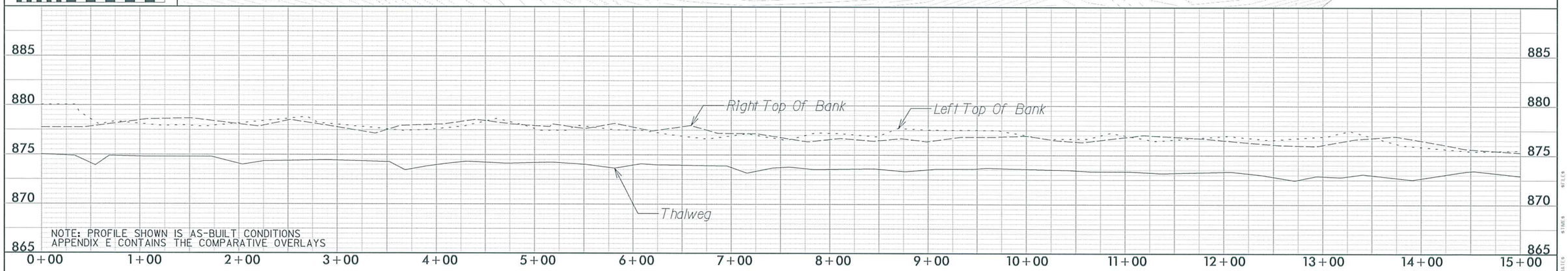
RED DENOTES YEAR 1 MONITORING



NOTE: PROFILE SHOWN IS AS-BUILT CONDITIONS
APPENDIX E CONTAINS THE COMPARATIVE OVERLAYS

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	10

YEAR 1 MONITORING

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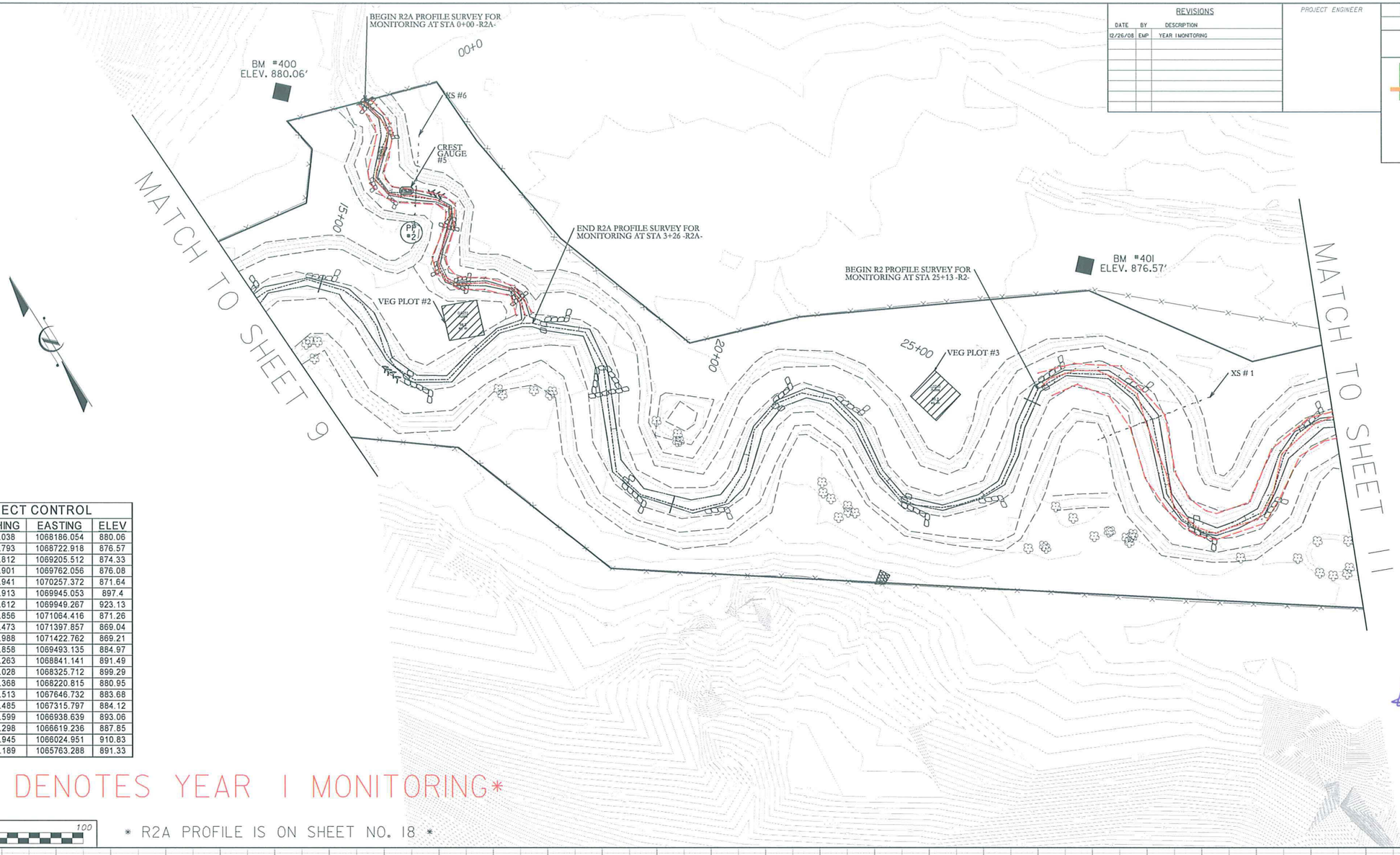

PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
400	576422.038	1068186.054	880.06
401	575893.793	1068722.918	876.57
402	575553.812	1069205.512	874.33
403	575226.901	1069762.056	876.08
404	574837.941	1070257.372	871.64
405	575926.913	1069945.053	897.4
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412	573828.028	1068325.712	899.29
413	573310.368	1068220.815	880.95
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415	573584.485	1067315.797	884.12
416	573948.599	1066938.639	893.06
417	573625.298	1066619.236	887.85
418	573993.945	1066024.951	910.83
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RED DENOTES YEAR 1 MONITORING

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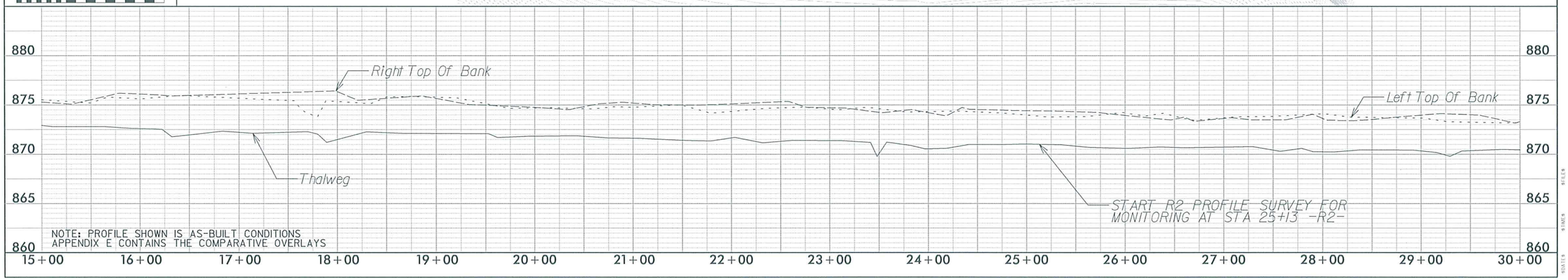
* R2A PROFILE IS ON SHEET NO. 18 *



NOTE: PROFILE SHOWN IS AS-BUILT CONDITIONS
APPENDIX E CONTAINS THE COMPARATIVE OVERLAYS

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
01.05.09

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	11

YEAR 1 MONITORING

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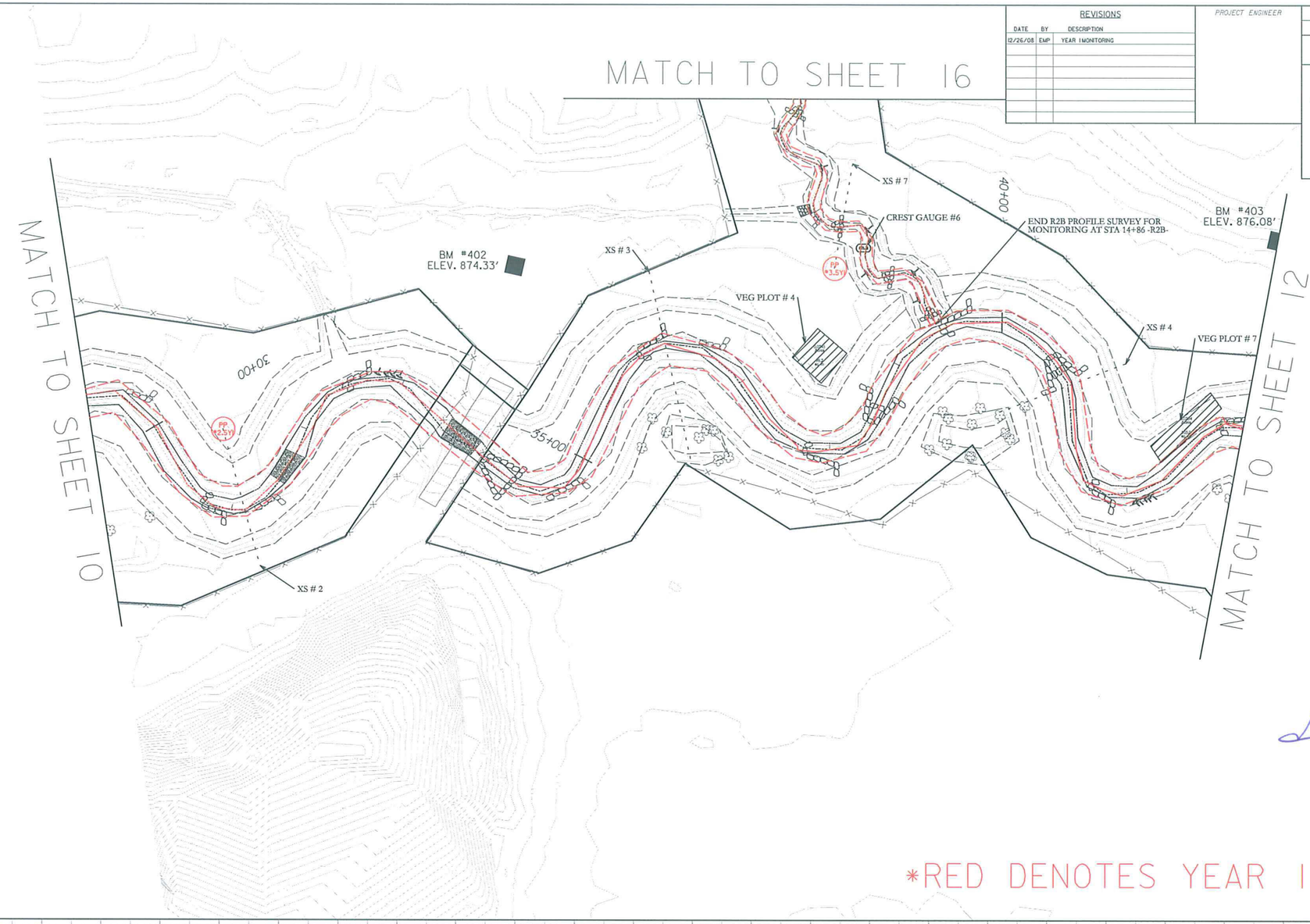

PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
400	576422.038	1068186.054	880.06
401	575893.793	1068722.918	876.57
402	575553.812	1069205.512	874.33
403	575226.901	1069762.056	876.08
404	574837.941	1070257.372	871.64
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410	574222.858	1069493.135	884.97
411	574100.263	1068841.141	891.49
412	573828.028	1068325.712	899.29
413	573310.368	1068220.815	880.95
414	573357.513	1067646.732	883.68
415	573584.485	1067315.797	884.12
416	573948.599	1066938.639	893.06
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419	574181.189	1065763.288	891.33

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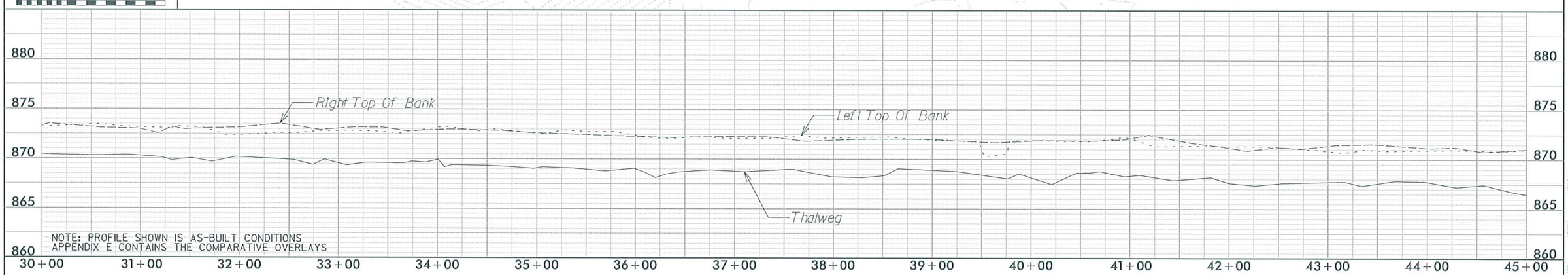

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
01.05.09

RED DENOTES YEAR 1 MONITORING

PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
400	576422.038	1068186.054	880.06
401	575893.793	1068722.918	876.57
402	575553.812	1069205.512	874.33
403	575226.901	1069762.056	876.08
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415	573584.485	1067315.797	884.12
416	573948.599	1066938.639	893.06
417	573625.298	1066619.236	887.85
418	573993.945	1066024.951	910.83
419	574181.189	1065763.288	891.33

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	12

YEAR 1 MONITORING

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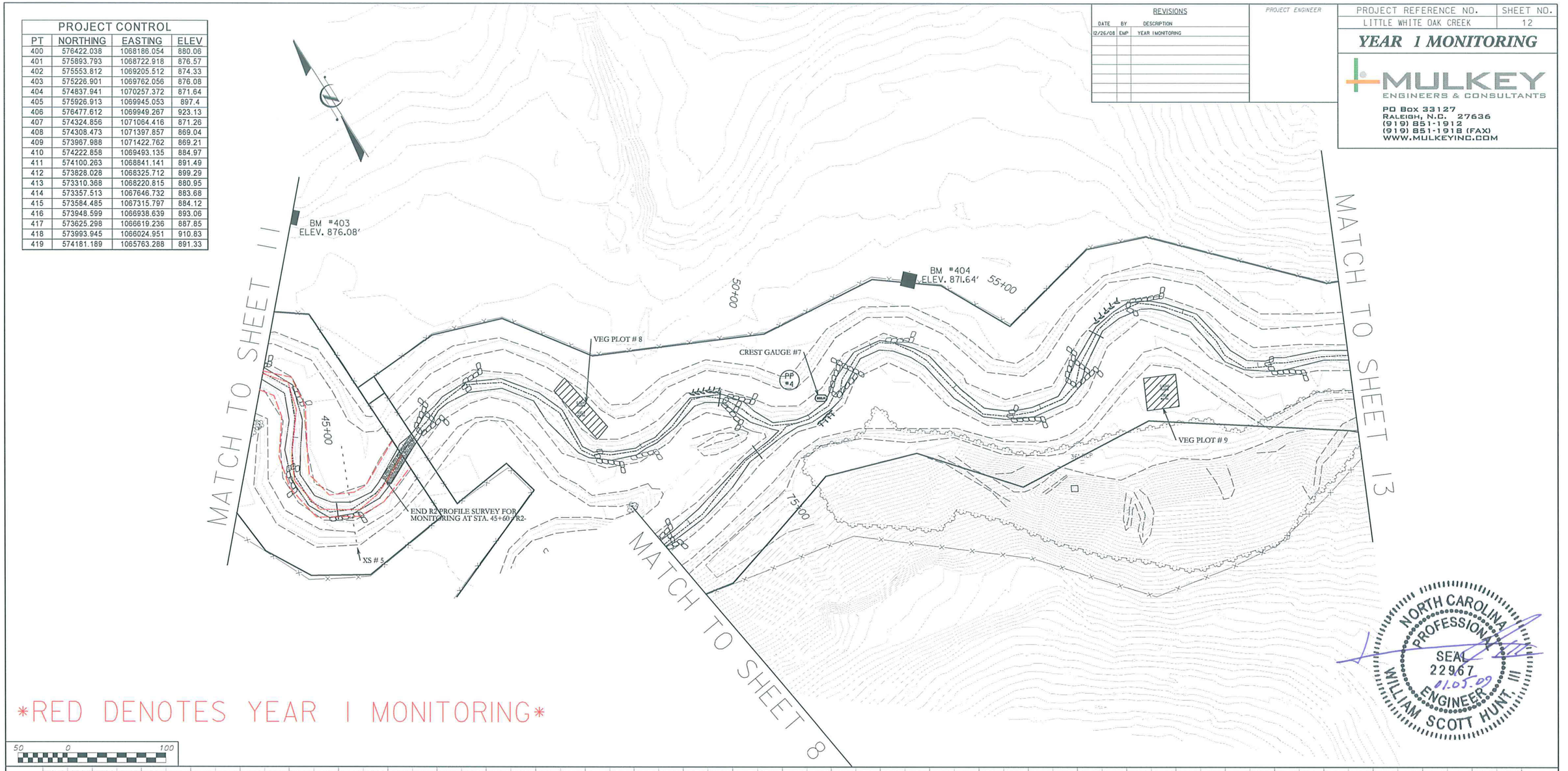
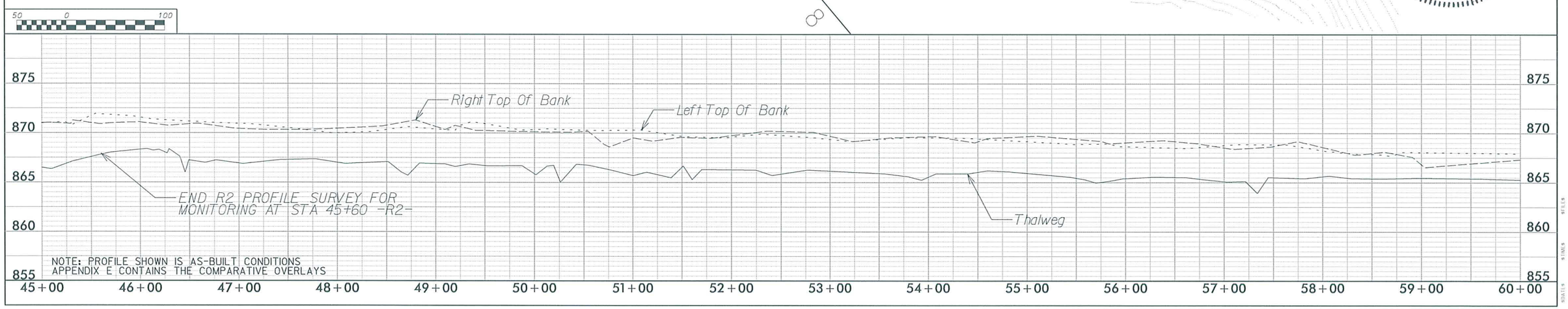


RED DENOTES YEAR 1 MONITORING



NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
01.05.09

PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
400	576422.038	1068186.054	880.06
401	575893.793	1068722.918	876.57
402	575553.812	1069205.512	874.33
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412	573828.028	1068325.712	899.29
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REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
01.05.09

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	13

YEAR 1 MONITORING

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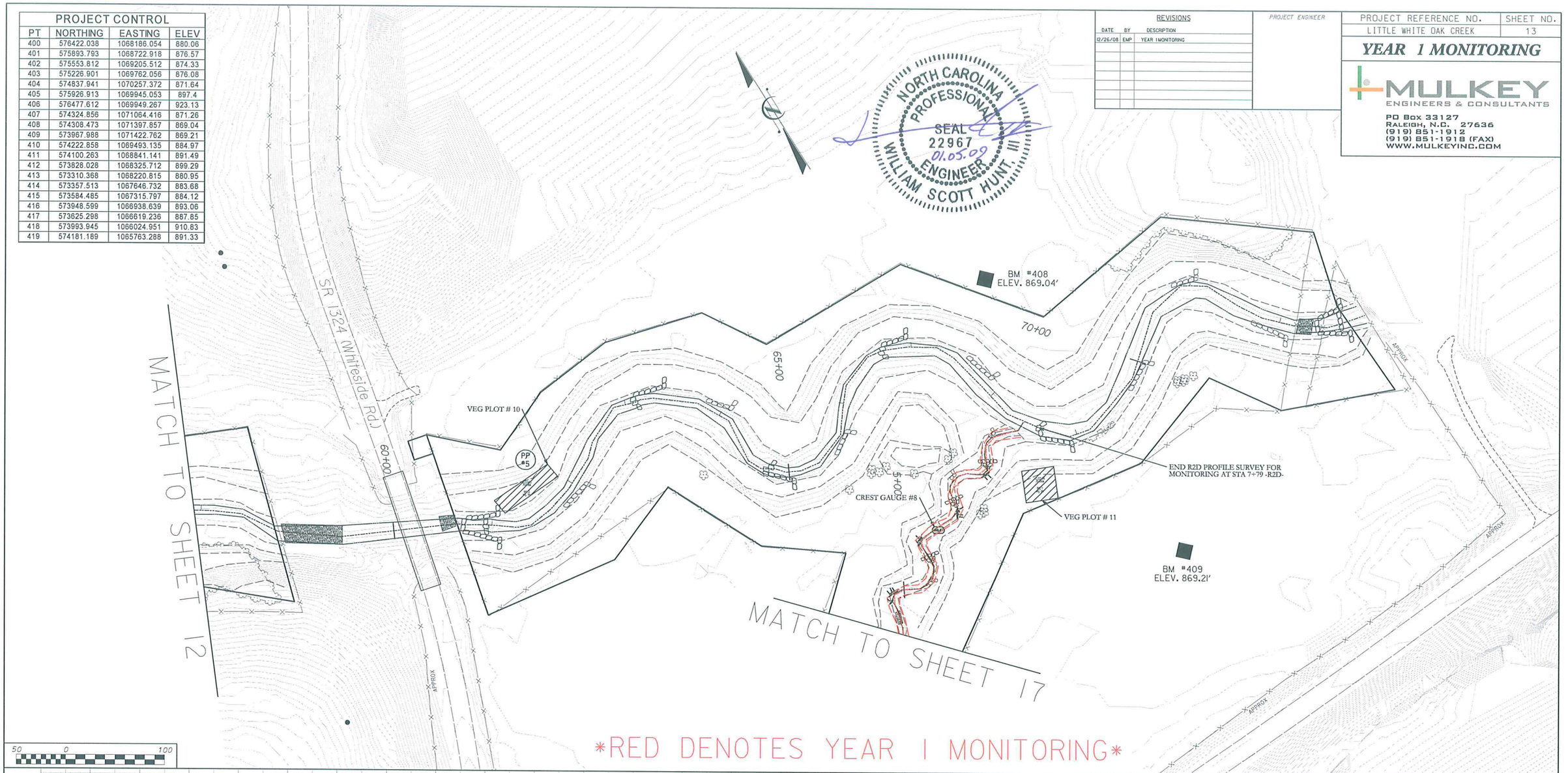
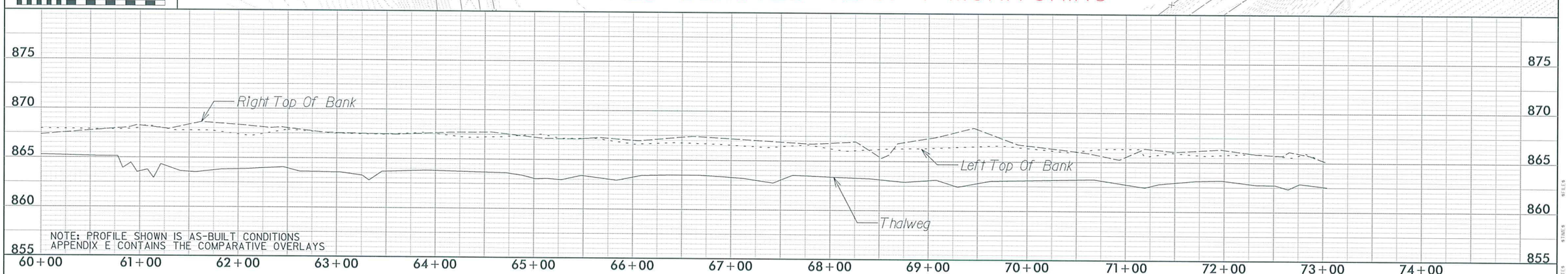
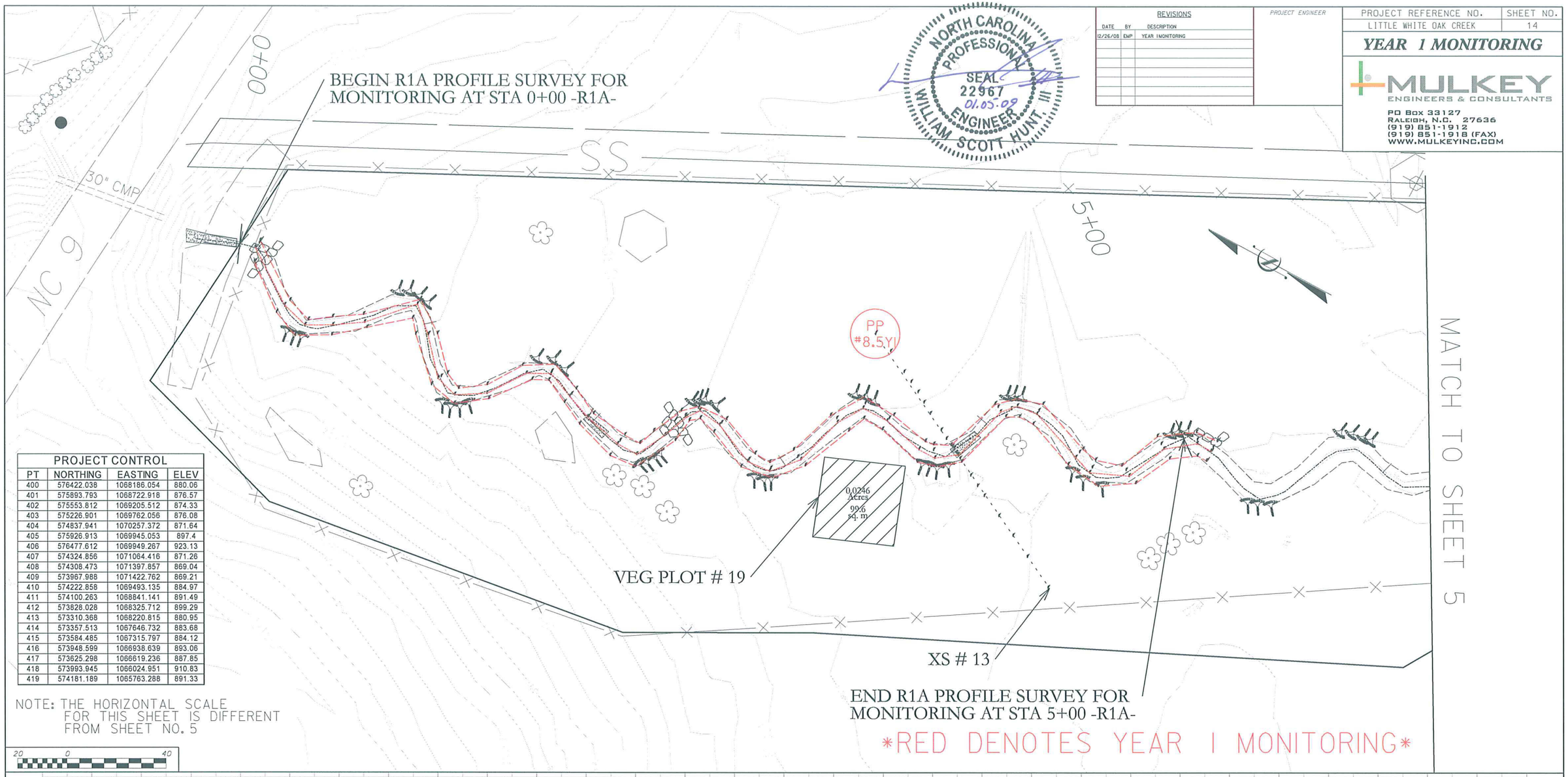


RED DENOTES YEAR 1 MONITORING



NOTE: PROFILE SHOWN IS AS-BUILT CONDITIONS
APPENDIX E CONTAINS THE COMPARATIVE OVERLAYS



NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
01.05.09

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	14

YEAR 1 MONITORING

MULKEY
ENGINEERS & CONSULTANTS
PO Box 33127
Raleigh, N.C. 27636
(919) 851-1912
(919) 851-1918 (FAX)
WWW.MULKEYINC.COM

PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
400	576422.038	1068186.054	880.06
401	575893.793	1068722.918	876.57
402	575553.812	1069205.512	874.33
403	575226.901	1069762.056	876.08
404	574837.941	1070257.372	871.64
405	575926.913	1069945.053	897.4
406	576477.612	1069949.267	923.13
407	574324.856	1071064.416	871.26
408	574308.473	1071397.857	869.04
409	573967.988	1071422.762	869.21
410	574222.858	1069493.135	884.97
411	574100.263	1068841.141	891.49
412	573828.028	1068325.712	899.29
413	573310.368	1068220.815	880.95
414	573357.513	1067646.732	883.68
415	573584.485	1067315.797	884.12
416	573948.599	1066938.639	893.06
417	573625.298	1066619.236	887.85
418	573993.945	1066024.951	910.83
419	574181.189	1065763.288	891.33

NOTE: THE HORIZONTAL SCALE FOR THIS SHEET IS DIFFERENT FROM SHEET NO. 5

20 0 40

SEE SHEET NO. 18 FOR -R1A- PROFILE

NOTE: PROFILE SHOWN IS AS-BUILT CONDITIONS
APPENDIX E CONTAINS THE COMPARATIVE OVERLAYS

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	15

YEAR 1 MONITORING

MULKEY
ENGINEERS & CONSULTANTS
PO Box 33127
Raleigh, N.C. 27636
(919) 851-1912
(919) 851-1918 (FAX)
WWW.MULKEYINC.COM

APPROXIMATE LOCATION
OF GAS LINE EASEMENT

00+0

VEG PLOT # 6

0.0242
Acres
98.0
sq. m

5+00

MATCH TO SHEET 16

PP
#3

NORTH CAROLINA
PROFESSIONAL
SEAL
22967
ENGINEER
WILLIAM SCOTT HUNT, III
01.05.09

PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
400	576422.038	1068186.054	880.06
401	575893.793	1068722.918	876.57
402	575553.812	1069205.512	874.33
403	575226.901	1069762.056	876.08
404	574837.941	1070257.372	871.64
405	575926.913	1069945.053	897.4
406	576477.612	1069949.267	923.13
407	574324.856	1071064.416	871.26
408	574308.473	1071397.857	869.04
409	573967.988	1071422.762	869.21
410	574222.858	1069493.135	884.97
411	574100.263	1068841.141	891.49
412	573828.028	1068325.712	899.29
413	573310.368	1068220.815	880.95
414	573357.513	1067646.732	883.68
415	573584.485	1067315.797	884.12
416	573948.599	1066938.639	893.06
417	573625.298	1066619.236	887.85
418	573993.945	1066024.951	910.83
419	574181.189	1065763.288	891.33

NOTE: THE HORIZONTAL SCALE
FOR THIS SHEET IS DIFFERENT
FROM SHEET NO. 11

20 0 40

RED DENOTES YEAR 1 MONITORING

SEE SHEET NO. 19 FOR -R2B- PROFILE

NOTE: PROFILE SHOWN IS AS-BUILT CONDITIONS
APPENDIX E CONTAINS THE COMPARATIVE OVERLAYS

PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
400	576422.038	1068186.054	880.06
401	575893.793	1068722.918	876.57
402	575553.812	1069205.512	874.33
403	575226.901	1069762.056	876.08
404	574837.941	1070257.372	871.64
405	575926.913	1069945.053	897.4
406	576477.612	1069949.267	923.13
407	574324.856	1071064.416	871.26
408	574308.473	1071397.857	869.04
409	573967.988	1071422.762	869.21
410	574222.858	1069493.135	884.97
411	574100.263	1068841.141	891.49
412	573828.028	1068325.712	899.29
413	573310.368	1068220.815	880.95
414	573357.513	1067646.732	883.68
415	573584.485	1067315.797	884.12
416	573948.599	1066938.639	893.06
417	573625.298	1066619.236	887.85
418	573993.945	1066024.951	910.83
419	574181.189	1065763.288	891.33

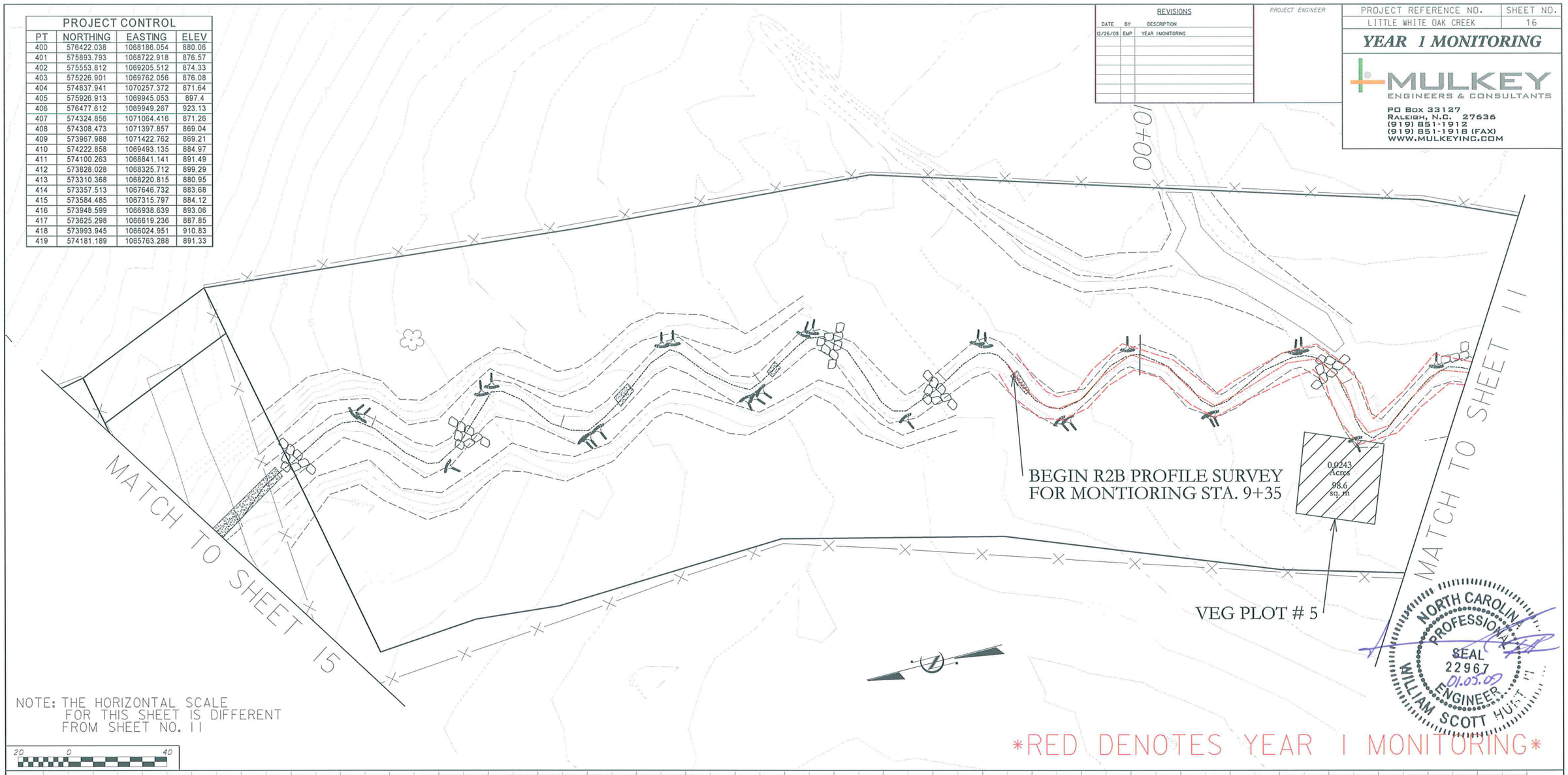
REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	16

YEAR 1 MONITORING

MULKEY
ENGINEERS & CONSULTANTS
PO Box 33127
Raleigh, N.C. 27636
(919) 851-1912
(919) 851-1918 (FAX)
WWW.MULKEYINC.COM



NOTE: THE HORIZONTAL SCALE FOR THIS SHEET IS DIFFERENT FROM SHEET NO. 11

20 0 40

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUFFT
01.05.09

RED DENOTES YEAR 1 MONITORING

SEE SHEET NO. 19 FOR -R2B- PROFILE

NOTE: PROFILE SHOWN IS AS-BUILT CONDITIONS
APPENDIX E CONTAINS THE COMPARATIVE OVERLAYS

PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
400	576422.038	1068186.054	880.06
401	575893.793	1068722.918	876.57
402	575553.812	1069205.512	874.33
403	575226.901	1069762.056	876.08
404	574837.941	1070257.372	871.64
405	575926.913	1069945.053	897.4
406	576477.612	1069949.267	923.13
407	574324.856	1071064.416	871.26
408	574308.473	1071397.857	869.04
409	573967.988	1071422.762	869.21
410	574222.858	1069493.135	884.97
411	574100.263	1068841.141	891.49
412	573828.028	1068325.712	899.29
413	573310.368	1068220.815	880.95
414	573357.513	1067646.732	883.68
415	573584.485	1067315.797	884.12
416	573948.599	1066938.639	893.06
417	573625.298	1066619.236	887.85
418	573993.945	1066024.951	910.83
419	574181.189	1065763.288	891.33

REVISIONS

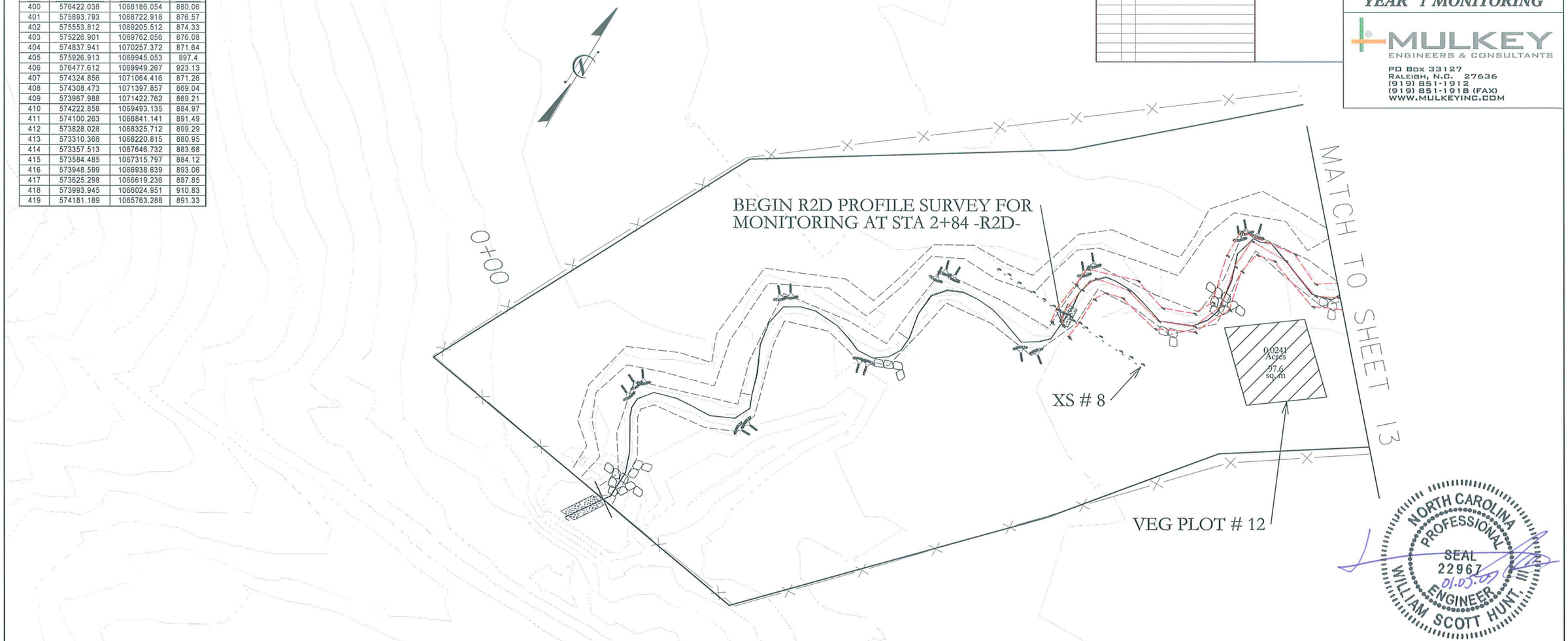
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	17

YEAR 1 MONITORING

MULKEY
ENGINEERS & CONSULTANTS
PO Box 33127
Raleigh, N.C. 27636
(919) 851-1912
(919) 851-1918 (FAX)
WWW.MULKEYINC.COM



NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
01.05.09

NOTE: THE HORIZONTAL SCALE FOR THIS SHEET IS DIFFERENT FROM SHEET NO. 13

20 0 40

RED DENOTES YEAR 1 MONITORING

SEE SHEET NO. 19 FOR -R2D- PROFILE

NOTE: PROFILE SHOWN IS AS-BUILT CONDITIONS
APPENDIX E CONTAINS THE COMPARATIVE OVERLAYS

AS-BUILT PROFILES

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO. LITTLE WHITE OAK CREEK | SHEET NO. 18

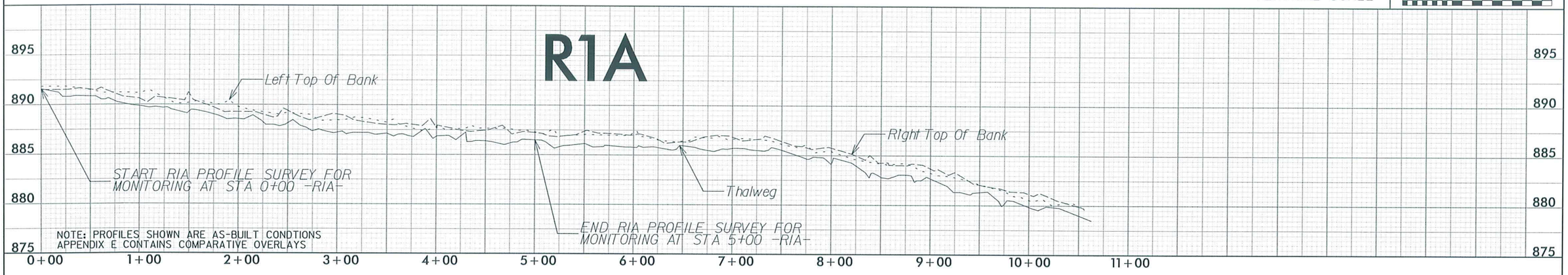
YEAR 1 MONITORING

MULKEY ENGINEERS & CONSULTANTS

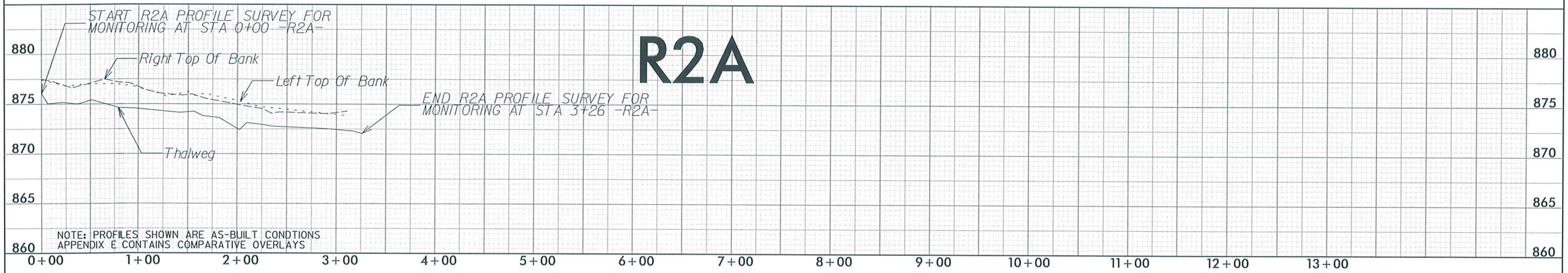
HORIZONTAL SCALE 50 0 100

VERTICAL SCALE 5 0 10

R1A



R2A



NOTE: PROFILES SHOWN ARE AS-BUILT CONDTIONS APPENDIX E CONTAINS COMPARATIVE OVERLAYS

NORTH CAROLINA PROFESSIONAL SEAL 22961 ENGINEER WILLIAM SCOTT HUNT, III 01.05.09

AS-BUILT PROFILES

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	19

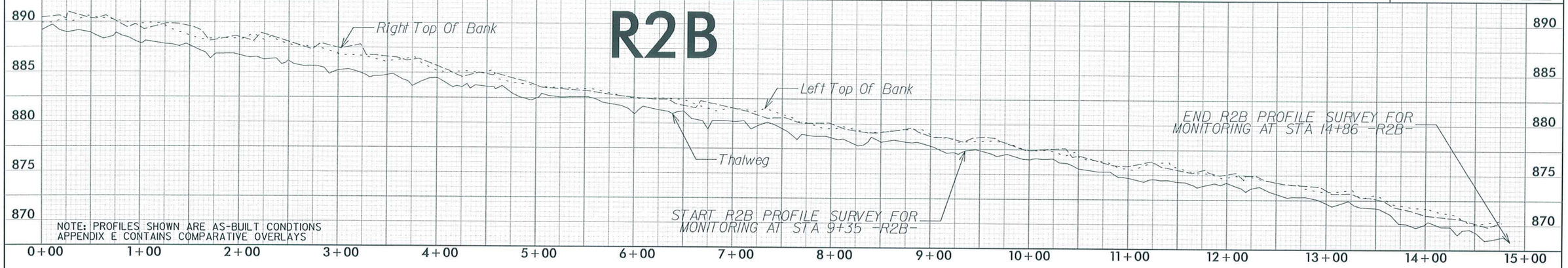
YEAR 1 MONITORING

MULKEY ENGINEERS & CONSULTANTS

HORIZONTAL SCALE 50 0 100

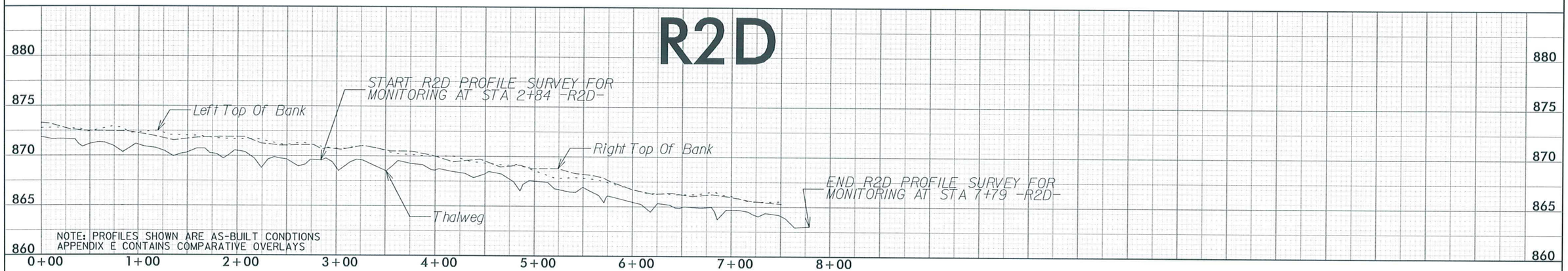
VERTICAL SCALE 5 0 10

R2B



NOTE: PROFILES SHOWN ARE AS-BUILT CONDTIONS
APPENDIX E CONTAINS COMPARATIVE OVERLAYS

R2D



NOTE: PROFILES SHOWN ARE AS-BUILT CONDTIONS
APPENDIX E CONTAINS COMPARATIVE OVERLAYS

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
21.05.09

Vegetation Plot 1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 2

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 3

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 4

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 5

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 6

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 7

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 8

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 9

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 10

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 11

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 12

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 13

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegeation Plot 14

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 15

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 16

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 17

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 18

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 19

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 20

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 21

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 22

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 23

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 24

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 1; Looking Downstream on Reach R2

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 2; Looking Downstream on Reach R2

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 2; Looking Upstream on Reach R2

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 2; Looking upstream on Reach R2A

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 2.5Y1; Looking Downstream Along R2

Not Applicable

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 2.5Y1; Looking Upstream Along Reach R2

Not Applicable

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 3; Looking Downstream

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 3; Looking Upstream

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 3.5Y1; Looking Downstream Along R2&R2B

Not Applicable

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 3.5Y1; Looking Upstream Along R2

Not Applicable

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 3.5Y1; Looking Upstream Along R2B

Not Applicable

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 4; Looking Downstream

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 4; Looking Upstream at Confluence of R1&R2

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 5; Looking Downstream

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 5; Looking Upstream

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 6; Looking Downstream Along Reach R1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 6; Looking Upstream Along Reach R1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 7; Looking Downstream Along R1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 7; Looking Upstream Along R1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 8; Looking Downstream Along R1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 8; Looking Upstream Along R1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 8; Looking Upstream Along R1A

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 8.5Y1; Looking Downstream Along R1A

Not Applicable

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 8.5Y1; Looking Upstream Along R1A

Not Applicable

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 9; Looking Across Reach R1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 9; Looking Downstream Along Reach R1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 9; Looking Upstream Along Reach R1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 10; Looking Across Reach R1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 10; Looking Downstream Along Reach R1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 10; Looking Upstream Along Reach R1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 11; Looking Across Reach R1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 11; Looking Downstream Along Reach R1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 11; Looking Upstream Along Reach R1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Permanent Cross Section 1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Permanent Cross Section 2

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Permanent Cross Section 3

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Permanent Cross Section 4

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Permanent Cross Section 5

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Permanent Cross Section 6

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Permanent Cross Section 7

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Permanent Cross Section 8

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Permanent Cross Section 9

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Permanent Cross Section 10

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Permanent Cross Section 11

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Permanent Cross Section 12

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Permanent Cross Section 13

As-built Survey: January 2008

Year 1 Monitoring: September 2008

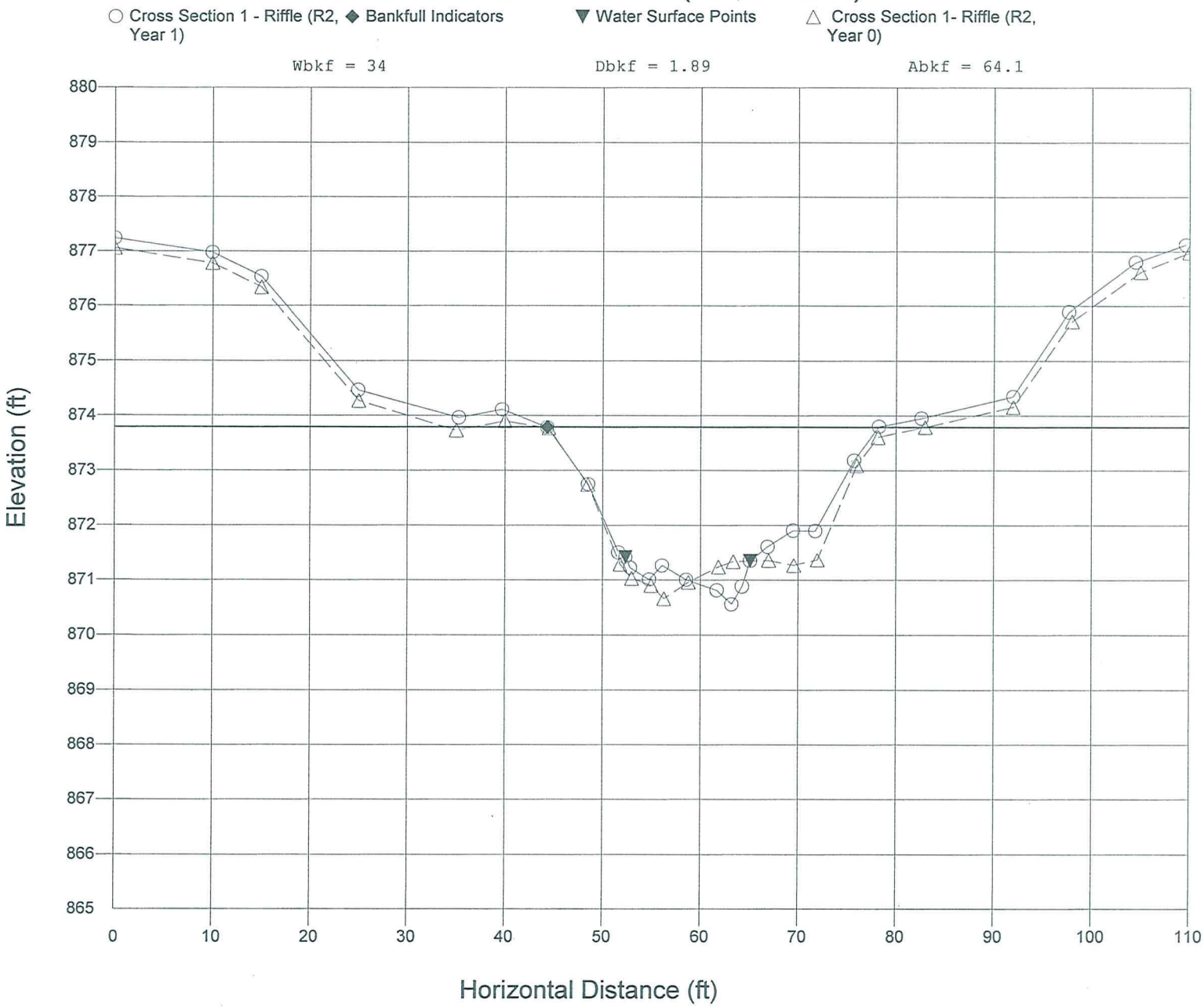
Year 2 Monitoring:

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Cross Section 1 - Riffle (R2, Year 1)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R2
Cross Section Name: Cross Section 1 - Riffle (R2, Year 1)
Survey Date: 11/10/2008

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	877.2423	GS
9.98	0	876.9775	GS
15	0	876.5338	GS
24.95	0	874.4637	GS
35.26	0	873.9631	GS
39.7	0	874.1106	GS
44.33	0	873.7856	BKF
48.52	0	872.7499	GS
51.63	0	871.508	GS
52.37	0	871.4202	LEW
52.85	0	871.2242	GS
54.8	0	871.0079	GS
56.12	0	871.2656	GS
58.58	0	871.0046	GS
61.73	0	870.8115	GS
63.24	0	870.5582	GS
64.3	0	870.884	GS
65.13	0	871.3534	REW
66.91	0	871.6119	GS
69.53	0	871.907	GS
71.79	0	871.8985	GS
75.74	0	873.1833	GS
78.29	0	873.8027	RB
82.61	0	873.9535	GS
91.99	0	874.3521	GS
97.68	0	875.892	GS
104.5	0	876.8015	GS
109.64	0	877.1228	GS

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	877.02	877.02	877.02
Bankfull Elevation (ft)	873.79	873.79	873.79
Floodprone Width (ft)	99.71	-----	-----
Bankfull Width (ft)	33.97	16.98	16.99
Entrenchment Ratio	2.94	-----	-----
Mean Depth (ft)	1.89	1.95	1.82
Maximum Depth (ft)	3.23	2.95	3.23
Width/Depth Ratio	17.97	8.71	9.34
Bankfull Area (sq ft)	64.13	33.16	30.97
Wetted Perimeter (ft)	34.94	20.4	20.44
Hydraulic Radius (ft)	1.84	1.63	1.51
Begin BKF Station	44.27	44.27	61.25

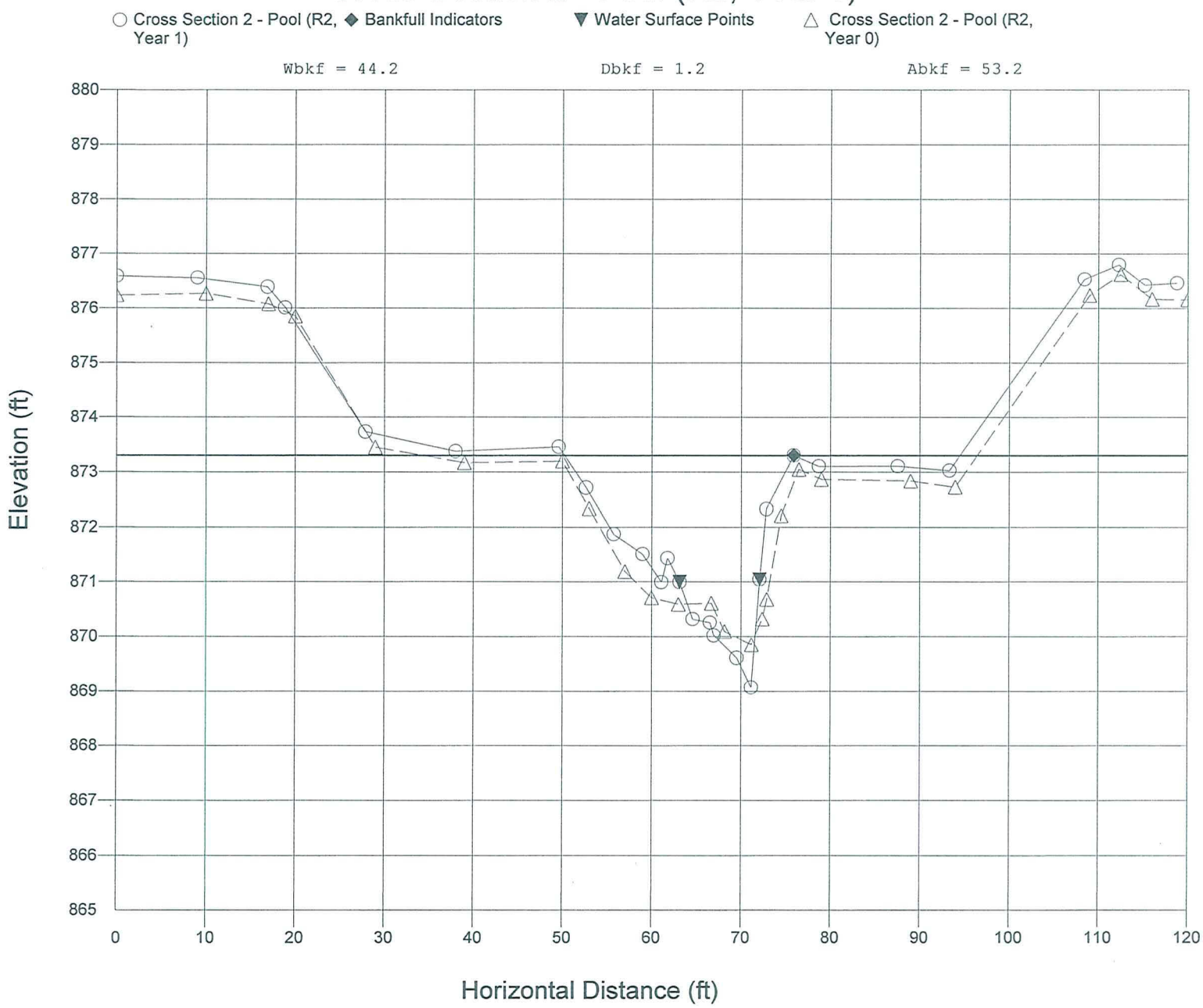
End BKF Station	78.24	61.25	78.24

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope			
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

Cross Section 2 - Pool (R2, Year 1)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R2
Cross Section Name: Cross Section 2 - Pool (R2, Year 1)
Survey Date: 11/10/2008

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	876.5906	GS
9.04	0	876.5554	GS
16.89	0	876.3899	GS
18.86	0	876.0113	GS
27.9	0	873.7327	GS
38	0	873.376	GS
49.59	0	873.458	LB
52.65	0	872.7189	GS
55.75	0	871.8763	GS
59	0	871.5102	GS
61.11	0	870.9945	GS
61.8	0	871.4367	GS
63.15	0	870.998	LEW
64.61	0	870.3188	GS
66.55	0	870.2556	GS
66.99	0	870.0193	GS
69.56	0	869.6106	GS
71.17	0	869.0673	TW
72.1	0	871.0466	REW
72.85	0	872.3305	GS
75.92	0	873.3031	BKF
78.71	0	873.1089	GS
87.56	0	873.1096	GS
93.37	0	873.0317	GS
108.43	0	876.5328	GS
112.28	0	876.7982	GS
115.19	0	876.4244	GS
118.8	0	876.4646	GS

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	877.53	877.53	877.53
Bankfull Elevation (ft)	873.3	873.3	873.3
Floodprone Width (ft)	118.8	-----	-----
Bankfull Width (ft)	44.23	22.12	22.16
Entrenchment Ratio	2.69	-----	-----
Mean Depth (ft)	1.2	2.15	0.25
Maximum Depth (ft)	4.23	4.23	1.81
Width/Depth Ratio	36.86	10.29	88.64
Bankfull Area (sq ft)	53.17	47.57	5.6
Wetted Perimeter (ft)	47.2	26.23	24.58
Hydraulic Radius (ft)	1.13	1.81	0.23
Begin BKF Station	50.24	50.24	72.36

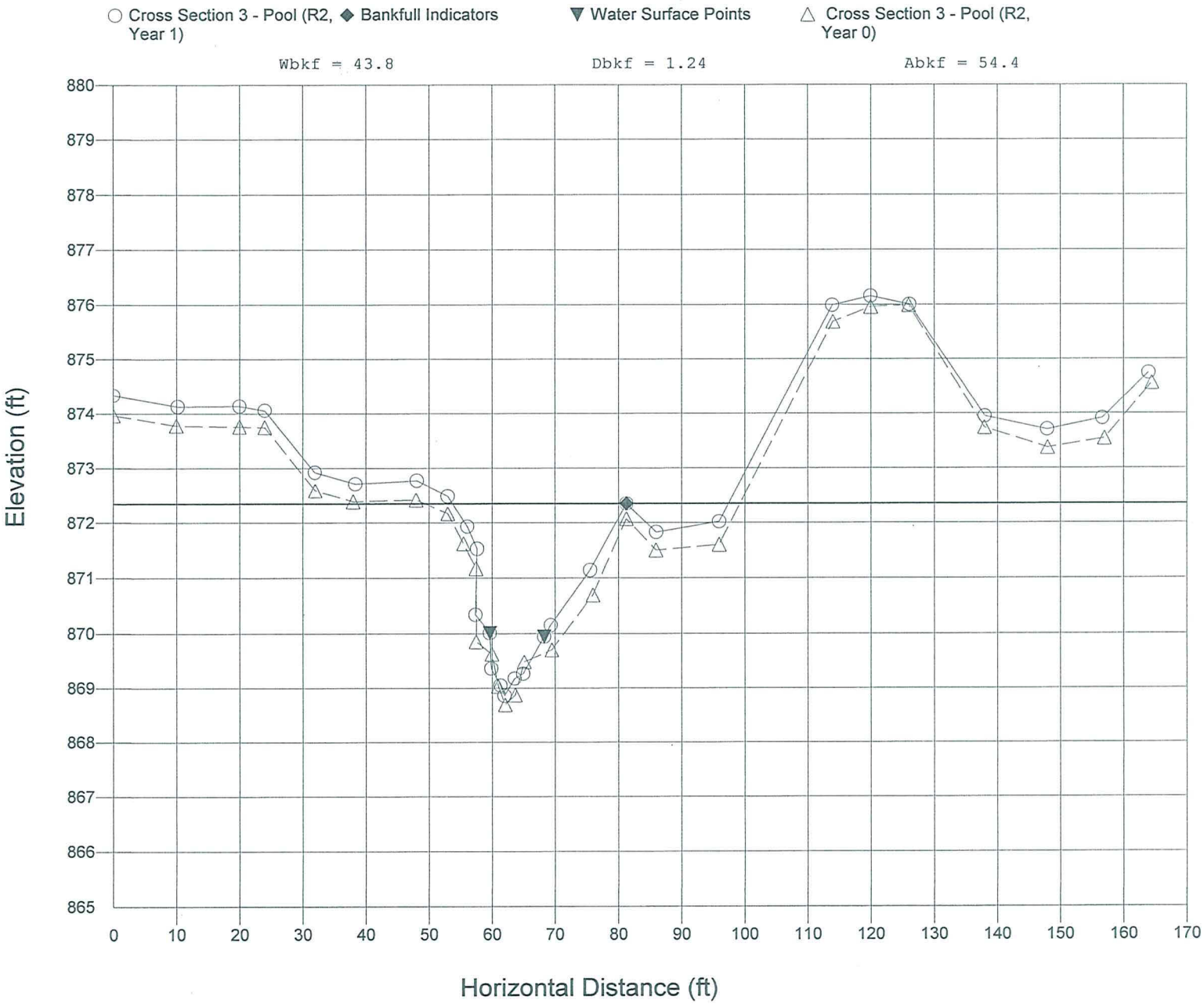
End BKF Station	94.52	72.36	94.52

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope			
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

Cross Section 3 - Pool (R2, Year 1)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R2
Cross Section Name: Cross Section 3 - Pool (R2, Year 1)
Survey Date: 11/10/2008

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	874.3382	GS
10.22	0	874.1291	GS
19.99	0	874.1371	GS
24	0	874.0576	GS
31.95	0	872.9249	GS
38.37	0	872.7133	GS
48.13	0	872.774	GS
52.98	0	872.4855	LB
56.11	0	871.9301	GS
57.69	0	871.527	GS
57.41	0	870.3392	GS
59.68	0	870.0057	LEW
59.91	0	869.3558	GS
61.35	0	869.0455	GS
62	0	868.8563	TW
63.61	0	869.173	GS
64.94	0	869.2617	GS
68.28	0	869.9383	REW
69.32	0	870.1478	GS
75.56	0	871.1376	GS
81.3	0	872.3463	BKF
86.04	0	871.8262	GS
96.01	0	872.0181	GS
113.9	0	875.991	GS
119.98	0	876.1569	GS
126.11	0	876.0048	GS
138.05	0	873.9475	GS
147.94	0	873.7047	GS
156.67	0	873.9106	GS
163.99	0	874.7447	GS

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	875.84	875.84	875.84
Bankfull Elevation (ft)	872.35	872.35	872.35
Floodprone Width (ft)	150.18	-----	-----
Bankfull Width (ft)	43.76	21.88	21.88
Entrenchment Ratio	3.43	-----	-----
Mean Depth (ft)	1.24	2.07	0.42
Maximum Depth (ft)	3.49	3.49	1.2
Width/Depth Ratio	35.29	10.57	52.1
Bankfull Area (sq ft)	54.41	45.23	9.18
Wetted Perimeter (ft)	46.29	25.41	23.27

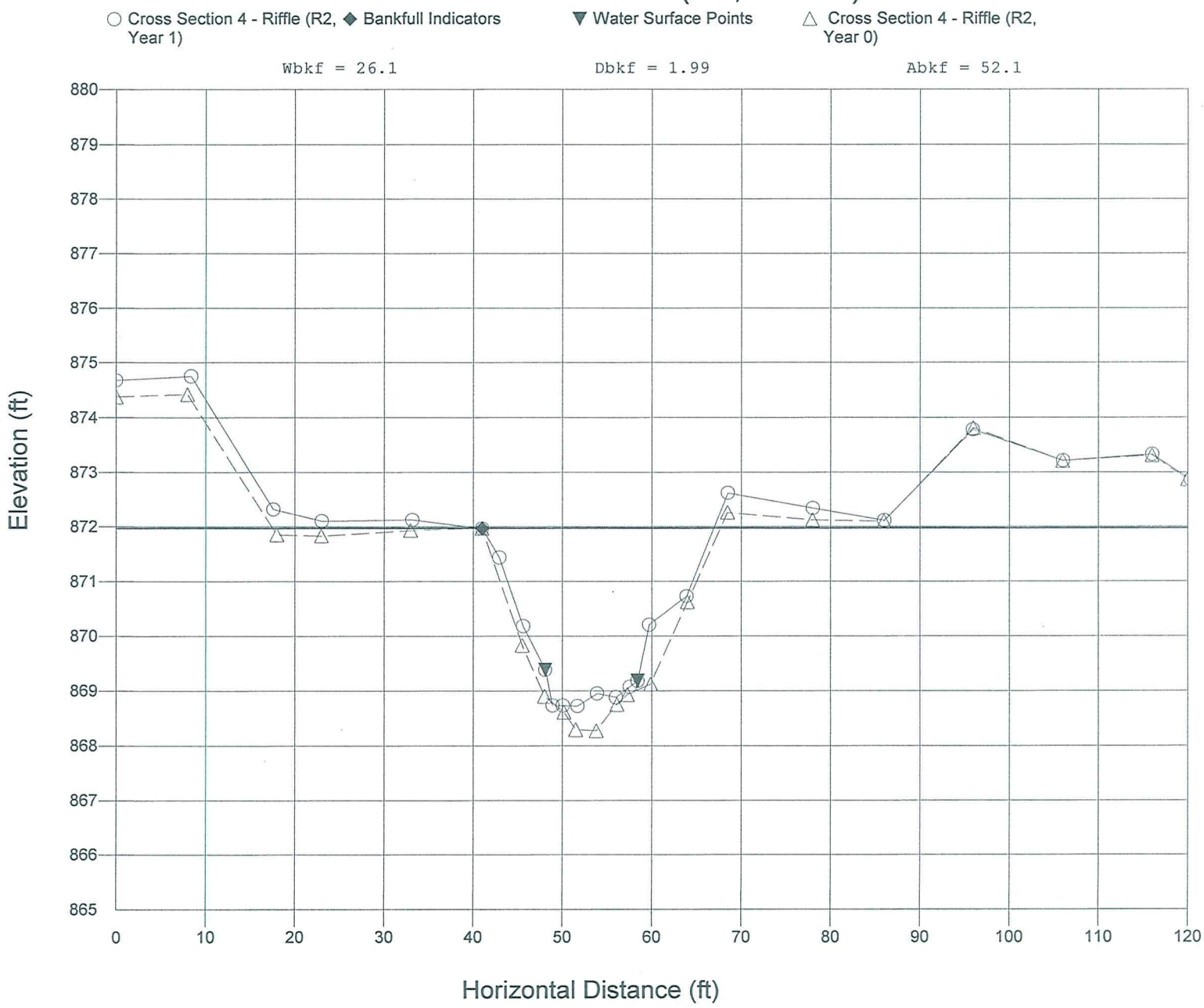
Hydraulic Radius (ft)	1.18	1.78	0.39
Begin BKF Station	53.74	53.74	75.62
End BKF Station	97.5	75.62	97.5

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope			
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

Cross Section 4 - Riffle (R2, Year 1)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R2
Cross Section Name: Cross Section 4 - Riffle (R2, Year 1)
Survey Date: 11/10/2008

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	874.6785	GS
8.41	0	874.7499	GS
17.62	0	872.3206	GS
23.06	0	872.1019	GS
33.21	0	872.1239	GS
41.03	0	871.9659	BKF
42.95	0	871.4335	GS
45.62	0	870.1768	GS
48.1	0	869.3806	LEW
48.93	0	868.7304	GS
50.08	0	868.7305	GS
51.71	0	868.7208	TW
53.91	0	868.949	GS
56.01	0	868.8795	GS
57.56	0	869.0718	GS
58.45	0	869.1806	REW
59.74	0	870.2013	GS
63.92	0	870.7265	GS
68.54	0	872.6206	RB
78.04	0	872.3378	GS
86.05	0	872.1115	GS
95.96	0	873.7782	GS
106.06	0	873.2136	GS
116.03	0	873.3264	GS
120.37	0	872.8616	GS

Cross Sectional Geometry

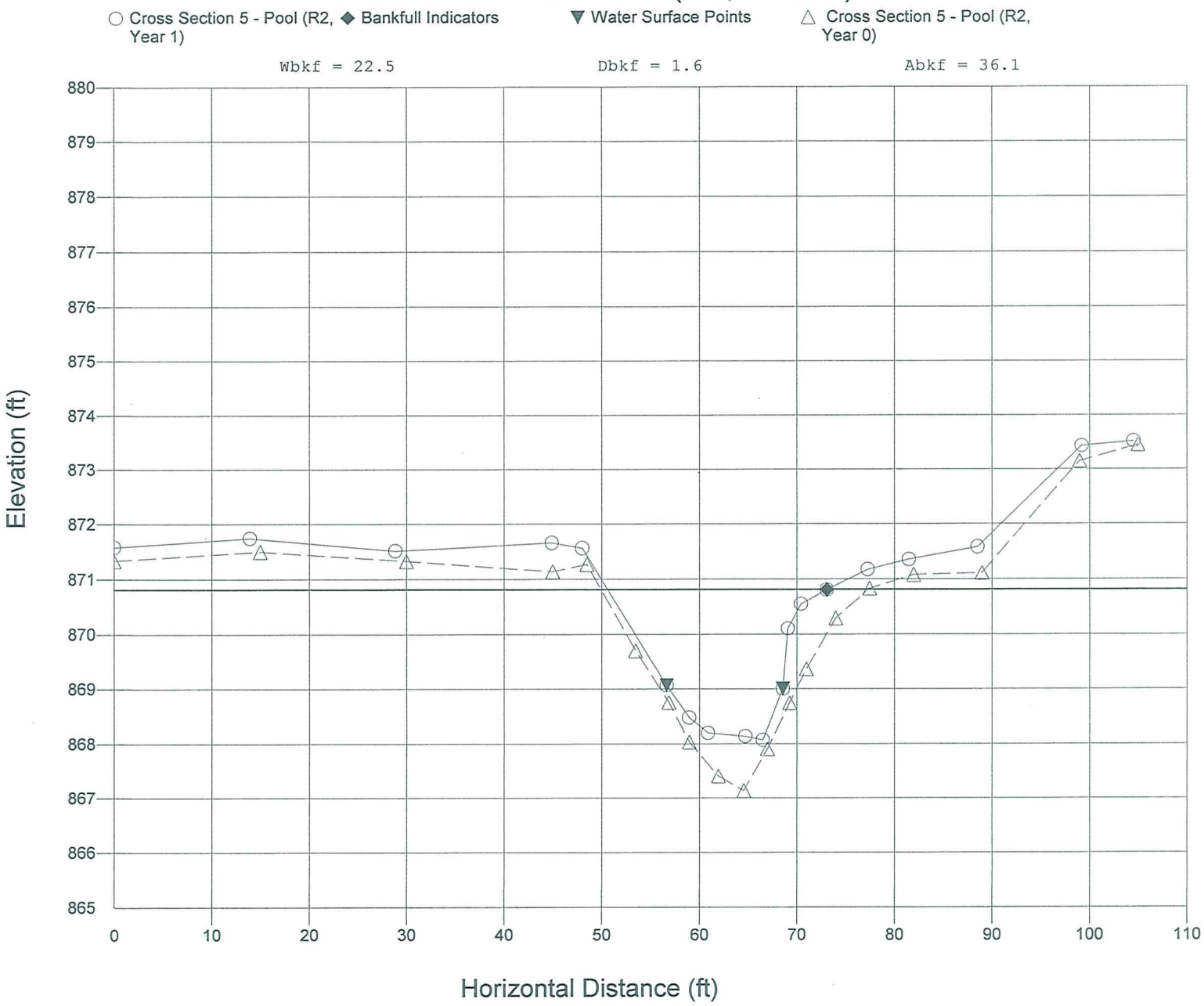
	Channel	Left	Right
Floodprone Elevation (ft)	875.22	875.22	875.22
Bankfull Elevation (ft)	871.97	871.97	871.97
Floodprone Width (ft)	120.37	-----	-----
Bankfull Width (ft)	26.13	13.06	13.06
Entrenchment Ratio	4.61	-----	-----
Mean Depth (ft)	1.99	2.09	1.9
Maximum Depth (ft)	3.25	3.25	3.09
Width/Depth Ratio	13.13	6.25	6.87
Bankfull Area (sq ft)	52.1	27.33	24.77
Wetted Perimeter (ft)	27.49	16.8	16.74
Hydraulic Radius (ft)	1.9	1.63	1.48
Begin BKF Station	40.83	40.83	53.89
End BKF Station	66.95	53.89	66.95

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope			
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

Cross Section 5 - Pool (R2, Year 1)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R2
Cross Section Name: Cross Section 5 - Pool (R2, Year 1)
Survey Date: 11/10/2008

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	871.583	GS
13.95	0	871.7439	GS
28.86	0	871.5156	GS
44.92	0	871.6589	GS
48.04	0	871.5644	LB
56.68	0	869.0614	LEW
58.98	0	868.4758	GS
60.93	0	868.1979	GS
64.76	0	868.1371	GS
66.53	0	868.0677	TW
68.6	0	868.9981	REW
69.1	0	870.1017	GS
70.46	0	870.5481	GS
73.09	0	870.8062	BKF
77.3	0	871.1763	GS
81.51	0	871.3567	GS
88.56	0	871.5819	GS
99.23	0	873.4296	GS
104.55	0	873.5183	GS

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	873.55	873.55	873.55
Bankfull Elevation (ft)	870.81	870.81	870.81
Floodprone Width (ft)	104.55	-----	-----
Bankfull Width (ft)	22.49	11.25	11.24
Entrenchment Ratio	4.65	-----	-----
Mean Depth (ft)	1.6	1.54	1.67
Maximum Depth (ft)	2.74	2.63	2.74
Width/Depth Ratio	14.06	7.31	6.73
Bankfull Area (sq ft)	36.06	17.31	18.75
Wetted Perimeter (ft)	23.83	14.21	14.86
Hydraulic Radius (ft)	1.51	1.22	1.26
Begin BKF Station	50.64	50.64	61.89
End BKF Station	73.13	61.89	73.13

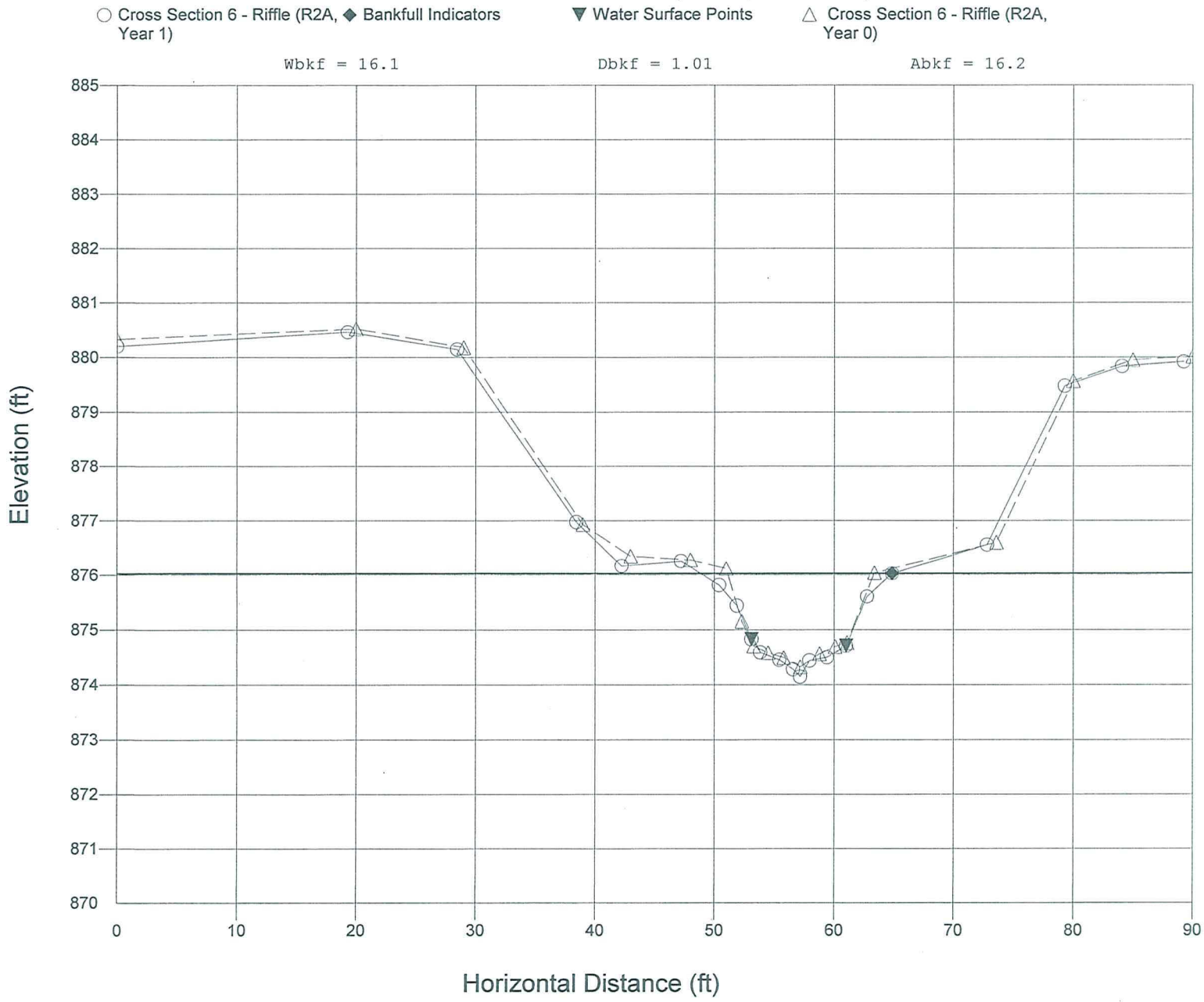
Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side

Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

Cross Section 6 - Riffle (R2A, Year 1)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R2A
Cross Section Name: Cross Section 6 - Riffle (R2A, Year 1)
Survey Date: 11/10/2008

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	880.2035	GS
19.31	0	880.4614	GS
28.46	0	880.1445	GS
38.46	0	876.9752	GS
42.25	0	876.1676	GS
47.22	0	876.2584	GS
50.41	0	875.8145	LB
51.88	0	875.4357	GS
53.11	0	874.8245	LEW
53.84	0	874.586	GS
55.44	0	874.4496	GS
56.6	0	874.2772	GS
57.19	0	874.1423	TW
57.97	0	874.4357	GS
59.42	0	874.4946	GS
61.02	0	874.7021	LEW
62.77	0	875.6016	RB
64.87	0	876.0269	BKF
72.82	0	876.5574	GS
79.31	0	879.4803	GS
84.11	0	879.8364	GS
89.27	0	879.9175	GS

Cross Sectional Geometry

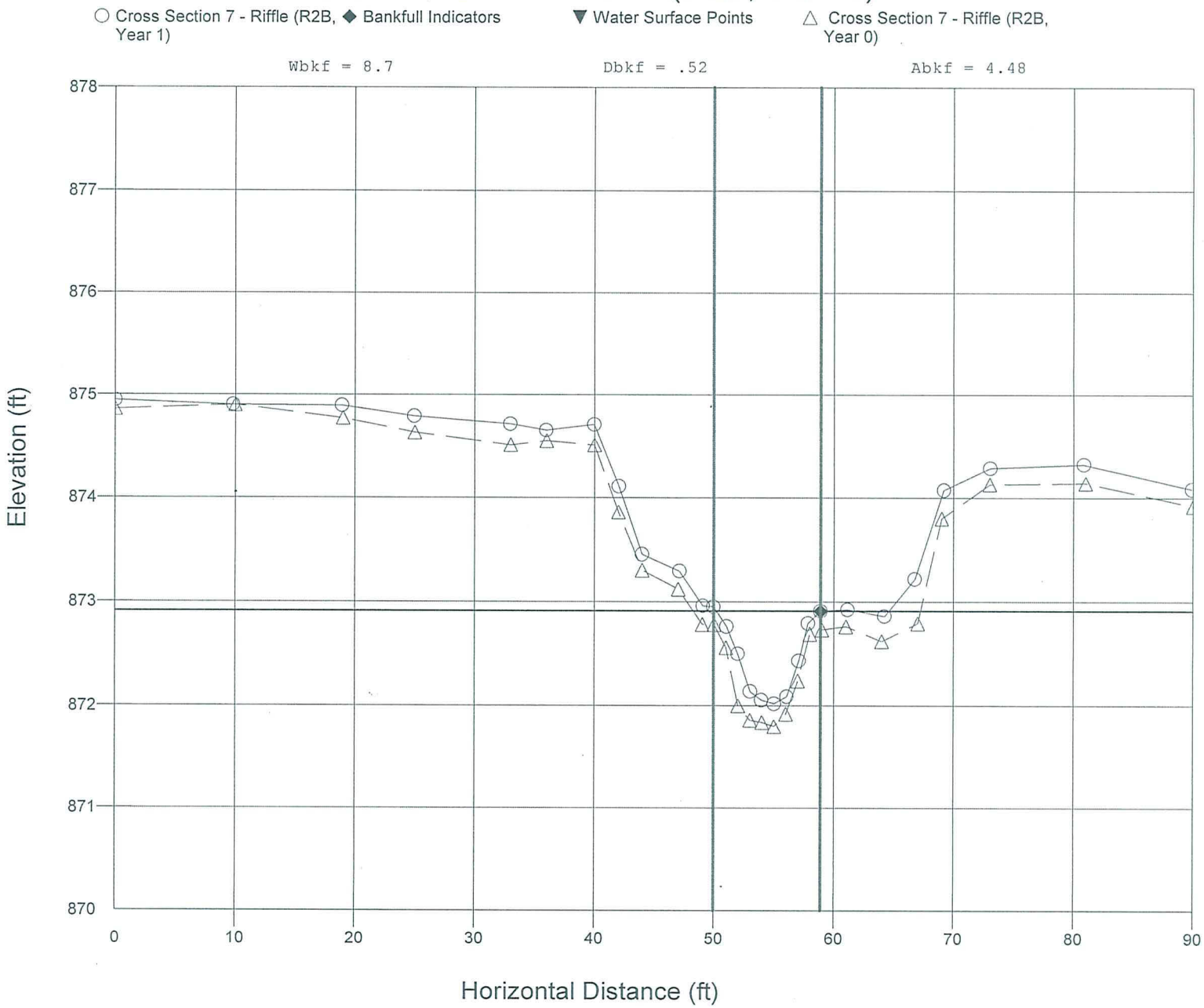
	Channel	Left	Right
Floodprone Elevation (ft)	877.92	877.92	-----
Bankfull Elevation (ft)	876.03	876.03	-----
Floodprone Width (ft)	40.35	-----	-----
Bankfull Width (ft)	16.06	26.14	-----
Entrenchment Ratio	2.51	-----	-----
Mean Depth (ft)	1.01	1.01	-----
Maximum Depth (ft)	1.89	1.89	-----
Width/Depth Ratio	15.9	25.88	-----
Bankfull Area (sq ft)	16.17	16.17	-----
Wetted Perimeter (ft)	16.66	16.66	-----
Hydraulic Radius (ft)	0.97	0.97	-----
Begin BKF Station	48.86	48.86	-----
End BKF Station	64.92	64.92	-----

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

Cross Section 7 - Riffle (R2B, Year 1)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R2B
Cross Section Name: Cross Section 7 - Riffle (R2B, Year 1)
Survey Date: 09/04/2008

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	874.9463	GS
9.83	0	874.9017	GS
18.92	0	874.8935	GS
24.96	0	874.789	GS
32.98	0	874.7125	GS
35.97	0	874.652	GS
39.98	0	874.7078	GS
42.03	0	874.1088	GS
43.99	0	873.4516	GS
47.11	0	873.2923	GS
49.07	0	872.9583	GS
49.96	0	872.9506	LB
51.05	0	872.7587	GS
51.99	0	872.4992	GS
53.03	0	872.1381	GS
53.96	0	872.0547	GS
55.02	0	872.0194	TW
56.08	0	872.088	GS
57.09	0	872.4319	GS
57.85	0	872.7895	GS
58.89	0	872.908	BKF
61.14	0	872.9226	GS
64.23	0	872.8586	GS
66.76	0	873.2168	GS
69.18	0	874.0729	GS
73.05	0	874.2865	GS
80.86	0	874.3224	GS
89.9	0	874.0824	GS

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	873.8	873.8	873.8
Bankfull Elevation (ft)	872.91	872.91	872.91
Floodprone Width (ft)	25.46	-----	-----
Bankfull Width (ft)	8.7	5.93	2.77
Entrenchment Ratio	2.93	-----	-----
Mean Depth (ft)	0.52	0.6	0.33
Maximum Depth (ft)	0.89	0.89	0.81
Width/Depth Ratio	16.73	9.88	8.39
Bankfull Area (sq ft)	4.48	3.57	0.92
Wetted Perimeter (ft)	8.96	6.86	3.72
Hydraulic Radius (ft)	0.5	0.52	0.25
Begin BKF Station	50.19	50.19	56.12

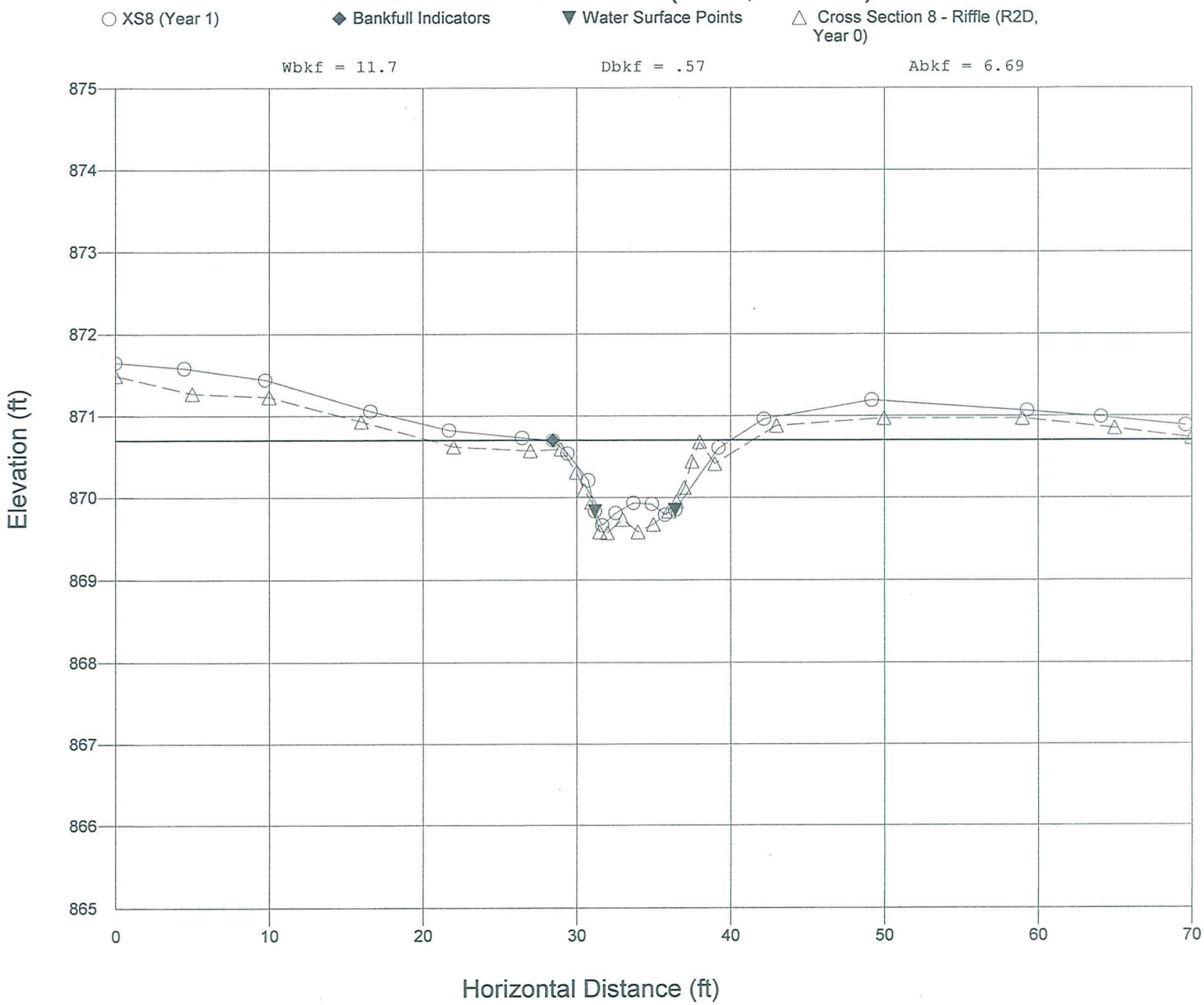
End BKF Station	58.89	56.12	58.89

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

Cross Section 8 - Riffle (R2D, Year 1)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R2D
Cross Section Name: Cross Section 8 - Riffle (R2D, Year 1)
Survey Date: 09/04/2008

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	871.6481	GS
4.49	0	871.5795	GS
9.75	0	871.4383	GS
16.6	0	871.058	GS
21.71	0	870.8233	GS
26.47	0	870.7301	GS
28.47	0	870.6976	BKF
29.43	0	870.5376	GS
30.77	0	870.2071	GS
31.2	0	869.8295	LEW
31.67	0	869.6601	TW
32.54	0	869.8094	GS
33.7	0	869.9324	GS
34.91	0	869.919	GS
35.77	0	869.7881	GS
36.42	0	869.8455	REW
39.25	0	870.6034	RB
42.19	0	870.961	GS
49.21	0	871.1897	GS
59.31	0	871.0629	GS
64.11	0	870.9877	GS
69.62	0	870.8823	GS

Cross Sectional Geometry

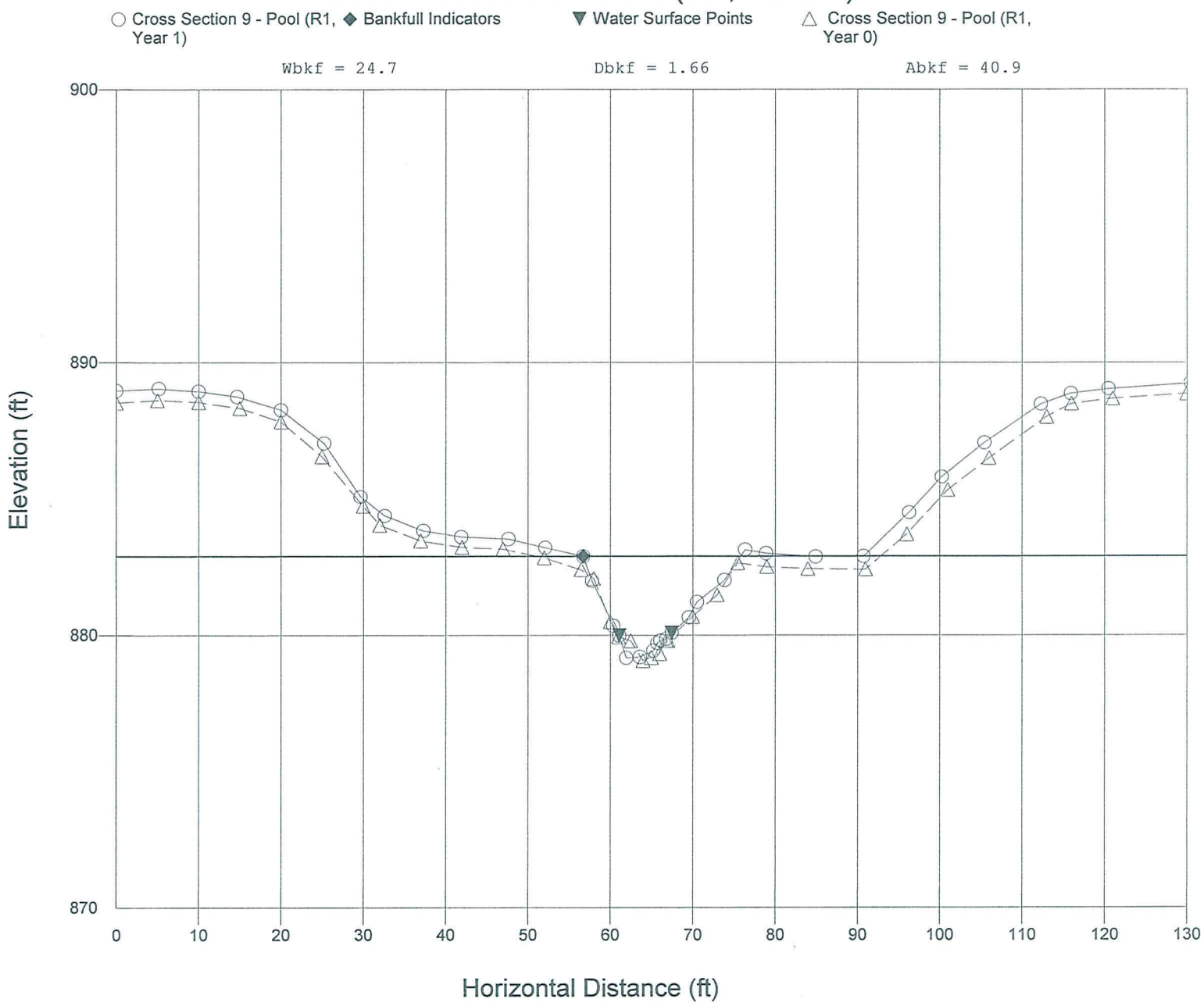
	Channel	Left	Right
Floodprone Elevation (ft)	871.74	871.74	871.74
Bankfull Elevation (ft)	870.7	870.7	870.7
Floodprone Width (ft)	69.62	-----	-----
Bankfull Width (ft)	11.72	5.86	5.86
Entrenchment Ratio	5.94	-----	-----
Mean Depth (ft)	0.57	0.59	0.56
Maximum Depth (ft)	1.04	1.04	0.91
Width/Depth Ratio	20.56	9.93	10.46
Bankfull Area (sq ft)	6.69	3.43	3.25
Wetted Perimeter (ft)	12.08	6.88	6.75
Hydraulic Radius (ft)	0.55	0.5	0.48
Begin BKF Station	28.32	28.32	34.18
End BKF Station	40.04	34.18	40.04

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

Cross Section 9 - Pool (R1, Year 1)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R1
Cross Section Name: Cross Section 9 - Pool (R1, Year 1)
Survey Date: 10/14/2008

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	888.982	GS
5.16	0	889.0535	GS
10.01	0	888.953	GS
14.69	0	888.7614	GS
20.01	0	888.2744	GS
25.28	0	887.0475	GS
29.69	0	885.071	GS
32.62	0	884.3704	GS
37.33	0	883.8159	GS
41.92	0	883.5905	GS
47.68	0	883.5139	GS
52.13	0	883.1962	GS
56.75	0	882.8811	BKF
57.81	0	881.9791	GS
60.37	0	880.331	GS
61.09	0	879.9773	LEW
61.96	0	879.1695	TW
63.63	0	879.2015	GS
65.26	0	879.4292	GS
65.74	0	879.7095	GS
66.1	0	879.7933	GS
66.8	0	879.8549	GS
67.48	0	880.0727	REW
69.56	0	880.6332	GS
70.54	0	881.2023	GS
73.9	0	882.009	GS
76.39	0	883.123	RB
78.92	0	882.9899	GS
84.96	0	882.8646	GS
90.78	0	882.8831	GS
96.3	0	884.4865	GS
100.27	0	885.8104	GS
105.44	0	887.0679	GS
112.31	0	888.4927	GS
115.92	0	888.8783	GS
120.51	0	889.0468	GS
130.51	0	889.2544	GS

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	886.59	886.59	886.59
Bankfull Elevation (ft)	882.88	882.88	882.88
Floodprone Width (ft)	77.18	-----	-----

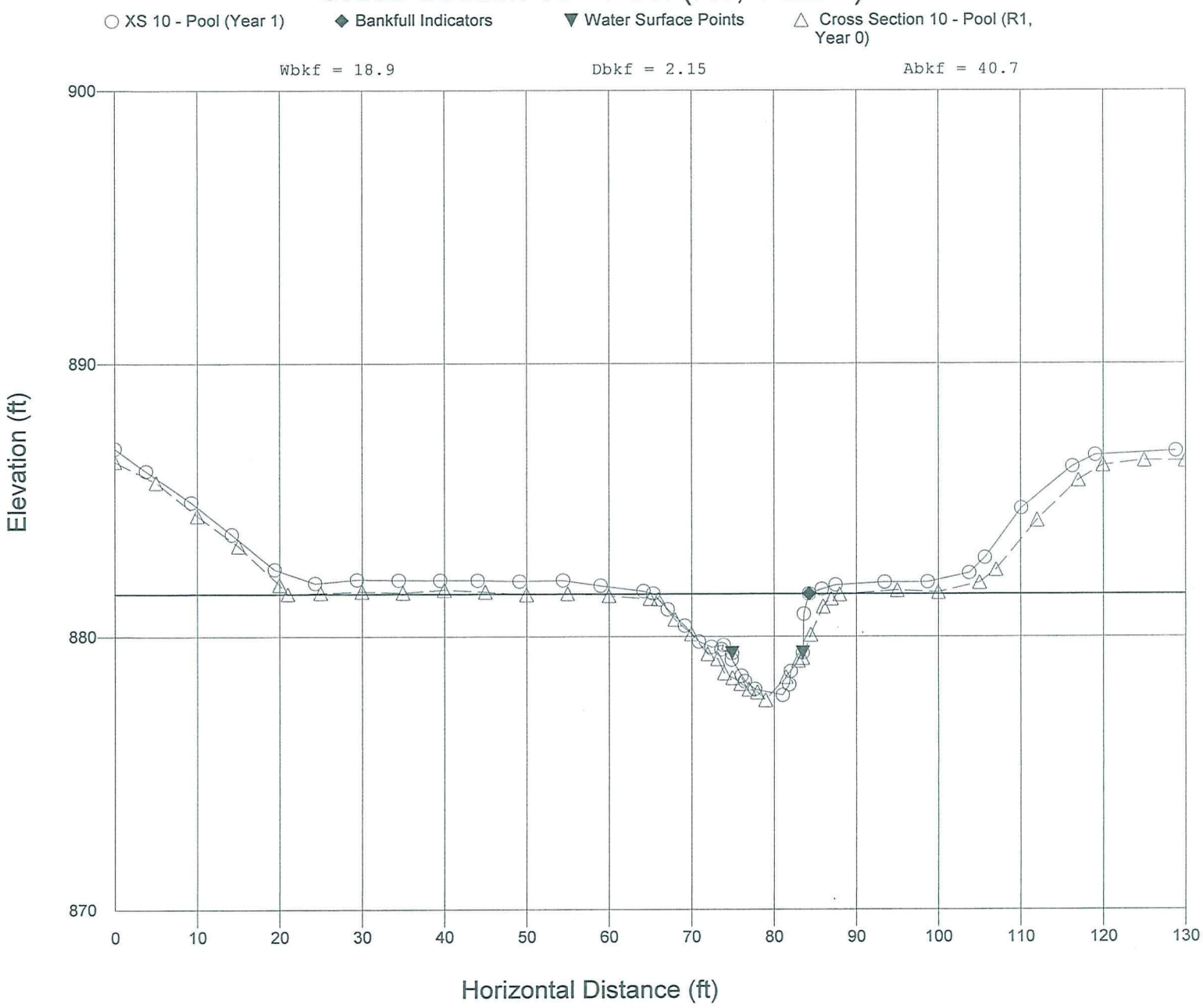
Bankfull Width (ft)	24.68	12.34	20.71
Entrenchment Ratio	3.13	-----	-----
Mean Depth (ft)	1.66	2.65	0.66
Maximum Depth (ft)	3.71	3.71	2.37
Width/Depth Ratio	14.87	4.66	31.38
Bankfull Area (sq ft)	40.9	32.72	8.18
Wetted Perimeter (ft)	26.55	16.12	15.16
Hydraulic Radius (ft)	1.54	2.03	0.54
Begin BKF Station	56.75	56.75	69.09
End BKF Station	89.8	69.09	89.8

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

Cross Section 10 - Pool (R1, Year 1)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R1
Cross Section Name: Cross Section 10 - Pool (R1, Year 1)
Survey Date: 10/14/2008

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	886.8813	GS
3.79	0	886.0528	GS
9.29	0	884.8979	GS
14.21	0	883.7397	GS
19.42	0	882.4609	GS
24.33	0	881.9533	GS
29.42	0	882.0849	GS
34.51	0	882.0655	GS
39.54	0	882.0581	GS
44.08	0	882.0574	GS
49.18	0	882.0207	GS
54.46	0	882.0533	GS
59	0	881.8604	GS
64.23	0	881.6602	GS
65.39	0	881.5705	LB
67.14	0	880.9866	GS
69.2	0	880.3866	GS
70.93	0	879.8058	GS
72.47	0	879.6055	GS
73.93	0	879.6784	GS
73.68	0	879.5218	GS
74.96	0	879.3781	LEW
74.92	0	879.1477	GS
76.11	0	878.5523	GS
76.5	0	878.3553	GS
77.73	0	878.0727	GS
81.1	0	877.8557	TW
81.89	0	878.2374	GS
82.08	0	878.7193	GS
83.55	0	879.3932	REW
83.66	0	880.8109	GS
84.3	0	881.5577	BKF
85.85	0	881.7273	GS
87.52	0	881.8809	GS
93.49	0	881.9836	GS
98.71	0	881.9906	GS
103.76	0	882.3211	GS
105.66	0	882.8868	GS
110.08	0	884.6739	GS
116.28	0	886.2119	GS
119.07	0	886.6256	GS
128.85	0	886.7806	GS

Cross Sectional Geometry

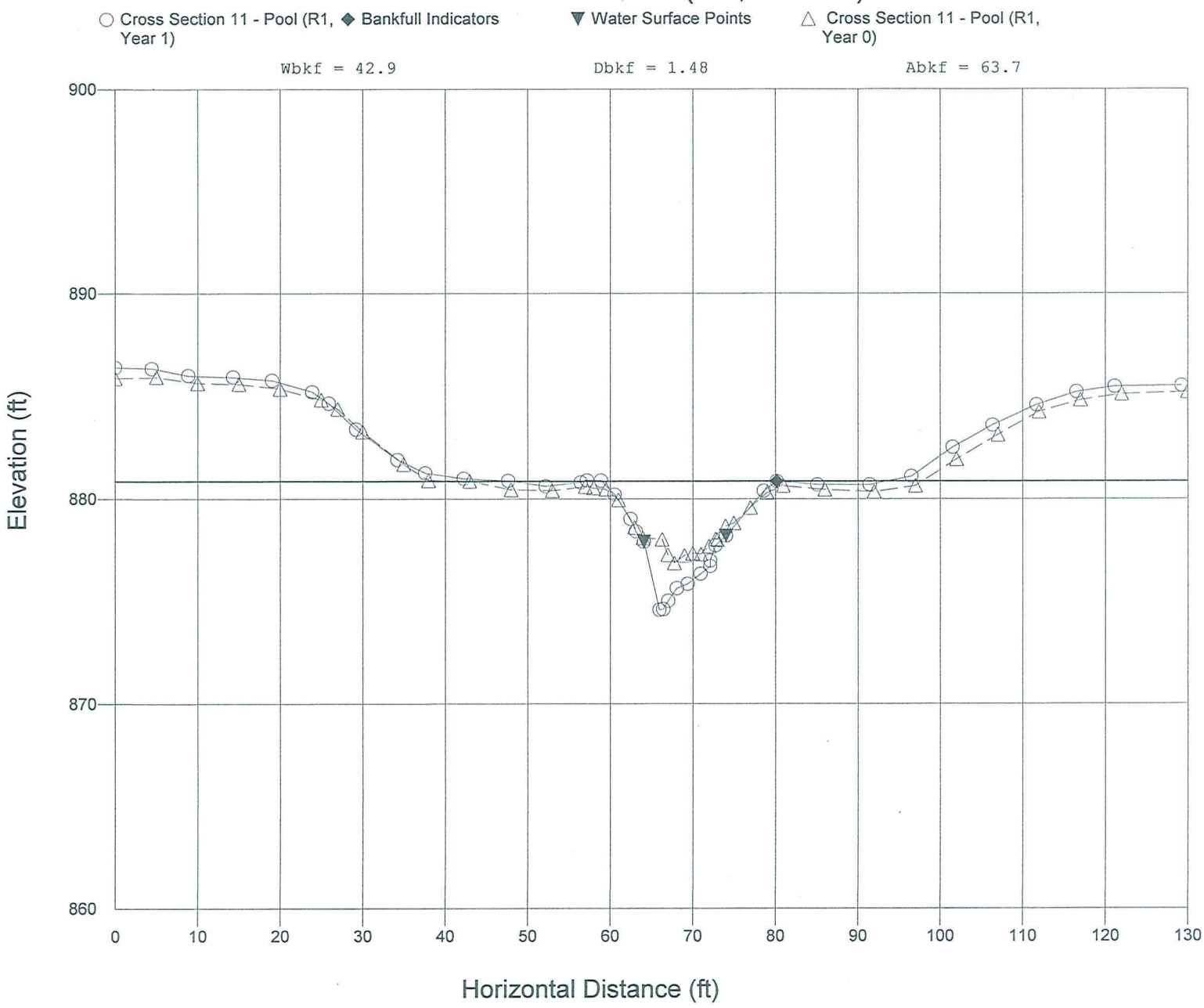
	Channel	Left	Right
Floodprone Elevation (ft)	885.26	885.26	885.26
Bankfull Elevation (ft)	881.56	881.56	881.56
Floodprone Width (ft)	104.91	-----	-----
Bankfull Width (ft)	18.9	9.45	9.45
Entrenchment Ratio	5.55	-----	-----
Mean Depth (ft)	2.15	1.32	2.99
Maximum Depth (ft)	3.7	2.17	3.7
Width/Depth Ratio	8.79	7.16	3.16
Bankfull Area (sq ft)	40.71	12.5	28.22
Wetted Perimeter (ft)	22.46	12.46	14.34
Hydraulic Radius (ft)	1.81	1	1.97
Begin BKF Station	65.42	65.42	74.87
End BKF Station	84.32	74.87	84.32

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

Cross Section 11 - Pool (R1, Year 1)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R1
Cross Section Name: Cross Section 11 - Pool (R1, Year 1)
Survey Date: 10/14/2008

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	886.4446	GS
4.45	0	886.3885	GS
8.89	0	886.041	GS
14.31	0	885.9687	GS
19.04	0	885.8056	GS
23.9	0	885.2437	GS
25.92	0	884.6872	GS
29.23	0	883.4106	GS
34.23	0	881.9198	GS
37.62	0	881.2731	GS
42.28	0	881.003	GS
47.68	0	880.8922	GS
52.21	0	880.6289	GS
56.46	0	880.8102	GS
57.23	0	880.9086	GS
58.91	0	880.9018	LB
60.55	0	880.2154	GS
62.48	0	879.0119	GS
63.13	0	878.3965	GS
64.11	0	877.8867	LEW
65.98	0	874.5401	TW
66.46	0	874.5685	GS
67.06	0	874.9805	GS
68.1	0	875.5934	GS
69.4	0	875.8088	GS
70.99	0	876.3042	GS
72.16	0	876.678	GS
72.15	0	876.9484	GS
72.8	0	877.7078	GS
74.05	0	878.1792	REW
78.63	0	880.3916	GS
80.2	0	880.8648	BKF
85.13	0	880.7019	GS
91.49	0	880.6985	GS
96.52	0	881.1097	GS
101.52	0	882.5236	GS
106.37	0	883.6097	GS
111.71	0	884.6097	GS
116.53	0	885.24	GS
121.18	0	885.4989	GS
129.26	0	885.5481	GS

Cross Sectional Geometry

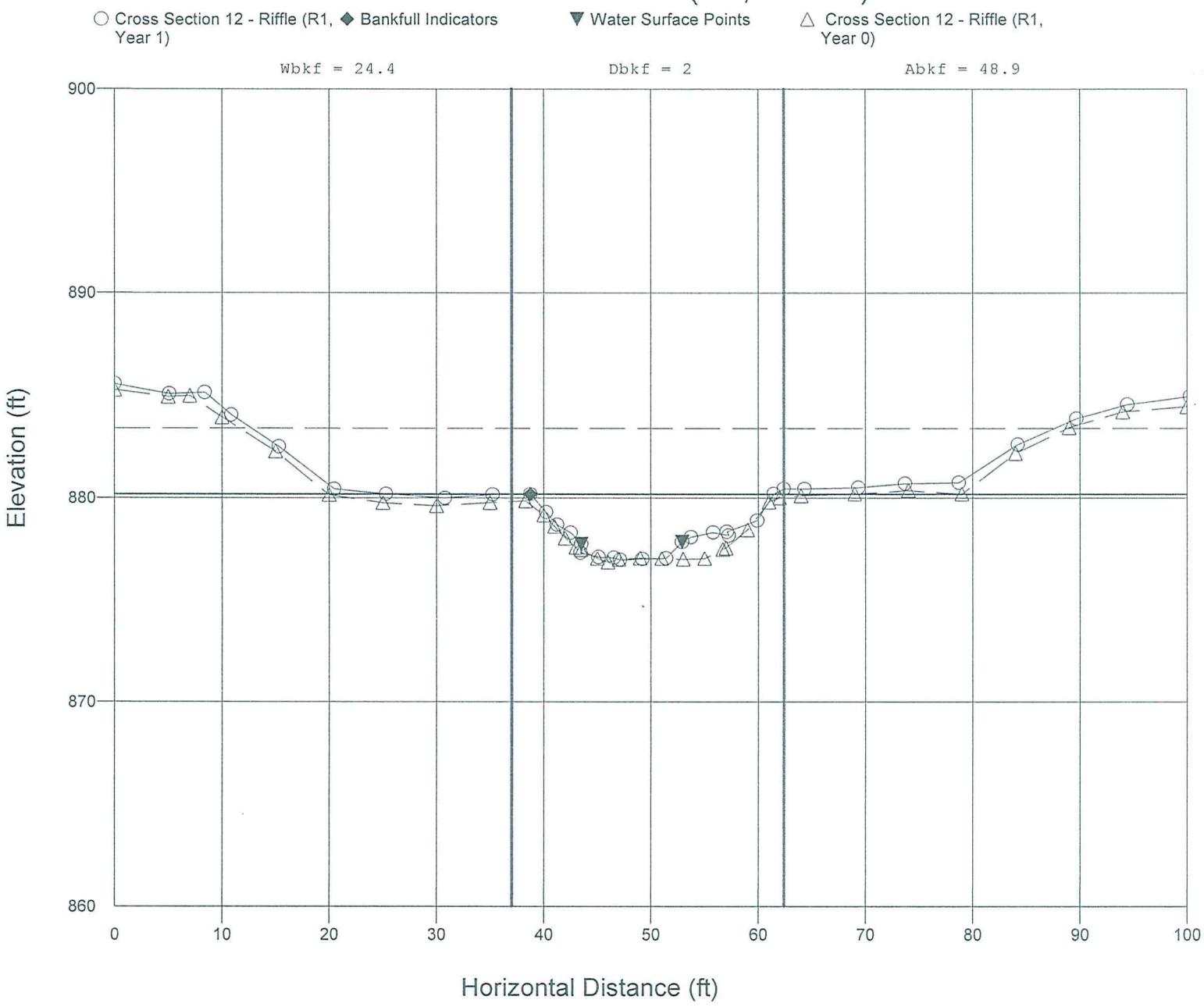
	Channel	Left	Right
Floodprone Elevation (ft)	887.18	887.18	887.18
Bankfull Elevation (ft)	880.86	880.86	880.86
Floodprone Width (ft)	129.26	-----	-----
Bankfull Width (ft)	42.91	21.46	23.78
Entrenchment Ratio	3.01	-----	-----
Mean Depth (ft)	1.48	1.94	1.11
Maximum Depth (ft)	6.32	6.32	4.96
Width/Depth Ratio	28.99	11.06	21.42
Bankfull Area (sq ft)	63.68	37.35	26.33
Wetted Perimeter (ft)	47.48	27.41	30
Hydraulic Radius (ft)	1.34	1.36	0.88
Begin BKF Station	48.23	48.23	69.69
End BKF Station	93.47	69.69	93.47

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

Cross Section 12 - Riffle (R1, Year 1)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R1
Cross Section Name: Cross Section 12 - Riffle (R1, Year 1)
Survey Date: 10/14/2008

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	885.5536	GS
5.11	0	885.0686	GS
8.4	0	885.1329	GS
10.88	0	884.0396	GS
15.31	0	882.4954	GS
20.48	0	880.4338	GS
25.31	0	880.1904	GS
30.79	0	879.9968	GS
35.26	0	880.1614	GS
38.76	0	880.1768	BKF
40.24	0	879.2987	GS
41.26	0	878.6773	GS
42.52	0	878.2842	GS
43.52	0	877.7308	LEW
43.44	0	877.2998	GS
45.12	0	877.0887	GS
46.54	0	877.0537	GS
47.14	0	876.9615	TW
49.21	0	876.9972	GS
51.41	0	877.0275	GS
52.9	0	877.8304	REW
53.72	0	878.066	GS
55.81	0	878.301	GS
57.26	0	878.1469	GS
57.08	0	878.3326	GS
59.91	0	878.8881	GS
61.44	0	880.197	GS
62.4	0	880.4494	RB
64.34	0	880.4467	GS
69.35	0	880.5116	GS
73.7	0	880.7063	GS
78.73	0	880.7546	GS
84.22	0	882.6033	GS
89.69	0	883.8705	GS
94.44	0	884.557	GS
100.3	0	884.9515	GS

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	883.4	883.4	883.4
Bankfull Elevation (ft)	880.18	880.18	880.18
Floodprone Width (ft)	74.93	-----	-----
Bankfull Width (ft)	24.42	6.51	17.91

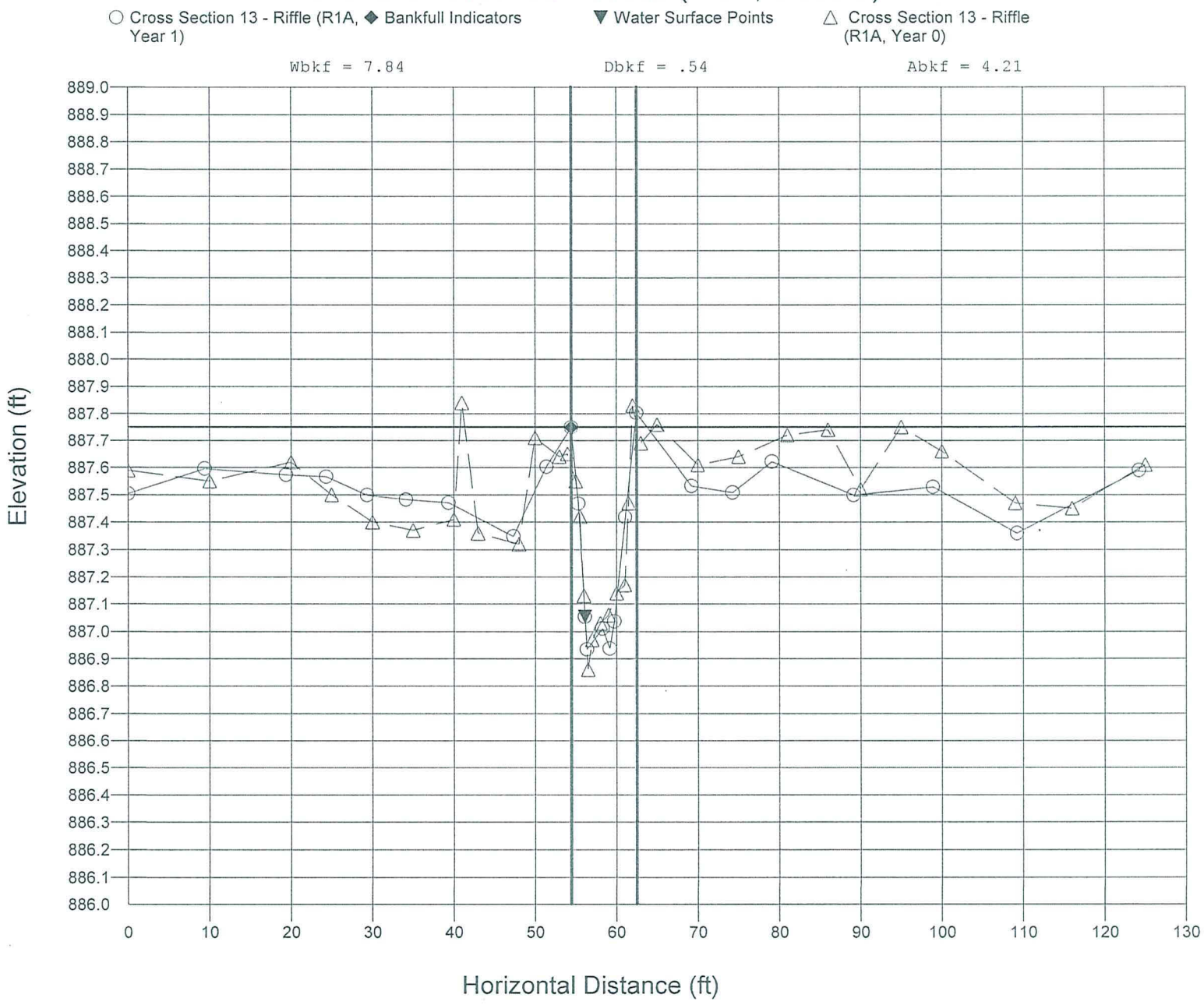
Entrenchment Ratio	3.07	-----	-----
Mean Depth (ft)	2	0.95	2.39
Maximum Depth (ft)	3.22	2.89	3.22
Width/Depth Ratio	12.21	6.85	7.49
Bankfull Area (sq ft)	48.92	6.19	42.73
Wetted Perimeter (ft)	26.82	10.54	22.05
Hydraulic Radius (ft)	1.82	0.59	1.94
Begin BKF Station	37	37	43.51
End BKF Station	61.42	43.51	61.42

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

Cross Section 13 - Riffle (R1A, Year 1)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R1A
Cross Section Name: Cross Section 13 - Riffle (R1A, Year 1)
Survey Date: 09/03/2008

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	887.5046	GS
9.4	0	887.5958	GS
19.4	0	887.573	GS
24.35	0	887.5662	GS
29.36	0	887.4985	GS
34.15	0	887.4824	GS
39.37	0	887.4705	GS
47.34	0	887.3477	GS
51.43	0	887.6029	GS
54.46	0	887.7488	BKF
55.33	0	887.4676	GS
56.11	0	887.0532	LEW
56.36	0	886.934	TW
58.27	0	887.0104	GS
59.16	0	886.9374	GS
59.71	0	887.0366	GS
61.09	0	887.4172	GS
62.49	0	887.8024	RB
69.22	0	887.5323	GS
74.28	0	887.5082	GS
79.11	0	887.6218	GS
89.14	0	887.4987	GS
98.92	0	887.5286	GS
109.24	0	887.3593	GS
124.24	0	887.5896	GS

Cross Sectional Geometry

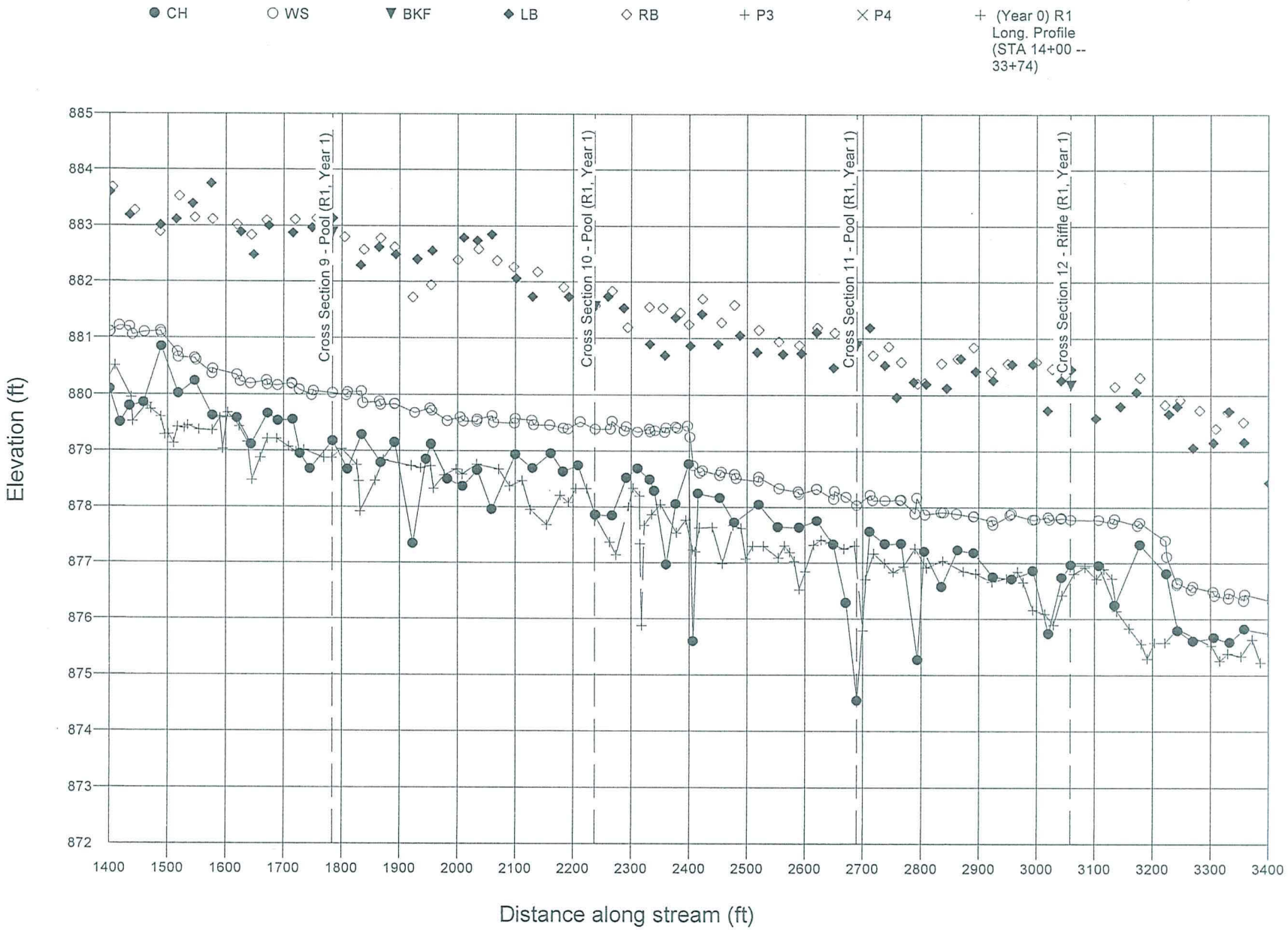
	Channel	Left	Right
Floodprone Elevation (ft)	888.57	888.57	888.57
Bankfull Elevation (ft)	887.75	887.75	887.75
Floodprone Width (ft)	124.24	-----	-----
Bankfull Width (ft)	7.84	3.92	3.92
Entrenchment Ratio	15.85	-----	-----
Mean Depth (ft)	0.54	0.58	0.5
Maximum Depth (ft)	0.82	0.82	0.81
Width/Depth Ratio	14.52	6.76	7.84
Bankfull Area (sq ft)	4.21	2.26	1.95
Wetted Perimeter (ft)	8.13	4.85	4.78
Hydraulic Radius (ft)	0.52	0.47	0.41
Begin BKF Station	54.46	54.46	58.38
End BKF Station	62.3	58.38	62.3

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

(Year 1) R1 Long. Profile (STA 14+00 -- 33+74)



RIVERMORPH PROFILE SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R1
Profile Name: (Year 1) R1 Long. Profile (STA 14+00 -- 33+74)
Survey Date: 12/31/2008

Survey Data

DIST	CH	WS	BKF	LB	RB	P3	P4
1400	880.093						
1400				883.591			
1400		881.096					
1401.17		881.109					
1404.645					883.681		
1416.793		881.214					
1417.99	879.503						
1434.563				883.185			
1434.563		881.19					
1434.563	879.79						
1439.29		881.052					
1442.865					883.269		
1458.437	879.856						
1459.888		881.101					
1486.805					882.887		
1487.407				883.005			
1487.902		881.12					
1488.733		881.08					
1488.936	880.841						
1514.502				883.106			
1516.787		880.749					
1518.283		880.653					
1518.283	880.014						
1519.755					883.522		
1542.837				883.386			
1546.723		880.64					
1546.723	880.235						
1546.723					883.14		
1548.746		880.604					
1574.525				883.747			
1576.288		880.368					
1577.367	879.622						
1577.367					883.11		
1577.687		880.446					
1619.186		880.342					
1619.186					883.014		
1619.186	879.58						
1624.867		880.231					
1626.102				882.879			
1643.007		880.191					
1643.721	879.105						
1644.267					882.828		
1648.005				882.472			
1670.378					883.091		
1670.578		880.244					
1671.816		880.17					
1672.296	879.659						
1674.389				882.992			

1689.592		880.159			
1689.921	879.534				
1713.763		880.198			
1714.727		880.18			
1715.554	879.551				
1715.554				882.865	
1719.304					883.105
1727.095		880.083			
1727.899	878.944				
1745.156	878.673				
1748.437		879.988			
1748.858				882.959	
1751.429		880.063			
1756.206					883.126
1784.368	879.17	880.025	882.881	883.123	
1804.642					882.791
1808.197		879.989			
1810.109	878.666				
1810.577		880.04			
1832.579				882.285	
1834.019		880.056			
1834.33	879.28				
1836.651		879.852			
1838.248					882.566
1864.157				882.608	
1865.295		879.878			
1867.245					882.773
1867.49		879.822			
1867.49	878.783				
1891.154					882.613
1891.28	879.143				
1891.28		879.833			
1891.966		879.836			
1893.182				882.476	
1922.604					881.72
1922.604	877.339				
1926.101		879.679			
1930.257				882.394	
1945.504	878.845				
1952.603		879.762			
1954.143	879.112				
1954.143					881.939
1955.641		879.719			
1956.28				882.547	
1982.254		879.534			
1982.605	878.493				
2000.546					882.386
2004.712		879.599			
2008.575	878.366				
2010.319		879.527			
2010.521				882.78	
2034.002		879.52			
2034.223				882.731	
2034.269		879.56			
2034.269	878.653				
2036.227					882.58
2058.83				882.838	
2058.83	877.956				
2059.991		879.626			
2062.449		879.506			
2068.17					882.373
2096.912					882.263
2098.623		879.492			
2100.037	878.931				

2100.037		879.573			
2101.135				882.052	
2128.404		879.544			
2129.473	878.686				
2129.473				881.727	
2131.656		879.462			
2137.859					882.174
2159.4		879.459			
2161.36	878.951				
2182.694	878.626				
2182.999		879.404			
2183.214					881.9
2190.953		879.386			
2192.495				881.728	
2208.14	878.736				
2211.877		879.516			
2237.897	877.856	879.386	881.558		881.571
2259.893				881.732	
2264.284		879.388			
2267.14					881.831
2267.14	877.846				
2267.14		879.53			
2287.183				881.528	
2288.22		879.357			
2291.556	878.52				
2291.556		879.437			
2293.88					881.185
2310.994	878.684				
2311.024		879.333			
2331.429		879.391			
2331.496					881.549
2332.257	878.49				
2332.257				880.89	
2333.041		879.337			
2339.798	878.29				
2341.598		879.361			
2354.676					881.529
2357.902		879.329			
2358.182				880.694	
2360.068		879.412			
2360.507	876.965				
2376.569				881.36	
2376.888		879.426			
2376.888	878.057				
2380.234		879.405			
2384.902					881.45
2397.651		879.447			
2399.448					881.242
2399.448	878.765				
2401.476		879.243			
2402.084				880.862	
2406.889		878.737			
2406.889	875.589				
2415.701	878.245				
2418.142		878.614			
2421.957				881.423	
2423.205		878.652			
2423.313					881.693
2449.983				880.891	
2452.902	878.166				
2452.902		878.571			
2455.481		878.626			
2455.779					881.277
2478.114					881.586

2478.114	877.727				
2478.583		878.583			
2481.539		878.515			
2487.516				881.047	
2517.191				880.748	
2519.501		878.469			
2520.448	878.046				
2520.448		878.538			
2520.448					881.145
2553.334	877.644				
2554.698					880.942
2555.502		878.336			
2561.731				880.714	
2588.189		878.277			
2589.841		878.238			
2590.248					880.88
2590.248	877.637				
2593.643				880.73	
2619.741		878.326			
2619.921				881.105	
2620.234		878.329			
2620.234	877.755				
2621.423					881.187
2648.872	877.331				
2649.313				880.476	
2649.831		878.148			
2651.133		878.29			
2651.574					881.099
2670.752	876.285				
2671.116		878.183			
2689.438	874.54	878.033	880.865		880.902
2711.569				881.185	
2711.569	877.562				
2712.641		878.221			
2716.771		878.124			
2717.497					880.699
2737.589				880.522	
2737.903	877.339				
2738.244		878.123			
2744.458					880.854
2758.05				879.96	
2764.098		878.128			
2766.14					880.58
2766.14	877.343				
2766.282		878.133			
2787.259				880.23	
2789.975		877.888			
2793.343		878.171			
2794.212	875.261				
2794.212					880.201
2805.964	877.203				
2806.712					880.212
2807.127		877.872			
2809.02				880.192	
2834.916		877.914			
2835.756	876.572				
2835.756					880.558
2839.254		877.907			
2844.711				880.12	
2861.716		877.884			
2863.48					880.642
2863.48	877.232				
2868.692				880.641	
2890.859		877.837			

2891.042				880.844
2891.042	877.184			
2891.993		877.839		
2894.54			880.417	
2921.337				880.407
2922.632		877.755		
2924.706	876.746			
2924.706			880.257	
2924.706		877.689		
2950.104				880.554
2953.918		877.858		
2956.493		877.886		
2957.169	876.709			
2957.169			880.539	
2993.532			880.54	
2993.745		877.781		
2993.745	876.859			
2996.974		877.78		
2999.46				880.583
3018.666			879.729	
3020.321	875.733			
3020.321		877.826		
3022.415		877.781		
3026.556				880.463
3041.593		877.797		
3042.27			880.254	
3043.299		877.808		
3043.299	876.732			
3049.557				880.368
3058.831	876.962	877.781	880.177	880.449
3101.904			879.59	
3107.345		877.776		
3107.345	876.951			
3131.305		877.717		
3134.873		877.792		
3134.873				880.152
3134.873	876.244			
3144.332			879.799	
3171.91			880.051	
3174.463		877.673		
3178.362		877.728		
3178.362				880.306
3178.362	877.328			
3221.428				879.834
3222.507		877.407		
3223.993	876.807			
3224.621		877.113		
3228.188			879.669	
3242.079		876.612		
3242.401			879.802	
3243.182		876.643		
3243.202	875.788			
3247.672				879.92
3266.861		876.521		
3269.584		876.578		
3270.066	875.598			
3270.066			879.06	
3281.061				879.735
3304.575		876.489		
3304.69			879.15	
3305.911	875.664			
3307.184		876.416		
3309.42				879.408
3329.722				879.703

3331.643		876.368		
3332.231			879.717	
3332.966		876.459		
3333.273	875.576			
3356.608				879.522
3357.862		876.326		
3358.154			879.165	
3358.646	875.816			
3359.433		876.439		
3401.07			878.443	
3406.927		876.321		
3407.277	875.724	876.411		879.285

Cross Section / Bank Profile Locations

Name	Type	Profile Station
Cross Section 9 - Pool (R1, Year 1)	Pool XS	1784
Cross Section 10 - Pool (R1, Year 1)	Pool XS	2237
Cross Section 11 - Pool (R1, Year 1)	Pool XS	2689
Cross Section 12 - Riffle (R1, Year 1)	Riffle XS	3058

Measurements from Graph

Bankfull Slope: 0

Variable	Min	Avg	Max
S riffle	0	0	0
S pool	0	0	0
S run	0	0	0
S glide	0	0	0
P - P	0	0	0
Pool length	0	0	0
Riffle length	0	0	0
Dmax riffle	0	0	0
Dmax pool	0	0	0
Dmax run	0	0	0
Dmax glide	0	0	0
Low bank ht	0	0	0

Length and depth measurements in feet, slopes in ft/ft.

RIVERMORPH PROFILE SUMMARY

Notes

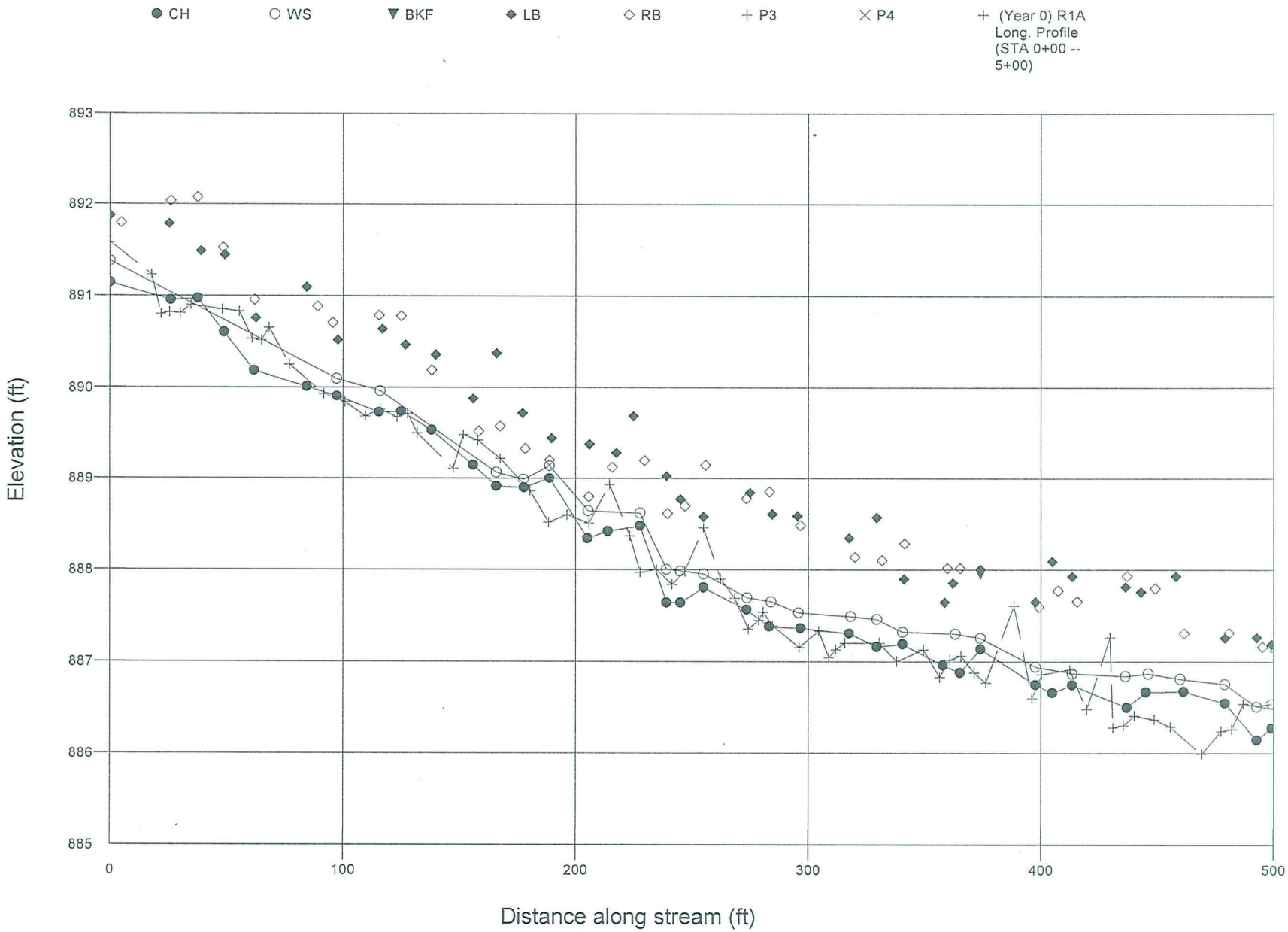
River Name: Little White Oak Creek (Year 1)
Reach Name: R1
Profile Name: (Year 1) R1 Long. Profile (STA 14+00 -- 33+74)
Survey Date: 12/31/2008

DIST	Note
1400	LEW
1401.17	REW
1416.793	LEW
1434.563	LEW
1439.29	REW
1459.888	LEW
1487.902	REW
1488.733	LEW

1516.787	LEW
1518.283	REW
1546.723	REW
1548.746	LEW
1576.288	LEW
1577.687	REW
1619.186	REW
1624.867	LEW
1643.007	LEW
1670.578	REW
1671.816	LEW
1689.592	LEW
1713.763	LEW
1714.727	REW
1727.095	LEW
1748.437	REW
1751.429	LEW
1784.368	XS9 - TW Intersect
1808.197	REW
1810.577	LEW
1834.019	LEW
1836.651	REW
1865.295	LEW
1867.49	REW
1891.28	REW
1891.966	LEW
1926.101	LEW
1952.603	LEW
1955.641	REW
1982.254	LEW
2004.712	REW
2010.319	LEW
2034.002	REW
2034.269	LEW
2059.991	LEW
2062.449	REW
2098.623	REW
2100.037	LEW
2128.404	LEW
2131.656	REW
2159.4	LEW
2182.999	REW
2190.953	LEW
2211.877	LEW
2237.897	XS10 - TW Intersect
2264.284	LEW
2267.14	REW
2288.22	LEW
2291.556	REW
2311.024	LEW
2331.429	REW
2333.041	LEW
2341.598	LEW
2357.902	REW
2360.068	LEW
2376.888	LEW
2380.234	REW
2397.651	REW
2401.476	LEW
2406.889	LEW
2418.142	REW
2423.205	LEW
2452.902	LEW
2455.481	REW

2478.583 REW
2481.539 LEW
2519.501 LEW
2520.448 REW
2555.502 LEW
2588.189 LEW
2589.841 REW
2619.741 REW
2620.234 LEW
2649.831 LEW
2651.133 REW
2671.116 LEW
2689.438 XS11 - TW Intersect
2712.641 LEW
2716.771 REW
2738.244 LEW
2764.098 LEW
2766.282 REW
2789.975 LEW
2793.343 REW
2807.127 LEW
2834.916 REW
2839.254 LEW
2861.716 LEW
2890.859 REW
2891.993 LEW
2922.632 REW
2924.706 LEW
2953.918 REW
2956.493 LEW
2993.745 LEW
2996.974 REW
3020.321 LEW
3022.415 REW
3041.593 REW
3043.299 LEW
3058.831 XS12 - TW Intersect
3107.345 REW
3131.305 LEW
3134.873 REW
3174.463 LEW
3178.362 REW
3222.507 REW
3224.621 LEW
3242.079 REW
3243.182 LEW
3266.861 REW
3269.584 LEW
3304.575 LEW
3307.184 REW
3331.643 REW
3332.966 LEW
3357.862 REW
3359.433 LEW
3406.927 LEW
3407.277 REW

(Year 1) R1A Long. Profile (STA 0+00 -- 5+00)



RIVERMORPH PROFILE SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R1A
Profile Name: (Year 1) R1A Long. Profile (STA 0+00 -- 5+00)1
Survey Date: 12/31/2008

Survey Data

DIST	CH	WS	BKF	LB	RB	P3	P4
0	891.14						
0		891.379					
0				891.872			
4.838					891.794		
25.316				891.781			
26.084	890.953						
26.084					892.033		
37.61					892.072		
37.61	890.969						
38.98				891.485			
48.441					891.522		
48.86	890.598						
49.107				891.442			
61.815	890.183						
61.994					890.955		
62.456				890.754			
84.29	890.01						
84.29				891.092			
89.073					890.883		
95.595					890.702		
97.22		890.096					
97.339	889.904						
97.751				890.513			
115.474	889.726						
115.474					890.785		
115.97		889.961					
116.886				890.633			
124.946					890.778		
124.946	889.733						
126.721				890.463			
138.059	889.529						
138.059					890.19		
139.79				890.355			
155.924	889.145						
155.924				889.876			
158.324					889.519		
165.933	888.91						
165.933		889.067					
165.933				890.369			
167.475					889.572		
177.14				889.713			
177.636		888.988					
177.799	888.897						
178.331					889.33		
188.768					889.201		
188.768	888.999	889.139					
189.748				889.441			
205.147	888.344						

205.416		888.644		
205.654				888.796
206.016			889.376	
213.907	888.421			
215.805				889.125
217.54			889.28	
224.92			889.682	
227.768	888.48	888.62		
229.605				889.199
239.09	887.644			
239.09			889.023	
239.09		888.001		
239.483				888.616
244.978		887.985		
245.021	887.643			
245.021			888.768	
246.998				888.697
254.91		887.952		
254.91			888.579	
254.91	887.804			
255.818				889.149
273.434	887.566			
273.434				888.777
273.715		887.696		
275.031			888.84	
283.194	887.378			
283.334				888.852
284.036		887.653		
284.575			888.607	
295.301			888.588	
295.848		887.533		
296.667	887.361			
296.667				888.485
317.606			888.347	
317.606	887.303			
318.234		887.491		
320.045				888.138
329.538			888.57	
329.538		887.46		
329.538	887.16			
331.726				888.102
340.503	887.188			
340.546		887.319		
341.068			887.897	
341.437				888.287
357.909	886.959			
358.574			887.646	
359.696				888.017
362.204			887.853	
363.244		887.299		
365.175				888.016
365.175	886.879			
373.964	887.134	887.253	887.949	888.002
397.683		886.942		
397.683			887.65	
397.683	886.748			
399.13				887.596
404.935			888.088	
404.935	886.661			
407.392				887.773
413.469	886.746			
413.469			887.926	
413.469		886.869		
415.552				887.656

436.349		887.813	
436.364	886.841		
436.913	886.499		
436.991			887.931
443.049		887.757	
445.183	886.668		
446.119	886.868		
449.122			887.798
457.99		887.928	
459.867	886.813		
461.276	886.676		
461.629			887.305
479.115	886.546		
479.115		887.252	
479.115	886.756		
480.771			887.308
492.769	886.144		
492.769		887.257	
492.769	886.509		
495.237			887.161
499.196		887.185	
499.196			887.16
499.196	886.54		
499.196	886.275		

Cross Section / Bank Profile Locations

Name	Type	Profile Station
Cross Section 13 - Riffle (R1A, Year 1)	Riffle XS	373

Measurements from Graph

Bankfull Slope: 0

Variable	Min	Avg	Max
S riffle	0	0	0
S pool	0	0	0
S run	0	0	0
S glide	0	0	0
P - P	0	0	0
Pool length	0	0	0
Riffle length	0	0	0
Dmax riffle	0	0	0
Dmax pool	0	0	0
Dmax run	0	0	0
Dmax glide	0	0	0
Low bank ht	0	0	0

Length and depth measurements in feet, slopes in ft/ft.

RIVERMORPH PROFILE SUMMARY

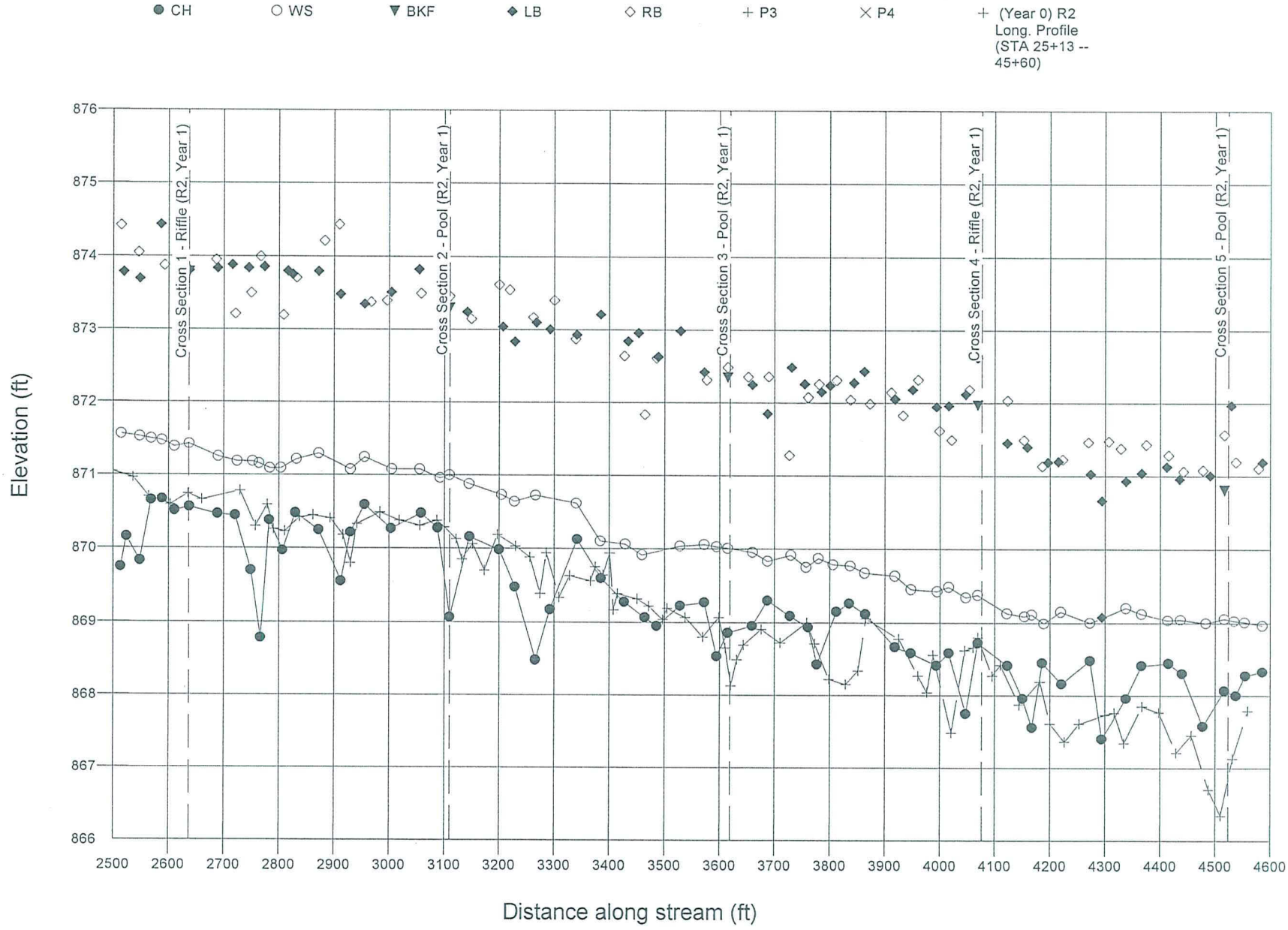
Notes

River Name: Little White Oak Creek (Year 1)
Reach Name: R1A
Profile Name: (Year 1) R1A Long. Profile (STA 0+00 -- 5+00)1
Survey Date: 12/31/2008

DIST	Note

0	LEW
97.22	LEW
115.97	LEW
165.933	LEW
177.636	LEW
205.416	LEW
239.09	LEW
244.978	LEW
254.91	LEW
273.715	LEW
284.036	LEW
295.848	LEW
318.234	LEW
329.538	LEW
340.546	LEW
363.244	LEW
373.964	XS13 - TW Intersect @ station 373.964
397.683	LEW
413.469	LEW
436.364	LEW
446.119	LEW
459.867	LEW
479.115	LEW
492.769	LEW
499.196	LEW

(Year 1) R2 Long. Profile (STA 25+13 -- 45+60)



RIVERMORPH PROFILE SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R2
Profile Name: (Year 1) R2 Long. Profile (STA 25+13 -- 45+60)
Survey Date: 12/31/2008

Survey Data

DIST	CH	WS	BKF	LB	RB	P3	P4
2513	869.741						
2513.849					874.418		
2514.284		871.557					
2518.555				873.781			
2523.697	870.154						
2545.662					874.048		
2548.026				873.69			
2548.026		871.521					
2548.026	869.824						
2568.445	870.65						
2568.445		871.491					
2586.049				874.43			
2587.96		871.468					
2588.323	870.665						
2592.202					873.873		
2610.537	870.51						
2610.537		871.383					
2637.424	870.558	871.42	873.786	873.803			
2685.713					873.949		
2688.734	870.462						
2688.734				873.833			
2689.814		871.248					
2715.311				873.878			
2720.561	870.445						
2720.875					873.215		
2724.349		871.181					
2744.866				873.836			
2748.829	869.696						
2749.493					873.504		
2752.306		871.18					
2764.119		871.155					
2766.473	868.779						
2766.473					873.994		
2773.694				873.852			
2782.605	870.379						
2783.639		871.089					
2803.733		871.09					
2806.415	869.964						
2808.145					873.196		
2816.072				873.797			
2824.932				873.753			
2829.838	870.478						
2831.791					873.706		
2831.844		871.211					
2871.889	870.246						
2871.889				873.793			
2872.455		871.293					
2882.558					874.213		

2909.129					874.433
2911.839				873.483	
2912.202	869.551				
2929.616	870.214				
2930.093		871.073			
2955.318	870.589				
2955.318				873.349	
2955.401		871.241			
2967.13					873.379
2995.814					873.401
3003.571	870.267				
3003.976				873.513	
3004.908		871.079			
3053.903				873.822	
3055.617		871.077			
3057.756	870.477				
3057.756					873.498
3088.215	870.276				
3088.215					873.135
3092.693		870.958			
3101.037				873.489	
3110.016	869.067	870.998	873.303		873.458
3141.232				873.243	
3145.092		870.878			
3145.913	870.159				
3149.068					873.147
3199.709	869.98				
3199.737					873.618
3204.248		870.73			
3206.51				873.038	
3218.594					873.549
3227.71		870.637			
3228.086				872.833	
3228.086	869.474				
3261.793					873.171
3265.347	868.481				
3266.262		870.725			
3267.499				873.097	
3291.994				873.004	
3291.994	869.173				
3300.001					873.407
3338.602					872.872
3340.272		870.614			
3340.852				872.93	
3341.601	870.125				
3383.74		870.103			
3384.116				873.21	
3384.726	869.594				
3426.832	869.276				
3426.832					872.639
3428.963		870.061			
3433.888				872.842	
3452.787				872.955	
3459.426		869.914			
3464.621					871.833
3464.621	869.069				
3485.677	868.95				
3485.677					872.607
3488.704				872.627	
3528.102		870.034			
3528.324	869.229				
3529.176				872.984	
3572.293	869.274				
3572.293		870.059			

3572.293				872.419	
3576.748					872.309
3594.75	868.533				
3594.75		870.028			
3614.704	868.856	870.006	872.346		872.486
3651.82					872.354
3659.121	868.954				
3659.531				872.244	
3660.078		869.953			
3687.058		869.83			
3687.058				871.845	
3687.058	869.302				
3688.891					872.356
3726.846					871.276
3727.983	869.093				
3729.485		869.914			
3730.534				872.485	
3754.555				872.257	
3757.015		869.749			
3760.788	868.935				
3760.896					872.075
3776.667	868.426				
3779.441		869.872			
3780.434					872.259
3784.861				872.148	
3800.827				872.236	
3806.004		869.786			
3812.2	869.15				
3812.492					872.309
3835.424	869.263				
3837.525		869.772			
3837.805					872.043
3843.893				872.274	
3862.689				872.433	
3863.221		869.674			
3864.912	869.119				
3872.856					871.986
3911.713					872.143
3918.364		869.635			
3918.422	868.666				
3918.422				872.051	
3932.844					871.823
3947.068	868.582				
3947.641		869.454			
3950.453				872.179	
3960.232					872.317
3994.006				871.944	
3994.008	868.414				
3995.294		869.427			
3999.273					871.617
4015.932				871.96	
4015.932		869.487			
4015.932	868.582				
4021.377					871.489
4046.851	867.747				
4046.882				872.117	
4047.067		869.348			
4053.5					872.18
4068.858	868.721	869.381	871.966	872.621	
4121.678		869.133			
4122.145				871.447	
4123.004	868.413				
4123.004					872.033
4150.446	867.957				

4152.595				871.489
4153.609		869.093		
4158.572			871.39	
4166.893		869.115		
4167.247	867.557			
4185.909				871.132
4185.909	868.451			
4189.007		868.993		
4196.36			871.184	
4215.33			871.196	
4219.709		869.157		
4221.019	868.162			
4222.878				871.226
4269.601				871.459
4272.641	868.483			
4272.684		869.003		
4273.657			871.025	
4294.374			870.66	
4294.374	867.396			
4294.529			869.08	
4306.565				871.473
4328.568				871.376
4337.8			870.925	
4337.8	867.958			
4337.8		869.208		
4366.229			871.037	
4366.28		869.128		
4366.383	868.415			
4374.701				871.427
4411.983			871.124	
4413.963		869.038		
4415.301	868.446			
4415.301				871.283
4435.033			870.955	
4437.165		869.047		
4439.741	868.305			
4442.199				871.063
4477.775	867.574			
4477.775				871.081
4483.025		869		
4490.888			871.002	
4516.567	868.068	869.061 870.806		871.564
4529.045			871.965	
4534.383		869.032		
4537.585	867.999			
4537.585				871.192
4553.263		869.014		
4554.473	868.277			
4578.852				871.104
4585.663	868.328	868.968	871.183	

Cross Section / Bank Profile Locations

Name	Type	Profile Station
Cross Section 2 - Pool (R2, Year 1)	Pool XS	3110
Cross Section 3 - Pool (R2, Year 1)	Pool XS	3619
Cross Section 4 - Riffle (R2, Year 1)	Riffle XS	4076
Cross Section 5 - Pool (R2, Year 1)	Pool XS	4524
Cross Section 1 - Riffle (R2, Year 1)	Riffle XS	2637

Measurements from Graph

Bankfull Slope: 0

Variable	Min	Avg	Max
S riffle	0	0	0
S pool	0	0	0
S run	0	0	0
S glide	0	0	0
P - P	0	0	0
Pool length	0	0	0
Riffle length	0	0	0
Dmax riffle	0	0	0
Dmax pool	0	0	0
Dmax run	0	0	0
Dmax glide	0	0	0
Low bank ht	0	0	0

Length and depth measurements in feet, slopes in ft/ft.

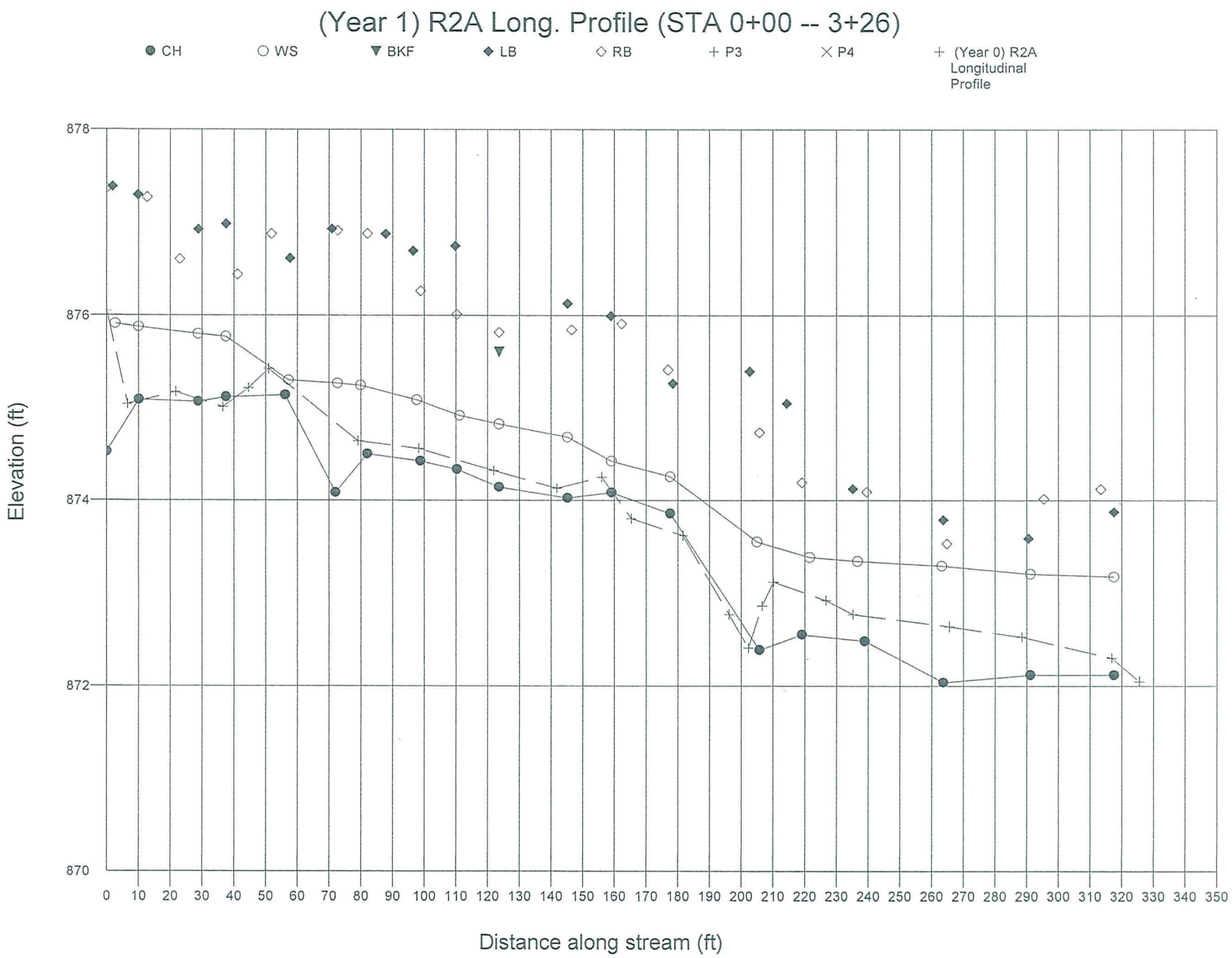
RIVERMORPH PROFILE SUMMARY

Notes

River Name: Little White Oak Creek (Year 1)
Reach Name: R2
Profile Name: (Year 1) R2 Long. Profile (STA 25+13 -- 45+60)
Survey Date: 12/31/2008

DIST	Note
2514.284	LEW
2548.026	LEW
2568.445	LEW
2587.96	LEW
2610.537	LEW
2637.424	XS1 - TW Intersect
2689.814	LEW
2724.349	LEW
2752.306	LEW
2764.119	LEW
2783.639	LEW
2803.733	LEW
2831.844	LEW
2872.455	LEW
2930.093	LEW
2955.401	LEW
3004.908	LEW
3055.617	LEW
3092.693	LEW
3110.016	XS2 - TW Intersect
3145.092	LEW
3204.248	LEW
3227.71	LEW
3266.262	LEW
3340.272	LEW
3383.74	LEW
3428.963	LEW
3459.426	LEW
3528.102	LEW
3572.293	LEW
3594.75	LEW
3614.704	XS3 - TW Intersect
3660.078	LEW

3687.058	LEW
3729.485	LEW
3757.015	LEW
3779.441	LEW
3806.004	LEW
3837.525	LEW
3863.221	LEW
3918.364	LEW
3947.641	LEW
3995.294	LEW
4015.932	LEW
4047.067	LEW
4068.858	XS4 - TW Intersect
4121.678	LEW
4153.609	LEW
4166.893	LEW
4189.007	LEW
4219.709	LEW
4272.684	LEW
4337.8	LEW
4366.28	LEW
4413.963	LEW
4437.165	LEW
4483.025	LEW
4516.567	XS5 - TW Intersect
4534.383	LEW
4553.263	LEW
4585.663	LEW


(Year 1) R2A Long. Profile (STA 0+00 -- 3+26)
CH
WS
BKF
LB
RB
P3
P4
(Year 0) R2A Longitudinal Profile
Elevation (ft)
878
876
874
872
870
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350
Distance along stream (ft)

RIVERMORPH PROFILE SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R2A
Profile Name: (Year 1) R2A Long. Profile (STA 0+00 -- 3+26)
Survey Date: 12/31/2008

Survey Data

DIST	CH	WS	BKF	LB	RB	P3	P4
0	874.525						
0					877.364		
1.811				877.38			
2.689		875.913					
9.785				877.29			
10.058		875.874					
10.116	875.087						
12.689					877.266		
22.995					876.605		
28.783				876.921			
28.783	875.065						
28.783		875.798					
37.494				876.978			
37.494		875.768					
37.494	875.116						
41.118					876.439		
51.829					876.875		
56.163	875.136						
57.207		875.297					
57.656				876.614			
70.82				876.928			
72.016	874.083						
72.666		875.262					
72.719					876.912		
79.938		875.24					
82.116	874.5						
82.116					876.878		
87.787				876.87			
96.498				876.692			
97.679		875.085					
98.856	874.423						
98.856					876.265		
109.795				876.744			
110.246					876.009		
110.38	874.332						
111.166		874.917					
123.656	874.142	874.825	875.602		875.815		
145.213	874.024						
145.213		874.681					
145.213				876.127			
146.502					875.843		
158.888				875.995			
159.075	874.082						
159.075		874.423					
162.296					875.908		
176.963					875.411		
177.619	873.857						
177.619		874.254					

178.461			875.26	
202.635			875.392	
204.948		873.551		
205.698				874.734
205.698	872.389			
214.389			875.048	
219.181				874.191
219.181	872.556			
221.582		873.387		
235.218			874.124	
236.704		873.344		
238.954	872.484			
239.55				874.089
263.265		873.297		
263.687	872.037			
263.687			873.787	
264.824				873.534
290.606			873.587	
291.201		873.207		
291.201	872.12			
295.406				874.014
313.387				874.118
317.52	872.117	873.176	873.871	

Cross Section / Bank Profile Locations

Name	Type	Profile Station
Cross Section 6 - Riffle (R2A, Year 1)	Riffle XS	123

Measurements from Graph

Bankfull Slope: 0

Variable	Min	Avg	Max
S riffle	0	0	0
S pool	0	0	0
S run	0	0	0
S glide	0	0	0
P - P	0	0	0
Pool length	0	0	0
Riffle length	0	0	0
Dmax riffle	0	0	0
Dmax pool	0	0	0
Dmax run	0	0	0
Dmax glide	0	0	0
Low bank ht	0	0	0

Length and depth measurements in feet, slopes in ft/ft.

RIVERMORPH PROFILE SUMMARY

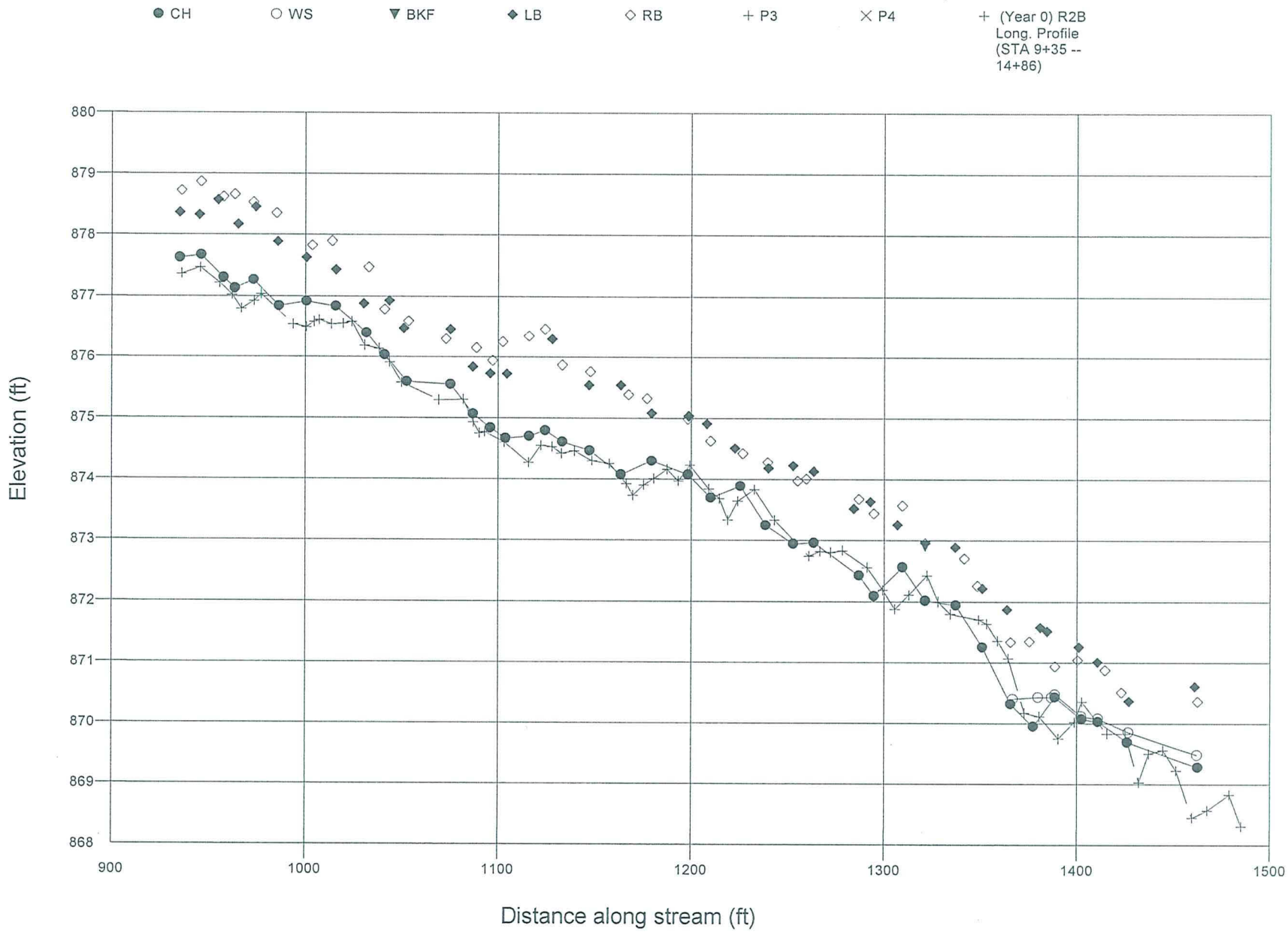
Notes

River Name: Little White Oak Creek (Year 1)
Reach Name: R2A
Profile Name: (Year 1) R2A Long. Profile (STA 0+00 -- 3+26)
Survey Date: 12/31/2008

DIST	Note

```
2.689       LEW
10.058      LEW
28.783      LEW
37.494      LEW
57.207      LEW
72.666      LEW
79.938      LEW
97.679      LEW
111.166     LEW
123.656     XS6 - TW Intersect @ station 123.656
145.213     LEW
159.075     LEW
177.619     LEW
204.948     LEW
221.582     LEW
236.704     LEW
263.265     LEW
291.201     LEW
317.52      LEW
```

(Year 1) R2B Long. Profile (STA 9+35 -- 14+86)



RIVERMORPH PROFILE SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R2B
Profile Name: (Year 1) R2B Long. Profile (STA 9+35 -- 14+86)
Survey Date: 12/31/2008

Survey Data

DIST	CH	WS	BKF	LB	RB	P3	P4
935	877.62						
935				878.365			
935.913					878.724		
945.086				878.326			
946.014	877.663						
946.014					878.867		
954.842				878.567			
957.596	877.297						
957.596					878.618		
963.394	877.124						
963.4					878.656		
965.197				878.17			
973.138	877.262						
973.138					878.529		
974.319				878.456			
985.058					878.355		
985.663				877.884			
986.278	876.835						
1000.531				877.622			
1000.555	876.908						
1003.52					877.825		
1013.865					877.895		
1015.654	876.829						
1015.799				877.423			
1030.21				876.87			
1031.601	876.382						
1032.766					877.467		
1040.98					876.777		
1040.98	876.029						
1043.457				876.921			
1051.006				876.461			
1052.54	875.594						
1053.478					876.582		
1072.95					876.291		
1075.166	875.55						
1075.166				876.445			
1086.834				875.834			
1086.834	875.061						
1088.681					876.148		
1095.843	874.839						
1095.843				875.727			
1097.049					875.94		
1102.359					876.245		
1103.764	874.668						
1104.546				875.723			
1115.92					876.338		
1115.983	874.703						
1124.348					876.451		

1124.348	874.796			
1127.954			876.288	
1133.145	874.611			
1133.145				875.867
1147.068			875.535	
1147.371	874.467			
1147.709				875.76
1163.62	874.072			
1163.62			875.535	
1167.645				875.383
1177.155				875.317
1179.601			875.073	
1179.601	874.298			
1198.363				874.983
1198.363	874.073			
1198.713			875.033	
1208.158			874.905	
1210.165	873.692			
1210.165				874.628
1222.636			874.507	
1225.546	873.887			
1226.866				874.424
1238.671	873.244			
1239.675				874.279
1240.112			874.181	
1252.826			874.218	
1252.826	872.939			
1255.217				873.974
1259.72				874.006
1263.485			874.126	
1263.485	872.958			
1284.295			873.516	
1286.902				873.676
1286.902	872.429			
1292.895			873.629	
1294.705	872.096			
1294.705				873.438
1306.975			873.251	
1309.432	872.563			
1309.432				873.567
1321.238	872.019	872.908		872.951
1336.896			872.884	
1337.11	871.944			
1341.606				872.703
1348.361				872.258
1350.922	871.254			
1350.922			872.216	
1363.852			871.872	
1365.618	870.311			
1365.618				871.339
1366.807		870.397		
1375.393				871.348
1377.408	869.946			
1379.89		870.426		
1381.049			871.58	
1384.547			871.514	
1386.931		870.423		
1388.679	870.427			
1388.679				870.939
1388.679		870.473		
1400.433				871.042
1400.997			871.254	
1402.302		870.113		
1402.452	870.069			

1410.638			871.006	
1410.973	870.027			
1410.973		870.077		
1414.571				870.876
1423.108				870.505
1426.176	869.691			
1426.698		869.855		
1426.97			870.356	
1461.105			870.604	
1462.326		869.483		
1462.603	869.279			870.354

Cross Section / Bank Profile Locations

Name	Type	Profile Station
Cross Section 7 - Riffle (R2B, Year 1)	Riffle XS	0

Measurements from Graph

Bankfull Slope: 0

Variable	Min	Avg	Max
S riffle	0	0	0
S pool	0	0	0
S run	0	0	0
S glide	0	0	0
P - P	0	0	0
Pool length	0	0	0
Riffle length	0	0	0
Dmax riffle	0	0	0
Dmax pool	0	0	0
Dmax run	0	0	0
Dmax glide	0	0	0
Low bank ht	0	0	0

Length and depth measurements in feet, slopes in ft/ft.

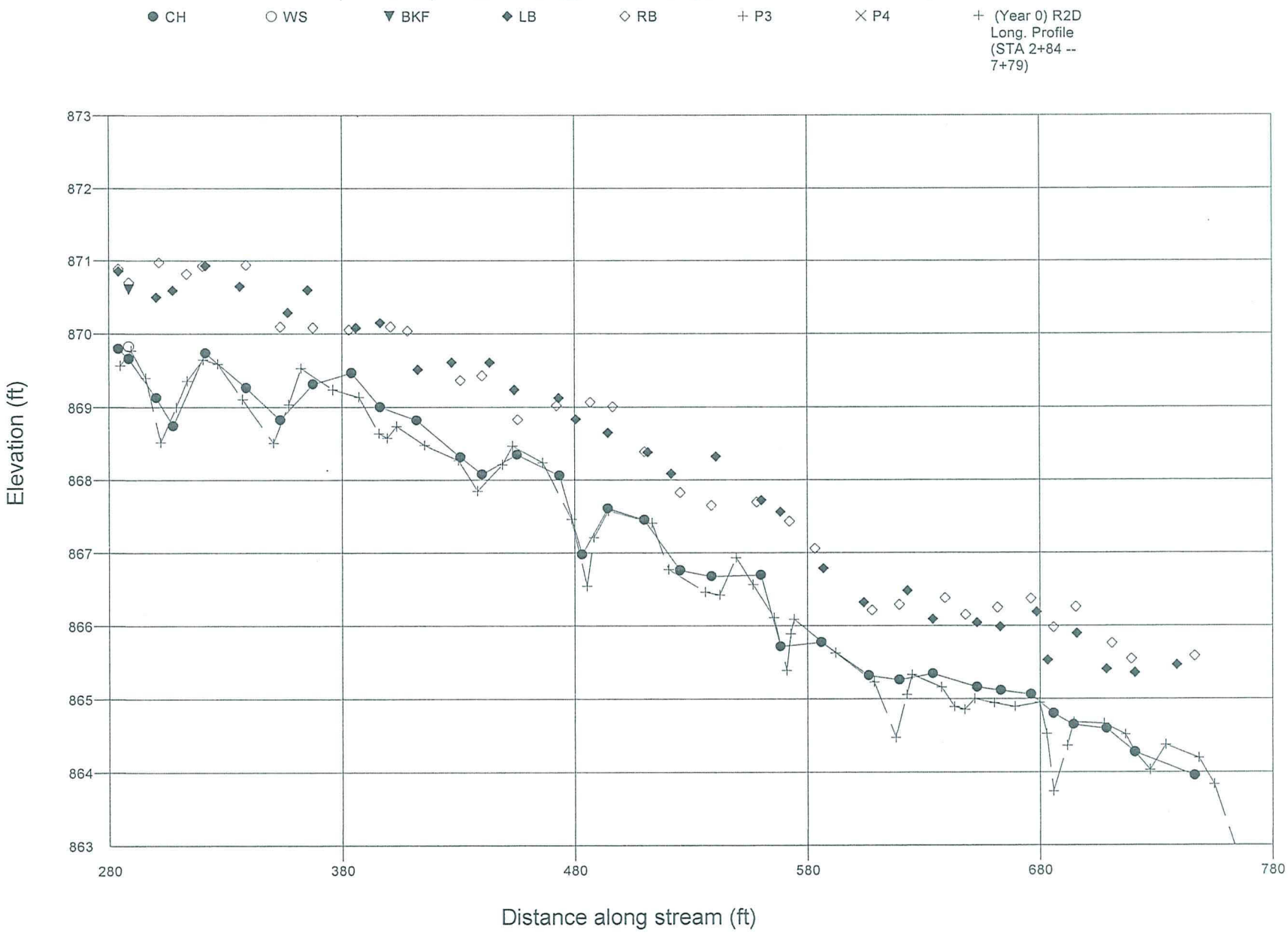
RIVERMORPH PROFILE SUMMARY

Notes

River Name: Little White Oak Creek (Year 1)
Reach Name: R2B
Profile Name: (Year 1) R2B Long. Profile (STA 9+35 -- 14+86)
Survey Date: 12/31/2008

DIST	Note
1321.238	XS7 - TW Intersect
1366.807	LEW
1379.89	LEW
1386.931	LEW
1388.679	LEW
1402.302	LEW
1410.973	LEW
1426.698	LEW
1462.326	LEW

(Year 1) R2D Long. Profile (STA 2+84 --7+79)



RIVERMORPH PROFILE SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R2D
Profile Name: (Year 1) R2D Long. Profile (STA 2+84 --7+79)
Survey Date: 12/31/2008

Survey Data

DIST	CH	WS	BKF	LB	RB	P3	P4
284	869.799						
284				870.856			
284					870.886		
288.453	869.66	869.83	870.603		870.698		
300.231	869.131						
300.231				870.492			
301.491					870.974		
307.295				870.586			
307.49	868.745						
313.289					870.814		
320.13					870.922		
321.334	869.738						
321.334				870.928			
336.079				870.64			
338.804					870.939		
338.804	869.267						
353.457	868.828						
353.457					870.094		
356.651				870.283			
365.201				870.591			
367.492	869.314						
367.492					870.083		
382.987					870.052		
384.043	869.467						
385.948				870.079			
396.423	869.005						
396.423				870.147			
400.905					870.094		
408.189					870.038		
412.129	868.82						
412.633				869.513			
427.154				869.608			
430.894	868.314						
430.894					869.368		
440.226	868.076						
440.226					869.43		
443.545				869.605			
454.098				869.237			
455.264	868.348						
455.607					868.833		
472.269					869.022		
473.16				869.126			
473.488	868.06						
480.597				868.834			
483.18	866.976						
486.727					869.069		
494.317	867.608						
494.317				868.651			

496.421			869.009
510.023	867.452		
510.126			868.389
511.494		868.382	
521.519		868.085	
525.384	866.755		
525.384			867.826
538.798	866.674		
538.798			867.65
540.771		868.32	
558.311			867.696
559.985	866.691		
560.295		867.718	
568.452		867.56	
568.452	865.716		
572.372			867.432
583.284			867.06
585.995	865.774		
586.849		866.781	
604.225		866.317	
606.366	865.32		
607.741			866.212
619.492	865.259		
619.492			866.287
622.991		866.477	
633.904	865.346		
633.904		866.091	
639.151			866.379
647.999			866.15
652.843		866.039	
652.843	865.16		
661.793			866.248
662.914		865.985	
663.104	865.114		
676.118			866.371
676.118	865.061		
678.559		866.185	
683.265		865.529	
685.837			865.977
685.837	864.794		
694.384	864.645		
695.36			866.257
695.861		865.893	
708.52	864.589		
708.52		865.404	
710.939			865.76
719.257			865.547
720.816		865.356	
720.816	864.268		
738.832		865.464	
746.465			865.589
746.465	863.948		

Cross Section / Bank Profile Locations

Name	Type	Profile Station
Cross Section 8 - Riffle (R2D, Year 1)	Riffle XS	288

Measurements from Graph

Bankfull Slope: 0

Variable	Min	Avg	Max
S riffle	0	0	0
S pool	0	0	0
S run	0	0	0
S glide	0	0	0
P - P	0	0	0
Pool length	0	0	0
Riffle length	0	0	0
Dmax riffle	0	0	0
Dmax pool	0	0	0
Dmax run	0	0	0
Dmax glide	0	0	0
Low bank ht	0	0	0

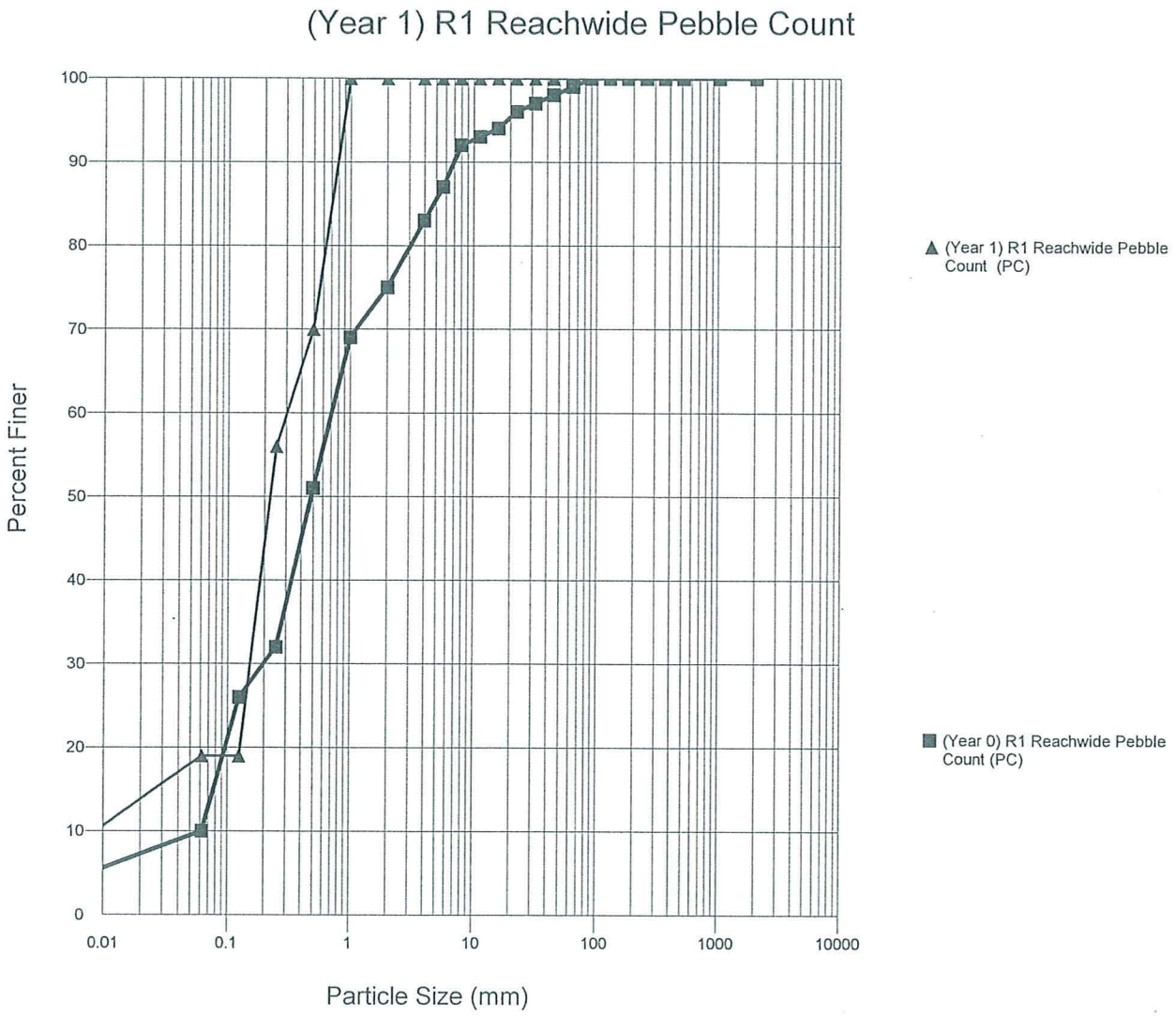
Length and depth measurements in feet, slopes in ft/ft.

RIVERMORPH PROFILE SUMMARY

Notes

River Name: Little White Oak Creek (Year 1)
Reach Name: R2D
Profile Name: (Year 1) R2D Long. Profile (STA 2+84 --7+79)
Survey Date: 12/31/2008

DIST	Note
288.453	XS8 - TW Intersect


(Year 1) R1 Reachwide Pebble Count
Percent Finer
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)
(Year 1) R1 Reachwide Pebble Count (PC)
(Year 0) R1 Reachwide Pebble Count (PC)

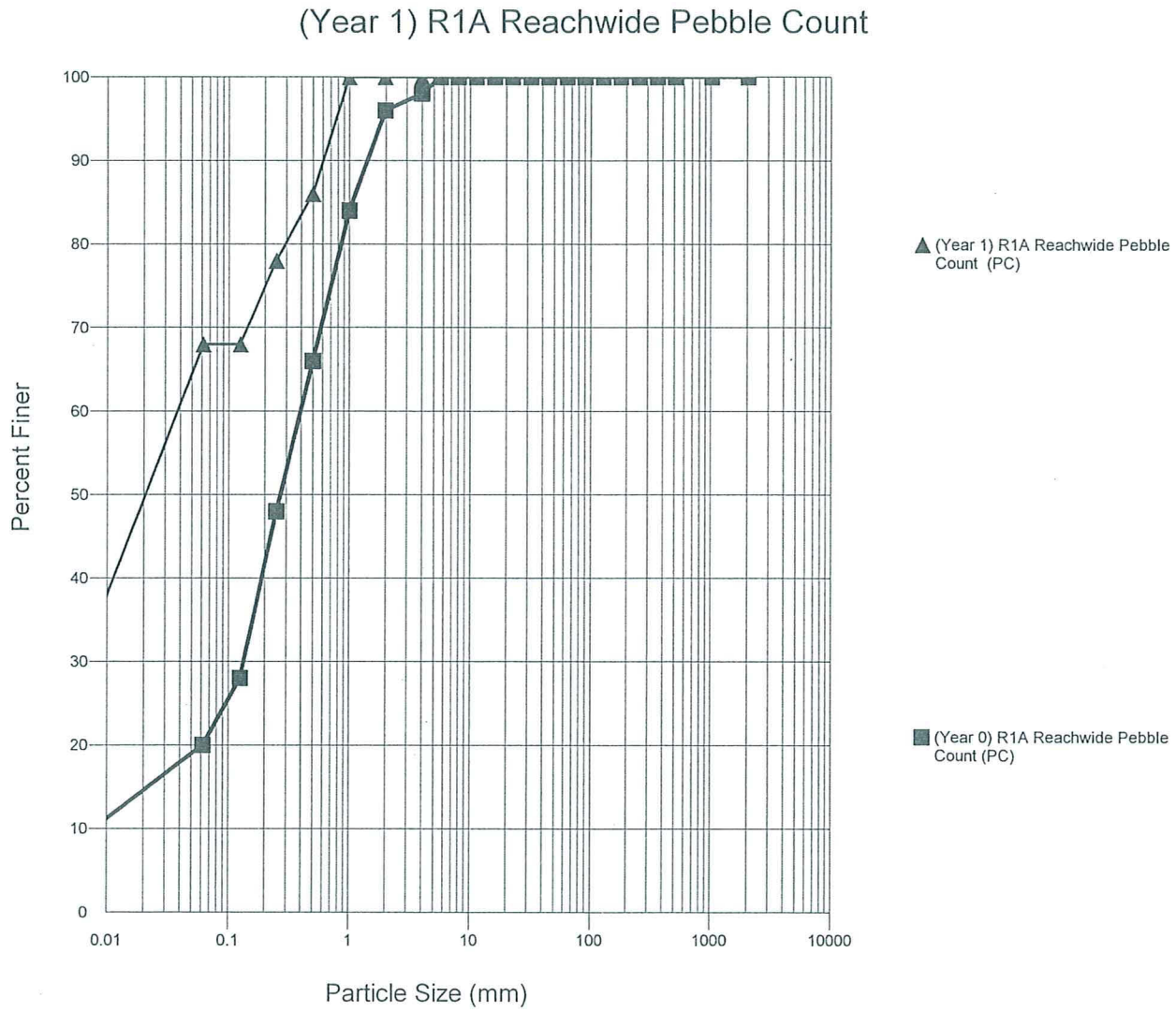
RIVERMORPH PARTICLE SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R1
Sample Name: Reachwide Pebble Count (R1)
Survey Date: 09/25/2008

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	19	19.00	19.00
0.062 - 0.125	0	0.00	19.00
0.125 - 0.25	37	37.00	56.00
0.25 - 0.50	14	14.00	70.00
0.50 - 1.0	30	30.00	100.00
1.0 - 2.0	0	0.00	100.00
2.0 - 4.0	0	0.00	100.00
4.0 - 5.7	0	0.00	100.00
5.7 - 8.0	0	0.00	100.00
8.0 - 11.3	0	0.00	100.00
11.3 - 16.0	0	0.00	100.00
16.0 - 22.6	0	0.00	100.00
22.6 - 32.0	0	0.00	100.00
32 - 45	0	0.00	100.00
45 - 64	0	0.00	100.00
64 - 90	0	0.00	100.00
90 - 128	0	0.00	100.00
128 - 180	0	0.00	100.00
180 - 256	0	0.00	100.00
256 - 362	0	0.00	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	0.05
D35 (mm)	0.18
D50 (mm)	0.23
D84 (mm)	0.73
D95 (mm)	0.92
D100 (mm)	1
Silt/Clay (%)	19
Sand (%)	81
Gravel (%)	0
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Particles = 100.


(Year 1) R1A Reachwide Pebble Count
Percent Finer
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)
(Year 1) R1A Reachwide Pebble Count (PC)
(Year 0) R1A Reachwide Pebble Count (PC)

RIVERMORPH PARTICLE SUMMARY

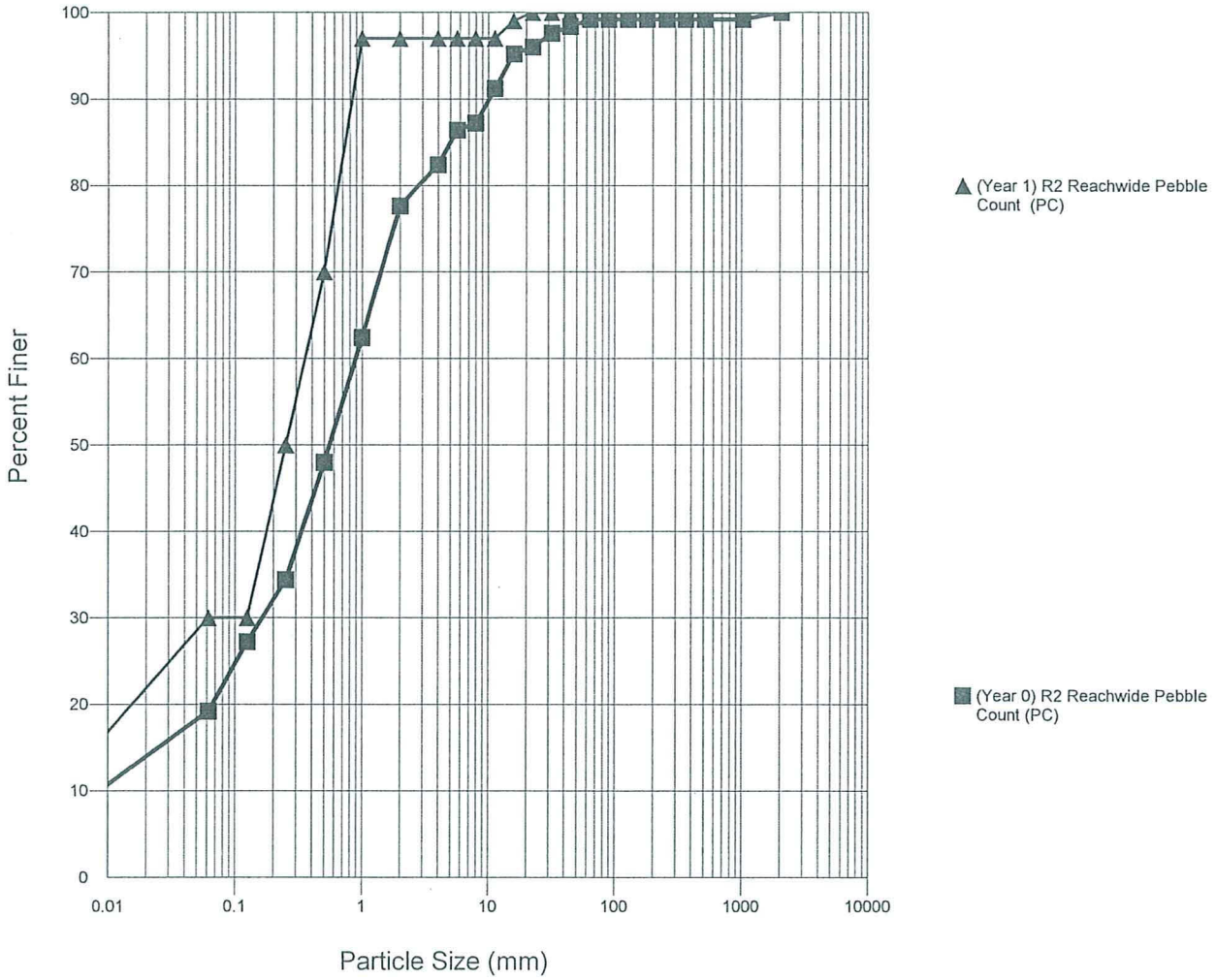
River Name: Little White Oak Creek (Year 1)
Reach Name: R1A
Sample Name: Reachwide Pebble Count (R1A)
Survey Date: 09/25/2008

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	34	68.00	68.00
0.062 - 0.125	0	0.00	68.00
0.125 - 0.25	5	10.00	78.00
0.25 - 0.50	4	8.00	86.00
0.50 - 1.0	7	14.00	100.00
1.0 - 2.0	0	0.00	100.00
2.0 - 4.0	0	0.00	100.00
4.0 - 5.7	0	0.00	100.00
5.7 - 8.0	0	0.00	100.00
8.0 - 11.3	0	0.00	100.00
11.3 - 16.0	0	0.00	100.00
16.0 - 22.6	0	0.00	100.00
22.6 - 32.0	0	0.00	100.00
32 - 45	0	0.00	100.00
45 - 64	0	0.00	100.00
64 - 90	0	0.00	100.00
90 - 128	0	0.00	100.00
128 - 180	0	0.00	100.00
180 - 256	0	0.00	100.00
256 - 362	0	0.00	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	0.02
D35 (mm)	0.03
D50 (mm)	0.05
D84 (mm)	0.44
D95 (mm)	0.82
D100 (mm)	1
Silt/Clay (%)	68
Sand (%)	32
Gravel (%)	0
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Particles = 50 (need at least 60).

(Year 1) R2 Reachwide Pebble Count



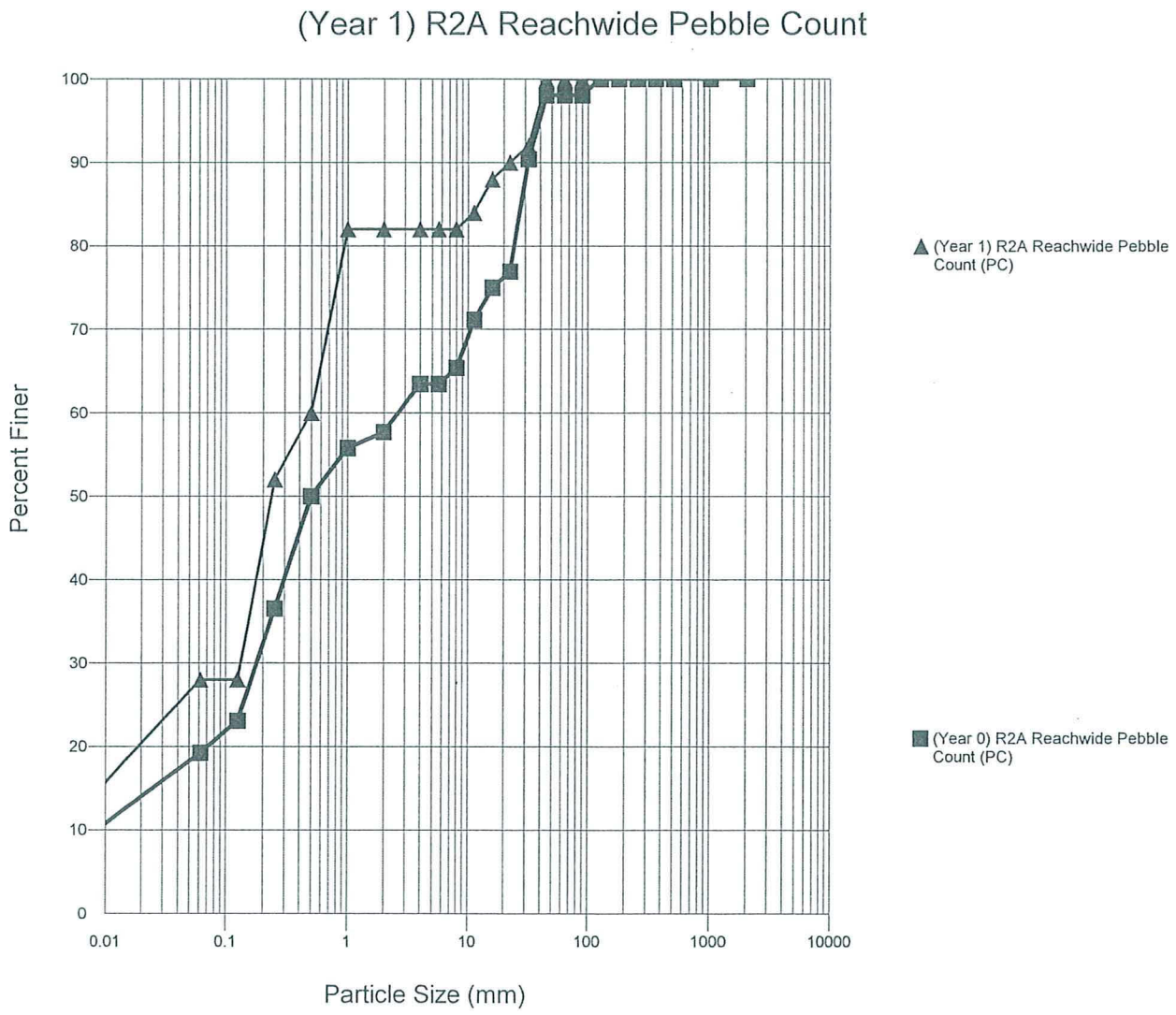
RIVERMORPH PARTICLE SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R2
Sample Name: Reachwide Pebble Count (R2)
Survey Date: 09/25/2008

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	30	30.00	30.00
0.062 - 0.125	0	0.00	30.00
0.125 - 0.25	20	20.00	50.00
0.25 - 0.50	20	20.00	70.00
0.50 - 1.0	27	27.00	97.00
1.0 - 2.0	0	0.00	97.00
2.0 - 4.0	0	0.00	97.00
4.0 - 5.7	0	0.00	97.00
5.7 - 8.0	0	0.00	97.00
8.0 - 11.3	0	0.00	97.00
11.3 - 16.0	2	2.00	99.00
16.0 - 22.6	1	1.00	100.00
22.6 - 32.0	0	0.00	100.00
32 - 45	0	0.00	100.00
45 - 64	0	0.00	100.00
64 - 90	0	0.00	100.00
90 - 128	0	0.00	100.00
128 - 180	0	0.00	100.00
180 - 256	0	0.00	100.00
256 - 362	0	0.00	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	0.03
D35 (mm)	0.16
D50 (mm)	0.25
D84 (mm)	0.76
D95 (mm)	0.96
D100 (mm)	22.6
Silt/Clay (%)	30
Sand (%)	67
Gravel (%)	3
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Particles = 100.


(Year 1) R2A Reachwide Pebble Count
Percent Finer
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)
(Year 1) R2A Reachwide Pebble Count (PC)
(Year 0) R2A Reachwide Pebble Count (PC)

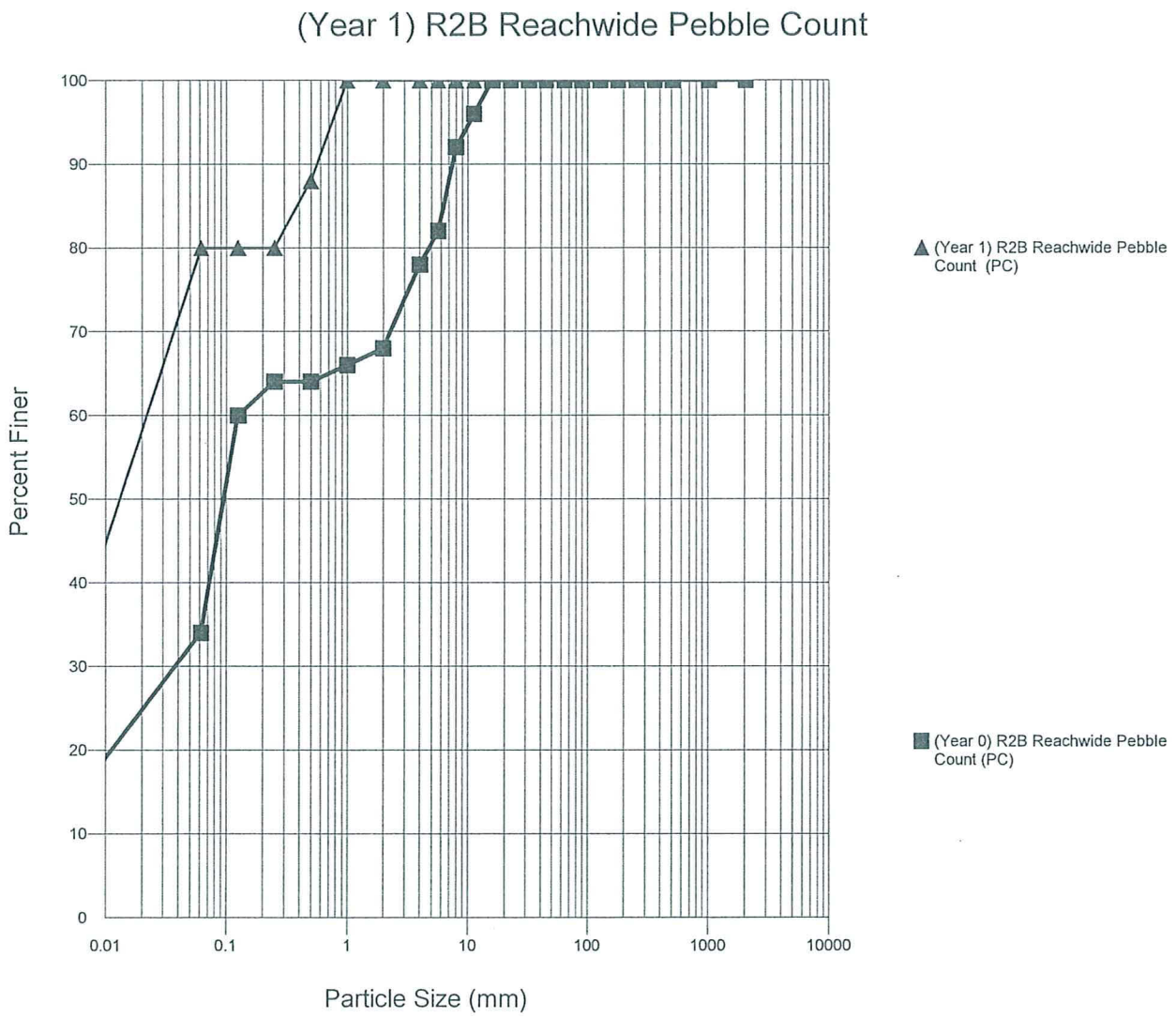
RIVERMORPH PARTICLE SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R2A
Sample Name: Reachwide Pebble Count (R2A)
Survey Date: 09/25/2008

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	14	28.00	28.00
0.062 - 0.125	0	0.00	28.00
0.125 - 0.25	12	24.00	52.00
0.25 - 0.50	4	8.00	60.00
0.50 - 1.0	11	22.00	82.00
1.0 - 2.0	0	0.00	82.00
2.0 - 4.0	0	0.00	82.00
4.0 - 5.7	0	0.00	82.00
5.7 - 8.0	0	0.00	82.00
8.0 - 11.3	1	2.00	84.00
11.3 - 16.0	2	4.00	88.00
16.0 - 22.6	1	2.00	90.00
22.6 - 32.0	1	2.00	92.00
32 - 45	4	8.00	100.00
45 - 64	0	0.00	100.00
64 - 90	0	0.00	100.00
90 - 128	0	0.00	100.00
128 - 180	0	0.00	100.00
180 - 256	0	0.00	100.00
256 - 362	0	0.00	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	0.04
D35 (mm)	0.16
D50 (mm)	0.24
D84 (mm)	11.3
D95 (mm)	36.88
D100 (mm)	45
Silt/Clay (%)	28
Sand (%)	54
Gravel (%)	18
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Particles = 50 (need at least 60).


(Year 1) R2B Reachwide Pebble Count
Percent Finer
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)
(Year 1) R2B Reachwide Pebble Count (PC)
(Year 0) R2B Reachwide Pebble Count (PC)

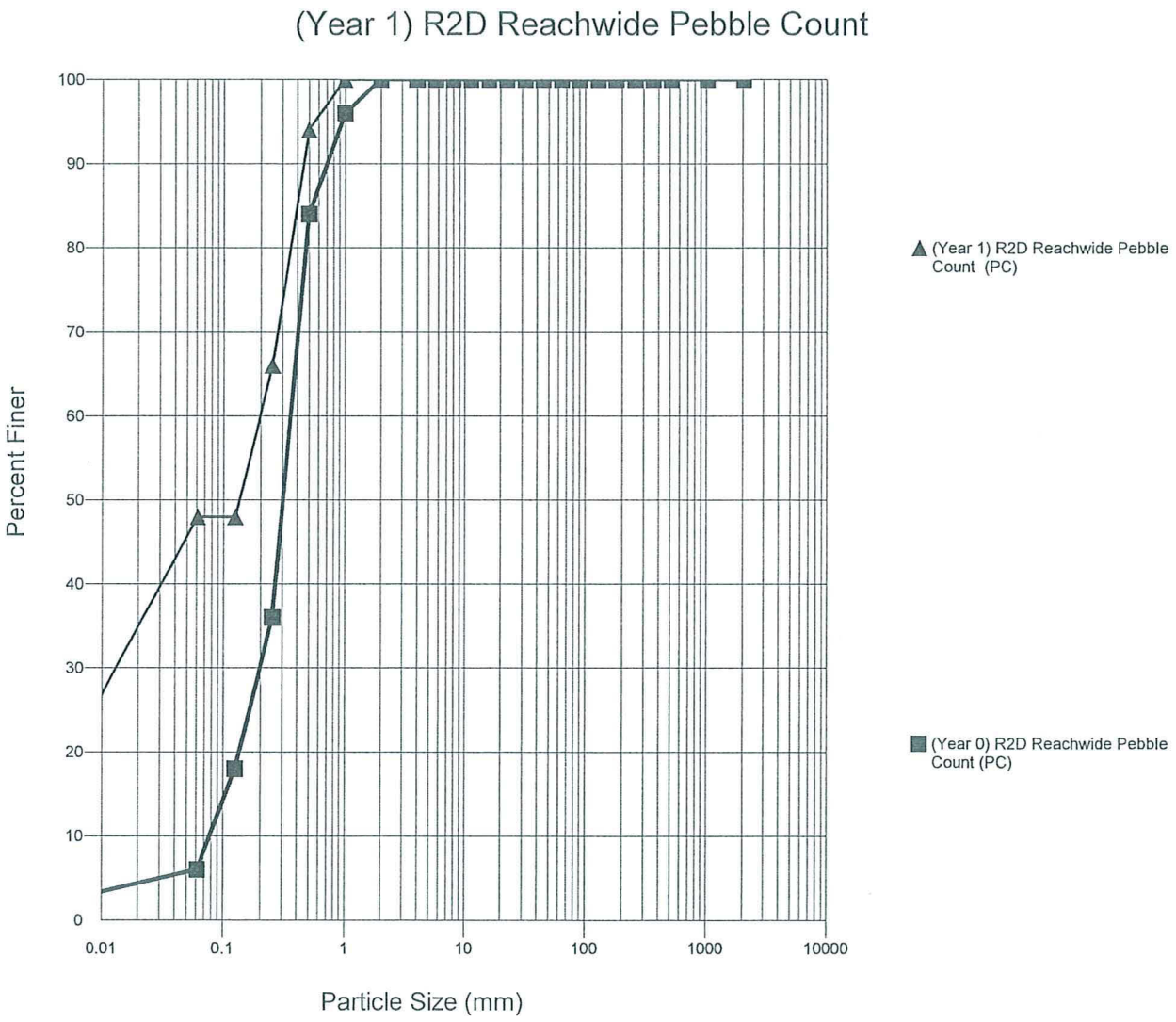
RIVERMORPH PARTICLE SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R2B
Sample Name: Reachwide Pebble Count (R2B)
Survey Date: 09/25/2008

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	40	80.00	80.00
0.062 - 0.125	0	0.00	80.00
0.125 - 0.25	0	0.00	80.00
0.25 - 0.50	4	8.00	88.00
0.50 - 1.0	6	12.00	100.00
1.0 - 2.0	0	0.00	100.00
2.0 - 4.0	0	0.00	100.00
4.0 - 5.7	0	0.00	100.00
5.7 - 8.0	0	0.00	100.00
8.0 - 11.3	0	0.00	100.00
11.3 - 16.0	0	0.00	100.00
16.0 - 22.6	0	0.00	100.00
22.6 - 32.0	0	0.00	100.00
32 - 45	0	0.00	100.00
45 - 64	0	0.00	100.00
64 - 90	0	0.00	100.00
90 - 128	0	0.00	100.00
128 - 180	0	0.00	100.00
180 - 256	0	0.00	100.00
256 - 362	0	0.00	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	0.01
D35 (mm)	0.03
D50 (mm)	0.04
D84 (mm)	0.38
D95 (mm)	0.79
D100 (mm)	1
Silt/Clay (%)	80
Sand (%)	20
Gravel (%)	0
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Particles = 50 (need at least 60).


(Year 1) R2D Reachwide Pebble Count
Percent Finer
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)
(Year 1) R2D Reachwide Pebble Count (PC)
(Year 0) R2D Reachwide Pebble Count (PC)

RIVERMORPH PARTICLE SUMMARY

River Name: Little White Oak Creek (Year 1)
Reach Name: R2D
Sample Name: Reachwide Pebble Count (R2D)
Survey Date: 09/25/2008

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	24	48.00	48.00
0.062 - 0.125	0	0.00	48.00
0.125 - 0.25	9	18.00	66.00
0.25 - 0.50	14	28.00	94.00
0.50 - 1.0	3	6.00	100.00
1.0 - 2.0	0	0.00	100.00
2.0 - 4.0	0	0.00	100.00
4.0 - 5.7	0	0.00	100.00
5.7 - 8.0	0	0.00	100.00
8.0 - 11.3	0	0.00	100.00
11.3 - 16.0	0	0.00	100.00
16.0 - 22.6	0	0.00	100.00
22.6 - 32.0	0	0.00	100.00
32 - 45	0	0.00	100.00
45 - 64	0	0.00	100.00
64 - 90	0	0.00	100.00
90 - 128	0	0.00	100.00
128 - 180	0	0.00	100.00
180 - 256	0	0.00	100.00
256 - 362	0	0.00	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	0.02
D35 (mm)	0.05
D50 (mm)	0.14
D84 (mm)	0.41
D95 (mm)	0.58
D100 (mm)	1
Silt/Clay (%)	48
Sand (%)	52
Gravel (%)	0
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Particles = 50 (need at least 60).

BEHI and Sediment Export Estimates for Project Site Streams

Little White Oak Creek Stream Restoration (D06027-B)

Time Point	Segment/ Reach	Linear Footage or Acreage	Extreme		Very High		High		Moderate		Low		Very Low		Sediment Export	
			ft	%	ft	%	ft	%	ft	%	ft	%	ft	%	Yd^3/yr	Ton/yr
Pre-Construction	R1	6530			5877	90									350	455
	R1A	906.1	906.1	100											176	229
	R1B	800.4	800.4	100											128	167
	R2 Upper	3981.9	3583.7	90											424	551
	R2 Lower	1996.5	1796.8	90											166	216
	R2A	625			625	100									25	32
	R2B	1713					1713	100							93	120
	R2C	1895.5	1895.5	100											108	140
	R2D	525.9	525.9	100											193	250
														Totals	1662	2161

Project Name: Little White Oak Creek **Installation Date:** 12/4/2007

County, State: Polk County, North Carolina

Crest Gauge Information			Year of Sampling 2008	2008					
Gauge ID	Bankfull Elevation (ft)	Zero Elevation (ft)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total Exceedance by Gauge
1	886.12	885.87	0	1	0	0	0	0	1
2	882.04	882.04	0	1	0	0	0	0	1
3	875.80	875.30	0	1	0	0	0	0	1
4	878.10	877.96	0	1	0	0	0	0	1
5	876.30	876.26	0	0	0	0	0	0	0
6	871.70	871.51	0	1	0	0	0	0	1
7	869.90	869.14	0	1	0	0	0	0	1
8	866.93	866.67	0	0	0	0	0	0	0
9			0	0	0	0	0	0	0
10			0	0	0	0	0	0	0

Initial Data Entry for Crest Gage (feet)													
Gage ID	BKF Elev.	1	2	3	4	5	6	7	8	9	10	11	12
1	886.12	1.18											
2	882.04	0.25											
3	875.80	0.95											
4	878.10	0.35											
5	876.30	0.00											
6	871.70	0.74											
7	869.90	0.84											
8	866.93	0.12											
9	0.00												
10	0.00												

Peak Flow Height by Crest Gage (feet)													
Gage ID	BKF Elev.	1	2	3	4	5	6	7	8	9	10	11	12
1	886.12	887.05	885.87	885.87	885.87	885.87	885.87	885.87	885.87	885.87	885.87	885.87	885.87
2	882.04	882.29	882.04	882.04	882.04	882.04	882.04	882.04	882.04	882.04	882.04	882.04	882.04
3	875.80	876.25	875.30	875.30	875.30	875.30	875.30	875.30	875.30	875.30	875.30	875.30	875.30
4	878.10	878.31	877.96	877.96	877.96	877.96	877.96	877.96	877.96	877.96	877.96	877.96	877.96
5	876.30	876.26	876.26	876.26	876.26	876.26	876.26	876.26	876.26	876.26	876.26	876.26	876.26
6	871.70	872.25	871.51	871.51	871.51	871.51	871.51	871.51	871.51	871.51	871.51	871.51	871.51
7	869.90	869.98	869.14	869.14	869.14	869.14	869.14	869.14	869.14	869.14	869.14	869.14	869.14
8	866.93	866.79	866.67	866.67	866.67	866.67	866.67	866.67	866.67	866.67	866.67	866.67	866.67
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Bankfull Exceedance by Crest Gage														Exceedance by Gage
Gage ID	BKF Elev.	1	2	3	4	5	6	7	8	9	10	11	12	
1	886.12	exceeds	below	below	below	below	below	below	below	below	below	below	below	1
2	882.04	exceeds	below	below	below	below	below	below	below	below	below	below	below	1
3	875.80	exceeds	below	below	below	below	below	below	below	below	below	below	below	1
4	878.10	exceeds	below	below	below	below	below	below	below	below	below	below	below	1
5	876.30	below	below	below	below	below	below	below	below	below	below	below	below	0
6	871.70	exceeds	below	below	below	below	below	below	below	below	below	below	below	1
7	869.90	exceeds	below	below	below	below	below	below	below	below	below	below	below	1
8	866.93	below	below	below	below	below	below	below	below	below	below	below	below	0
9	0.00	below	below	below	below	below	below	below	below	below	below	below	below	0
10	0.00	below	below	below	below	below	below	below	below	below	below	below	below	0
No. of Exceedances by Sampling		6	0	0	0	0	0	0	0	0	0	0	0	