NORTH CAROLINA
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LITTLE WHITE OAK CREEK STREAM RESTORATION

POLK COUNTY, NORTH CAROLINA

CONTRACT # D06027-B


Year 0 - Photo Point 11


Year 2 - Photo Point 11

Prepared For:

Ecosystem Enhancement Program
Department of Environment and Natural Resources
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ANNUAL MONITORING REPORT (YEAR 2 OF 5)

FEBRUARY 2010

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1.0 Executive Summary

This annual monitoring report details the second 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 was monitored at representative vegetation plots as well as project-wide. Stem counts, photo documentation and comparison, and visual assessment were 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 was monitored using annual stem counts at each of the plots. In addition to the stem counts, annual photos were taken at each of the plots and also from 14 other permanent photo reference points. The vegetation plot photos were used for photo documentation and comparison of the vegetation growth at each plot. The photo documentation at the reference points were 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 after Year 3 and 260 stems per acre after Year 5, across the project site. The stem counts were 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 will meet the success criteria outlined above for Year 3 and Year 5. 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 complemented this suggestion, as no concerns, problems, or negative trends were documented. Similarly, the project-wide visual assessment provided further validation, as no vegetation problem areas were observed.

In mid October 2009, the vegetation monitoring for Monitoring Year 2 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 367 to 1000 stems per acre, with an average survivability of 670 stems per acre. As with the previous year, the results indicated the survivability of the planted woody vegetation at LWOC will meet the success criteria outlined above for Year 3 and Year 5. The comparisons of the baseline and Monitoring Year 2 photos at both the 24 vegetation plot photo reference points and the 14 permanent photo reference indicated the vegetation is moving in a positive direction. The project-wide visual assessment provided validated this positive trend, as no vegetation problem areas were observed.

Stream dimension, pattern, profile, stream bed material, bank stability, and bankfull hydrology were 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 were 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 was used for stream monitoring to complement and validate the other stream monitoring practices from 14 permanent reference photo points. Annual project wide visual assessment was 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 was 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 were 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 suggested on-site sediment supply from LWOC has been 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. Data collected at six of the eight on-site crest gauges provided evidence indicating 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 the 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.

In mid October and early November 2009, the stream monitoring for Monitoring Year 2 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 were 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 suggested on-site sediment supply from LWOC has been reduced as a result of the restoration, particularly from increased native vegetation and soil stabilization. Fluctuations in bed materials are likely to continue and several years may be needed to observe a consistent bed material. Data collected at seven of the eight on-site crest gauges provided evidence indicating a storm event producing a stage in excess of the bankfull storm occurred at LWOC during Monitoring Year 2. This documented the second 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 3 specific stream problem areas, all of which are associated with beaver dams constructed along reaches R1 and R2. Mulkey is actively coordinating with the United States Department of Agriculture (USDA) Wildlife Services under their Beaver Management Assistance Program (BMAP) to have the beavers and beaver dams removed, as well as to have site monitored for future beaver activity.

Therefore, based on the results of the stream monitoring for Monitoring Year 2 at LWOC, as well as the ongoing corrective actions being taken, Mulkey did 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. Therefore 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 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 stock. 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) 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, was monitored at representative vegetation plots as well as project-wide. Monitoring at representative vegetation plots focused primarily on planted woody vegetation and was conducted using stem counts and photo documentation. Project-wide monitoring of planted vegetation included both woody and herbaceous species and was 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).

An As-Built Survey was initiated immediately following the installation of plant materials. In December 2007, during the as-built survey 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, all stems contained in the plots were identified and tallied by species and plot, then marked with loosely tied survey flagging (on lateral branches) to facilitate future identification. This data was recorded to provide the baseline survivability. The survivability of the planted woody vegetation at LWOC for the various monitoring periods was then calculated using annual stem counts at each of the plots and compared to the baseline data. During each of the annual stem counts, the planted stems were re-flagged as required to ensure that all planted stems were accounted for and considered in the survivability calculations. In addition to the stem counts, photos were taken at each of the plots. Where necessary, the corner of each plot was remarked with PVC pipe and the plot number relabeled. This PVC plot corner was used as the reference point from which the annual vegetation plot photos were taken such that the photos at each plot will have the same orientation. The photos were compared to the photos from the previous years 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 permanent photo reference points (photo points 2.5Y1, 3.5Y1, and 8.5Y1) were added during the Year 1 monitoring period to ensure adequate photo documentation would be conducted within the monitoring limits of the project stream reaches. These additional permanent photo reference points were monumented using steel rebar and PVC pipe. Photos were taken from each of the 14 permanent photo reference points with the same orientation each applicable year and used for photo documentation and annual comparison of the vegetation growth across LWOC. This exercise helped to further validate and document vegetation success at LWOC. Between January and February 2008, after installation of the described 11 permanent photo reference points, photos were taken from each of the permanent photo reference points to document the baseline conditions at LWOC with regards to planted vegetation. Monitoring Year 1 and Monitoring Year 2 photos were taken from all 14 photo points during the visit in August 2008 and October 2009, respectively. Project-wide visual assessment was also used for vegetation monitoring at LWOC. A visual assessment was 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 was lacking or exotic vegetation was present, was identified and categorized as bare bank, bare bench, bare floodplain, or invasive population. Such areas were documented using representative photos and their locations were identified on the Monitoring Plan View.

3.1.2 Vegetation Monitoring Success Criteria

Vegetation success at LWOC was determined by stem survivability. Successful survivability is dependent upon achieving at least 320 stems per acre after three years and 260 stems per acre after five years across the project site. Therefore, survivability rates exceeding these requirements in previous years were deemed successful. The stem counts were conducted during the latter part of the growing season months (August, September, and October) to ensure survival throughout a complete growing season while still allowing for relative ease in identification. As described above, photo documentation and visual assessment was used to complement the stem counts as part of the vegetation monitoring protocol at LWOC. If during any given year, the planted species survivability was not anticipated to meet the final criteria established for vegetation; supplemental plantings were considered. In the event this occurred, a remedial planting plan was developed to achieve 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 and the results are summarized in Table V. 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 showed 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 indicated the survivability of the planted woody vegetation at LWOC should meet the success criteria defined in Section 3.1.2. During the stem counts, it was noted no significant volunteer woody species were observed at any of the 24 vegetation plots. The comparison of the baseline and Monitoring Year 1 photos at both the 24 vegetation plot photo reference points and the 11 permanent photo reference points strongly complemented 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. Based on the results of the vegetation monitoring for Monitoring Year 1 at LWOC, Mulkey did not propose any additional recommendations or actions other than to proceed with the annual vegetation monitoring.

3.1.4 Vegetation Monitoring Results for Year 2 of 5

In mid October 2009, the vegetation monitoring for Monitoring Year 2 was conducted. The methodologies described in the Vegetation Monitoring Methodology Section were used for the vegetation monitoring at LWOC for Monitoring Year 2. 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, the previous years, and Monitoring Year 2. Photos were taken from the photo reference points at each of the 24 vegetation plots and are compared to the previously collected photos in Appendix B. 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 from Year 0 and the photos from the 14 total permanent photo reference points in Monitoring Year 1. A project-wide visual assessment was also conducted to identify any specific vegetation problem areas and is summarized in Table VI. The results of the Monitoring Year 2 stem counts continued to display successful survivability in all 24 vegetation plots with the counts ranging from 367 to 1000 stems per acre and an average survivability of 670 stems per acre. Therefore survivability of the planted woody vegetation at LWOC should meet the success criteria established in Section 3.1.2. Similar to Monitroing Year 1, no significant volunteer woody species were observed at any of the 24 vegetation plots. The comparison of the Monitoring Year 2 photos to those previously collected at both the 24 vegetation plot photo reference points and the 14 permanent photo reference points suggested the vegetation was growing exceptionally well. Live stake vegetation has exceeded growth expectations and the bare root material is starting to overcome the weedy vegetation. A further review of the vegetation through the project-wide visual assessment validated this positive trend, as no concerns, problems, or negative trends were documented. Based on the results of the vegetation monitoring for Monitoring Year 2 at LWOC, Mulkey did 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 were 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, were conducted using annual field surveys along with visual assessment. The morphometric, stream bed material, and stream bank stability monitoring were conducted along representative sections of the project stream reaches. Hydrologic monitoring consisted of field measurements of bankfull events using crest gages. Project-wide stream monitoring was 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 survey 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 survey 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 are 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 survey, 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 pins. 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 survey process. 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 survey 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 survey 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. Annually, photos will be taken at each of the 13 cross sections looking across the stream from left to right and compared to the photos from the previous years to document stream conditions 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 survey. Monitoring surveys for stream pattern are limited to the project stream reaches specified above for annual monitoring surveys. The stream pattern parameters resulting from the annual monitoring surveys include sinuosity, belt width, radii of curvature, meander wavelength, and meander width ratio. These parameters will be compared annually.

The as-built survey included a 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 survey were used to establish the baseline conditions with regards to monitoring the longitudinal profile within the project reaches described above. The longitudinal profiles surveys conducted each year are then limited to the project stream reaches specified above. The parameters resulting from these longitudinal profile surveys are compared on an annual basis to those of the baseline and previous years. The parameters to be monitored include bankfull slope, riffle length, riffle slope, pool length, and pool to pool spacing.

During the as-built survey, 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 are monitored at LWOC by repeating the same pebble count procedures on an annual basis. The results of the pebble counts for each specified project stream reach are 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.

A total of eight crest gages, one at each reach and one at the confluence of Reaches R1 and R2, were installed across LWOC during the as-built survey. 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 survey. The crest gages were 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 were 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 were 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 was 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 survey 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 were taken from each of the 14 permanent photo reference points with the same orientation each year and were used for photo documentation and annual comparison of the stream conditions across LWOC. This exercise helped to further validate and document stream restoration success at LWOC. The visual assessment was conducted using annual field observations and pedestrian surveys to identify any specific problem areas along the streams at LWOC during the monitoring period. Any such problem areas were identified and organized under appropriate categories. Such areas were documented using representative photos, where applicable, and their locations were mapped on the Monitoring Plan View. The suspected cause and appropriate remedial action for each problem was determined. If during any given year, the streams were not anticipated to meet the final established monitoring criteria, corrective actions were considered. Such modifications were documented and discussed with EEP.

3.2.2 Stream Monitoring Success Criteria

Stream dimension, pattern, profile, stream bed material, bank stability, and bankfull hydrology were monitored annually for the project stream reaches as described in detail above. Stream restoration success at LWOC was evaluated by comparison of the annual results against the same parameters as predicted, specified, and required in the proposed design. Success was achieved when all such comparisons reveal positive trends toward overall stream stability. Expectation was the stream monitoring results should confirm 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 were measured and/or calculated for each of the permanent cross sections. The described dimension parameters were expected to remain consistent from year to year and should fall within the ranges established by the original proposed design parameters. It was 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 was 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 were measured and/or calculated. Stream pattern measurements were 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 was 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 were measured. Longitudinal profiles parameters were 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 was expected.

Stream bed material was 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 was 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 were used to determine and document the occurrence of these bankfull events.

As described above, photo documentation and visual assessment was used to complement the other stream monitoring practices as part of the stream monitoring protocol at LWOC. If during any given year, the streams were not anticipated to meet the final established monitoring criteria, corrective actions was considered. Such modifications were 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 Section 3.2.1 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. The results of these surveys were compared to the baseline data for the morphometric monitoring obtained during the as-built survey.

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 complemented 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 has been 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 any evidence of a flood stage event, possibly due to problems with the cork or the gage itself. 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, in order 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 ensure 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 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 did not propose any additional recommendations or actions other than to proceed with the annual stream monitoring.

3.2.4 Stream Monitoring Results for Year 2 of 5

In mid October and the beginning of November 2009, the stream monitoring for Monitoring Year 2 was conducted. The methodologies described in the Section 3.2.1 were used for the stream monitoring at LWOC for Monitoring Year 2. Detailed surveys were conducted along the project stream reaches specified to be surveyed for annual monitoring. The results of these surveys were compared to the previous data collected during prior monitoring periods, baseline conditions established through the as-built survey, and to the proposed design parameters calculated prior to construction.

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 2 with the initial baseline photos and the previous monitoring photos taken at each of the 13 cross sections. Appendix E provides an overlay of the Monitoring Year 2, the previous monitoring periods, and baseline conditions along with the raw data for each cross section. The comparison of Monitoring Year 2 to the previous surveys for stream dimension data for each of the project stream reaches showed very positive results, all of which were comparable to the originally proposed design parameters. Throughout all the cross sections, the bankfull cross sectional area and entrenchment ratios remained consistent indicating the channels were able to contain and convey all the flows experienced during Monitoring Year 2. However, the main channels R1 and R2 displayed typical signs of adjustment in their channel geometries. Both of these reaches have recently been impacted by beavers and some of these adjustments can be attributed to this recent development. In particular on R1, cross section 11 had a significant increase in the width to depth ratio due to the backwater of a downstream beaver dam causing the pool to experience siltation. On the other end, cross section 12 experienced the reverse because a beaver dam was located directly upstream and the cascading water created scour ultimately decreasing the width to depth ratio. Similarly, cross sections along R2 exhibited localized changes in channel geometries, some attributable to beaver activity and others to natural fluctuations, but all within the acceptable ranges of the design parameters. The one exception was cross section 1, with a width to depth ratio climbing up to 22 and the bankfull cross sectional area remaining consistent, a cursory analysis raised concern. However, the overlay of cross section 1 clearly demonstrated the channel developing opposing inner berms to better accommodate the low flow capacity. This effectively allowed the channel to deepen without creating a change in the cross sectional area causing the width to depth ratio to increase instead of decrease due to the derivation being based on the calculated value of mean depth. The results of the smaller tributaries R1A, R2A, R2B, and R2D consistently exhibited minor natural adjustments typical of stable C type streams. The comparisons of the Monitoring Year 2 overlays and cross sectional photos to the previous years strongly substantiated these findings, 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 Year 2 monitoring data to previous years stream pattern 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 remained consistent to the design parameters with minor variations attributed to vegetation establishment, natural channel adjustments, and variance in measuring techniques. These minor variations 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. In comparing the data collected from Monitoring Year 2 to the previously collected data, the results followed the previous analysis. All reaches showed acceptable minor variations in all parameters monitored. These variations are within the design tolerances and are attributable to vegetation establishment, natural channel adjustments, and variance in measuring techniques. Overall, none of the longitudinal profiles showed excessive aggrading or degrading. Overlays of the longitudinal profiles can be found in Appendix E.

Modified Wolman pebble counts were repeated at each of the project stream reaches to classify the stream bed materials and for comparison to the previous years' 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. Over time the expectation was for the stream to eventually coarsen, however, Monitoring Year 1 and Year 2 have shown the opposite to be true. Specifically, the bed material d50 and d84 for each of the stream reaches decreased. Therefore 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. Nonetheless, the monitoring results do suggest on-site sediment supply from LWOC was 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 2 surveys to monitor hydrology at LWOC. Seven of the eight crest gages recorded flood stages in excess of the bankfull stage. The one crest gage that did not record a flood stage in excess of the bankfull stage was at Reach R2D. Although, the region has seen a significant drought, the site has received large quantities of rain this monitoring year. Additionally, the R2D reach has a constant flow of water throughout its course. The crest gage at Reach R2D recorded a flood stage that was 0.10 feet below the bankfull stage this monitoring year. This information coupled with the other seven gauges having recorded a bankfull event during this monitoring year suggested that Mulkey needs to recheck the R2D crest gage in 2010 for elevation discrepancies with regard to its zero elevation. All of the crest gages were reset after checking stage measurements, in order to record future events. Table X lists the information related to the verification of bankfull events at LWOC for Monitoring Year 2 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 2. This documented the second and final required bankfull event at LWOC and therefore demonstrated success with regards to hydrologic monitoring per Section 3.2.2.

Photo documentation and project-wide visual assessment were used to complement the other Monitoring Year 2 stream monitoring practices. Photos were taken from each of the 14 permanent photo reference points. Appendix C includes all of the described photos and provides comparison of the photos between the baseline conditions, Monitoring Year 1 and Monitoring Year 2 photos taken from the 14 permanent photo reference points. 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). During the project-wide visual assessment, along with the other Monitoring Year 2 field work activities, Mulkey noticed a significant increase in beaver activity at the site. Specifically, beaver dams have been constructed along Reaches

R1, R2 Upper, and R2 Lower in several locations. Please note that Table XI and Table XII have been updated to reflect these observations. Mulkey is currently coordinating with the USDA Wildlife Services under BMAP to have the beavers and beaver dams removed, as well as to have the site monitored for future beaver activity. Mulkey has also observed cattle intrusion into the fenced buffers at LWOC. Mulkey is working with the landowner to prevent future cattle trespass from occurring. Other field observations made during the Monitoring Year 2 include the observation of the apparent restoration of wetland hydrology adjacent to Reach R1A. The restoration of Reach R1A appears to have reconnected the stream to its historic floodplain, as well as raise the groundwater table in the buffer areas adjacent to the reach. These observations are evidenced by the increase of wetland vegetation species and the saturation of the soils in the buffer areas adjacent to Reach R1A. The waste treatment outfall located on R1 reach and emanating from the nearby school appears to be functioning extremely well. Vegetation around the outfall is growing rapidly and helping to create a highly stable secondary treatment area.

Based on the results of the stream monitoring for Monitoring Year 2 at LWOC, as well as the subsequent corrective actions being taken, Mulkey does not propose any additional recommendations or actions other than to proceed with the annual stream monitoring.

NCEEP expressed concerns regarding the fencing of the conservation easement at LWOC to Mulkey in a letter dated May 26, 2009. Mulkey responded to NCEEP in a June 1, 2009 letter, urging NCEEP to consider several key exceptions for this particular case. These exceptions are explained in the referenced June 1, 2009 letter. Mulkey awaits response from NCEEP regarding the July 2009 letter before further addressing the concerns raised by NCEEP.

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.

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

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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.

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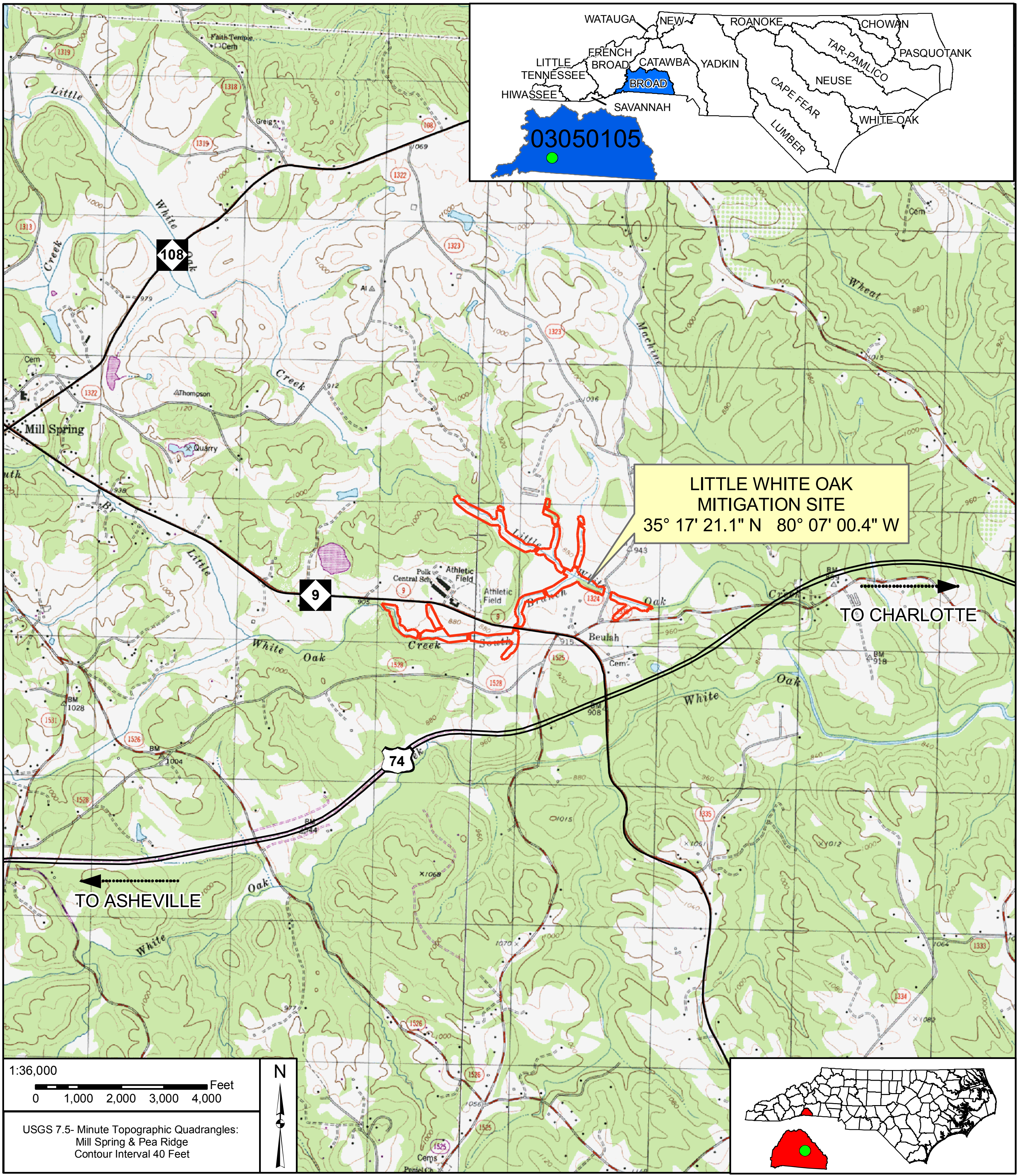


USGS 7.5- Minute Topographic Quadrangles:
Mill Spring & Pea Ridge
Contour Interval 40 Feet

Ecosystem Enhancement Program

MULKEY ENGINEERS & CONSULTANTS

PROJECT NO. D06027-B

LOCATION MAP

LITTLE WHITE OAK STREAM RESTORATION

POLK COUNTY, NORTH CAROLINA

March 20, 2008

Figure

1

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	Oct-09	Dec-09
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 2 for Each Species Arranged by Plot
Little White Oak Creek Stream Restoration / D06027-B

Species	Plots																								Year 0 Totals	Year 0 Totals (Adjusted) ^	Year 1 Totals	Year 2 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																3			1				3		9	9	8	7	78%
Cornus amomum		2					8	2		1		1		3						1					15	18	18	18	100%
Sambucus canadensis																									2	2	2	0	0%
Trees																													
Betula nigra	1	8				2	6	5		2				2				1		2			6		41	40	37	35	88%
Cornus florida															1						1				2	2	2	2	100%
Corylus americana														3											17	5	4	3	60%
Diospyros virginiana			1								4	3					2							7	19	19	16	17	89%
Fraxinus pennsylvanica					1			3		2			7	1	1	1		4	2	1		7	1		37	35	35	31	89%
Juglans nigra			2								1										1			2	7	7	6	6	86%
Pinus echinata			2	2	2				2			1					2								28	26	15	11	42%
Pinus strobus									2		1				4		1							3	20	21	18	11	52%
Pinus virginiana					3				2		2				1										12	13	9	8	62%
Prunus serotina			1		2						1	1			1						1				6	7	7	7	100%
Plantanus occidentalis							2	2		5		7				5		2	5	16			1		45	45	45	45	100%
Quercus alba			6	7	3				4		1	1	1	1	1		7		1		1			7	35	43	39	41	95%
Quercus falcata									3	1	5				9		2		1		7				41	36	30	28	78%
Quercus michauxii	8	2								1			9	2		4		1		4		5	4		47	46	45	40	87%
Quercus nigra	8	2			1	10																			34	23	21	21	91%
Quercus phellos	7	5			1	6																			9	19	19	19	100%
Salix nigra							1																		1	1	1	1	100%
Ulmus americana								4		5				3		4		3	9			9	4		26	43	42	41	95%
Totals	24	19	12	9	13	18	17	16	13	17	15	14	17	15	18	17	14	11	19	24	11	21	19	19	453	460	419	392	85%

	Stems/Acre																								Min	Ave	Max
Year 0	996	823	735	653	741	950	748	763	683	694	656	705	795	615	850	868	757	518	854	1000	645	924	776	939	518	779	1000
Year 1	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
Year 2	996	823	490	367	535	744	669	643	522	694	615	581	711	615	729	702	558	438	772	1000	444	843	776	776	367	668	1000
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			

Notes: ^ Year 0 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 (Year 1, 2008)	All project reaches	N/A	N/A
No vegetative problem areas observed (Year 2, 2009)	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	22.9	24.1	23.5
Floodprone Width (ft)	--	--	--	--	--	--	69.6	118.6	94.1	67.2	72.8	67.2	90.8	113.6	98.4	73.5	79.5	76.5
BKF Cross Sectional Area (sq. ft.)	--	--	--	30	110	60	52.9	69.7	61.3	27.4	33.4	30.3	--	--	52.0	39.5	49.1	44.3
BKF Mean Depth (ft)	--	--	--	1.5	3.8	2.5	3.20	3.43	3.32	1.57	1.72	1.64	--	--	2.02	1.6	2.1	1.89
BKF Max Depth (ft)	--	--	--	--	--	--	2.37	5.00	3.69	1.54	2.36	1.90	1.90	2.91	2.34	2.8	3.0	2.89
Width/Depth Ratio	--	--	--	--	--	--	5.2	5.9	5.6	9.3	12.7	11.3	--	--	12.7	10.7	14.7	12.7
Entrenchment Ratio	--	--	--	--	--	--	4.2	5.8	5.0	3.5	4.4	3.8	3.5	4.4	3.8	3.2	3.3	3.3
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	25.4	--	--	20.8	--	--	29.7	24.3	25.2	24.7
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	2.8	--	--	1.4	--	--	1.8	1.57	2.03	1.8
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	1.7	5.8	3.7
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	26.7	33.1	30.2
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	61.9	73.5	66.0
BKF Mean Depth (ft)	--	--	--	1.8	4	2.9	3.13	3.14	3.14	1.57	1.72	1.64	--	--	2.45	1.89	2.38	2.20
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	11.5	17.5	14.0
Entrenchment Ratio	--	--	--	--	--	--	3.1	10.3	6.7	3.5	4.4	3.8	3.5	4.4	3.8	2.8	4.5	3.6
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	28.0	--	--	20.8	--	--	35.9	28.0	34.0	31.5
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	2.7	--	--	1.4	--	--	2.1	1.8	2.3	2.1
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	1.3	5.6	3.5
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	8.8	8.9	8.8
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	4.9	8.7	6.3
BKF Mean Depth (ft)	--	--	--	0.45	1.2	0.8	1.31	1.35	1.33	1.57	1.72	1.64	--	--	0.63	0.56	0.98	0.72
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	9.0	15.7	13.0
Entrenchment Ratio	--	--	--	--	--	--	1.2	30.3	15.8	3.5	4.4	3.8	3.5	4.4	3.8	3.0	8.5	5.6
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	6.4	--	--	20.8	--	--	9.3	9.1	9.7	9.3
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	0.9	--	--	1.4	--	--	0.5	0.5	0.9	0.7
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	0.9	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)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	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	--	--	8.8
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	--	--	6.0
BKF Mean Depth (ft)	--	--	--	--	--	0.6	0.70	0.80	0.75	1.57	1.72	1.64	--	--	0.63	--	--	0.68
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	--	--	13.0
Entrenchment Ratio	--	--	--	--	--	--	1.8	2.2	2.0	3.5	4.4	3.8	3.5	4.4	3.8	--	--	7.9
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	--	--	--	20.8	--	--	9.3	--	--	9.3
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	--	--	--	1.4	--	--	0.5	--	--	0.7
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	1.0	4.8	2.8
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)	23.1	23.6				18.9	26				21.2	20.5				22.7	23.66													
Floodprone Width (ft)	80.3	87.7				104.9	105.7				129.3	83.33				74.9	96.46													
BKF Cross Sectional Area (sq. ft.)	45.9	45.1				40.7	42.62				61.1	44.35				48.9	59.24													
BKF Mean Depth (ft)	1.99	1.91				2.15	1.64				2.88	2.16				2.16	2.5													
BKF Max Depth (ft)	3.95	4.38				3.70	3.48				6.32	3.59				3.22	5.01													
Width/Depth Ratio	11.6	12.4				8.8	15.85				7.4	9.49				10.5	9.46													
Entrenchment Ratio	3.47	3.59				5.55	4.06				6.10	4.06				3.31	4.08													
Wetted Perimeter (ft)	25.1	26.2				22.5	27.86				25.7	23.63				25.0	27.2													
Hydraulic Radius (ft)	1.83	1.72				1.81	1.53				2.37	1.88				1.95	2.18													

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	38.7	121.8	90.9									
Radius of Curvature (ft)	44.9	73.6	54.0	37.4	87.0	55.2									
Meander Wavelength (ft)	186.6	240.2	210.4	189.0	240.1	209.5									
Meander Width Ratio	2.2	6.0	4.2	1.6	5.1	3.8									
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	13.1	30.0	22.5									
Riffle Slope (ft/ft)	0.001	0.015	0.006	0.002	0.028	0.018									
Pool Length (ft)	25.7	85.0	43.0	37.5	88.1	54.7									
Pool Spacing (ft)	49.4	138.4	85.7	33.7	168.7	89.6									
Substrate															
d50 (mm)	0.23			0.15											
d84 (mm)	0.73			0.65											
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0020			0.00205											
Monitored Channel Length (ft)	2022			2053											
Monitored Valley Length (ft)	1277			1414											
Sinuosity	1.58			1.45											
Total Channel Length (ft)	7543			7543											
Rosgen Classification	C5			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	9.23																												
Floodprone Width (ft)	124.2	125																												
BKF Cross Sectional Area (sq. ft.)	4.2	4.39																												
BKF Mean Depth (ft)	0.54	0.48																												
BKF Max Depth (ft)	0.82	0.77																												
Width/Depth Ratio	14.5	19.23																												
Entrenchment Ratio	15.85	13.54																												
Wetted Perimeter (ft)	8.1	9.75																												
Hydraulic Radius (ft)	0.52	0.45																												

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	13.7	25.5	20.3									
Radius of Curvature (ft)	8.1	20.1	13.8	12.9	21.2	17.0									
Meander Wavelength (ft)	60.6	70.0	66.1	52.6	78.9	66.3									
Meander Width Ratio	2.1	3.6	3.0	1.5	2.8	2.2									
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	11.6	19.4	14.9									
Riffle Slope (ft/ft)	0.012	0.050	0.023	0.01311	0.03303	0.02236									
Pool Length (ft)	12.1	29.1	15.9	11.1	24.7	16.6									
Pool Spacing (ft)	32.5	55.2	43.1	25.7	73.6	50.6									
Substrate															
d50 (mm)	0.14			0.05											
d84 (mm)	0.44			0.79											
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0114			0.0106											
Monitored Channel Length (ft)	501			499											
Monitored Valley Length (ft)	380			402											
Sinuosity	1.32			1.24											
Total Channel Length (ft)	1040			1040											
Rosgen Classification	C6			C6											

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

PARAMETERS	Cross Section 1					Cross Section 2					Cross Section 3					Cross Section 4					Cross Section 5									
	Riffle					Pool					Pool					Riffle					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	37.5				25.7	25.2				27.6	26.2				26.1	26.0				28.0	27.7								
Floodprone Width (ft)	99.7	110.0				118.8	116.5				150.2	155.3				120.4	120.0				104.6	105.0								
BKF Cross Sectional Area (sq. ft.)	64.1	64.2				49.7	44.2				48.7	46.9				52.1	55.4				45.4	46.2								
BKF Mean Depth (ft)	1.89	1.71				1.94	1.75				1.77	1.79				1.99	2.13				1.62	1.67								
BKF Max Depth (ft)	3.23	3.95				4.23	3.48				3.49	3.79				3.25	3.74				3.11	3.09								
Width/Depth Ratio	18.0	21.9				13.2	14.4				15.6	14.6				13.1	12.2				17.3	16.6								
Entrenchment Ratio	2.94	2.93				4.63	4.63				5.45	5.93				4.61	4.62				3.73	3.79								
Wetted Perimeter (ft)	34.9	39.3				28.6	27.1				30.0	29.0				27.5	27.6				29.4	28.9								
Hydraulic Radius (ft)	1.84	1.64				1.74	1.63				1.62	1.62				1.90	2.01				1.54	1.60								

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	57.5	139.1	105.8									
Radius of Curvature (ft)	41.9	79.3	54.7	37.3	77.6	59.4									
Meander Wavelength (ft)	183.6	258.7	236.1	177.2	263.4	236.7									
Meander Width Ratio	2.1	4.7	3.7	1.8	4.4	3.3									
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	20.4	34.71	28.1									
Riffle Slope (ft/ft)	0.002	0.013	0.005	0.00201	0.00616	0.00375									
Pool Length (ft)	35.6	94.9	57.7	30.6	91.9	50.3									
Pool Spacing (ft)	108.7	264.9	176.3	79.6	228.7	147									
Substrate															
d50 (mm)	0.25			0.11											
d84 (mm)	0.76			0.38											
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0014			0.00138											
Monitored Channel Length (ft)	2093			2112											
Monitored Valley Length (ft)	1392			1390											
Sinuosity	1.50			1.52											
Total Channel Length (ft)	7107			7107											
Rosgen Classification	C5			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	16.11																												
Floodprone Width (ft)	40.35	40.6																												
BKF Cross Sectional Area (sq. ft.)	16.17	15.14																												
BKF Mean Depth (ft)	1.01	0.94																												
BKF Max Depth (ft)	1.89	1.9																												
Width/Depth Ratio	15.9	17.14																												
Entrenchment Ratio	2.51	2.52																												
Wetted Perimeter (ft)	16.66	16.87																												
Hydraulic Radius (ft)	0.97	0.9																												

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	35.0	48.3	40.5									
Radius of Curvature (ft)	21.3	26.8	23.7	20.1	27.1	22.9									
Meander Wavelength (ft)	98.3	105.2	100.6	99.6	103.3	101.0									
Meander Width Ratio	2.1	2.9	2.4	2.2	3.0	2.5									
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	18.2	26.34	21.4									
Riffle Slope (ft/ft)	0.007	0.020	0.013	0.0046	0.0201	0.01158									
Pool Length (ft)	18.3	45.0	31.7	13.2	22.1	18.3									
Pool Spacing (ft)	71.8	133.0	102.4	47.7	93	72.7									
Substrate															
d50 (mm)	0.24			0.68											
d84 (mm)	11.3			11.3											
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0108			0.01149											
Monitored Channel Length (ft)	320			321											
Monitored Valley Length (ft)	246			248											
Sinuosity	1.30			1.30											
Total Channel Length (ft)	336			336											
Rosgen Classification	C5			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	8.26																												
Floodprone Width (ft)	25.46	24.89																												
BKF Cross Sectional Area (sq. ft.)	4.5	4.24																												
BKF Mean Depth (ft)	0.52	0.51																												
BKF Max Depth (ft)	0.89	0.85																												
Width/Depth Ratio	16.73	16.2																												
Entrenchment Ratio	2.93	3.01																												
Wetted Perimeter (ft)	9.0	8.5																												
Hydraulic Radius (ft)	0.50	0.5																												

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	15.1	28.7	21.1									
Radius of Curvature (ft)	9.4	22.2	16.7	11.5	23.1	18.0									
Meander Wavelength (ft)	59.4	68.7	64.2	60.1	69.8	64.6									
Meander Width Ratio	1.9	3.6	2.6	1.8	3.5	2.6									
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	--	--	--	5.1	10.7	7.8									
Riffle Slope (ft/ft)	--	--	--	0.0125	0.04758	0.03485									
Pool Length (ft)	9.6	18.6	15.0	13.5	23.6	17.5									
Pool Spacing (ft)	24.8	60.2	44.0	30.4	55.1	42.2									
Substrate															
d50 (mm)	0.04			0.03											
d84 (mm)	0.38			0.06											
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0165			0.01641											
Monitored Channel Length (ft)	528			553											
Monitored Valley Length (ft)	387			433											
Sinuosity	1.36			1.28											
Total Channel Length (ft)	1474			1474											
Rosgen Classification	C6			C6											

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

PARAMETERS	Cross Section 8 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	10.93																												
Floodprone Width (ft)	69.62	70																												
BKF Cross Sectional Area (sq. ft.)	6.7	7.11																												
BKF Mean Depth (ft)	0.57	0.65																												
BKF Max Depth (ft)	1.04	1.05																												
Width/Depth Ratio	20.56	16.82																												
Entrenchment Ratio	5.94	6.4																												
Wetted Perimeter (ft)	12.1	11.29																												
Hydraulic Radius (ft)	0.55	0.63																												

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	6.7	28.7	21.4									
Radius of Curvature (ft)	12.4	20.4	15.1	10.8	23.8	15.7									
Meander Wavelength (ft)	49.7	67.7	61.6	50.1	69.4	61.5									
Meander Width Ratio	1.0	2.6	2.0	0.6	2.6	2.0									
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	7.0	14.9	11.4	5.8	12.2	8.1									
Riffle Slope (ft/ft)	--	--	--	0.01092	0.04369	0.02507									
Pool Length (ft)	12.2	19.7	16.32	8.1	24.4	16.8									
Pool Spacing (ft)	42.22	51.13	44.63	27.9	66.3	49.4									
Substrate															
d50 (mm)	0.14			0.16											
d84 (mm)	0.41			0.42											
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.01243			0.01252											
Monitored Channel Length (ft)	463			464											
Monitored Valley Length (ft)	346			345											
Sinuosity	1.34			1.35											
Total Channel Length (ft)	790			790											
Rosgen Classification	C5			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
10/13/09 - 10/14/09	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%	100%			
Pools	100%	100%	100%			
Thalwegs	100%	100%	100%			
Meanders	100%	100%	95%			
Bed General	100%	100%	100%			
Structures	100%	100%	95%			
Rootwads	100%	100%	95%			

Reach R1A (1040ft)

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
Riffles	100%	100%	100%			
Pools	100%	100%	100%			
Thalwegs	100%	100%	100%			
Meanders	100%	100%	100%			
Bed General	100%	100%	100%			
Structures	100%	100%	100%			
Rootwads	100%	100%	100%			

Reach R2 (7107ft)

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
Riffles	100%	100%	100%			
Pools	100%	100%	100%			
Thalwegs	100%	100%	100%			
Meanders	100%	100%	95%			
Bed General	100%	100%	100%			
Structures	100%	100%	95%			
Rootwads	100%	100%	95%			

Reach R2A (336ft)

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
Riffles	100%	100%	100%			
Pools	100%	100%	100%			
Thalwegs	100%	100%	100%			
Meanders	100%	100%	100%			
Bed General	100%	100%	100%			
Structures	100%	100%	100%			
Rootwads	100%	100%	100%			

Reach R2B (1474ft)

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
Riffles	100%	100%	100%			
Pools	100%	100%	100%			
Thalwegs	100%	100%	100%			
Meanders	100%	100%	100%			
Bed General	100%	100%	100%			
Structures	100%	100%	100%			
Rootwads	100%	100%	100%			

Reach R2D (790ft)

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
Riffles	100%	100%	100%			
Pools	100%	100%	100%			
Thalwegs	100%	100%	100%			
Meanders	100%	100%	100%			
Bed General	100%	100%	100%			
Structures	100%	100%	100%			
Rootwads	100%	100%	100%			

Notes: The results shown above as less than 100% percent, reflect the construction of beaver dams on the respective reaches during MY-02 (2009).

Table XII. Stream Problem Areas (Year 2 of 5)
Little White Oak Creek Stream Restoration / D06027-B

Feature/Issue	Station / Range	Probable Cause	Photo No. (If Available)
Beaver dams constructed	Reach -R1- scattered reach-wide	Beavers	N/A
Beaver dams constructed	Reach -R2- Upper scattered reach-wide	Beavers	N/A
Beaver dams constructed	Reach -R2- Lower scattered reach-wide	Beavers	N/A

Table XII. Stream Problem Areas (Year 1 of 5)
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.

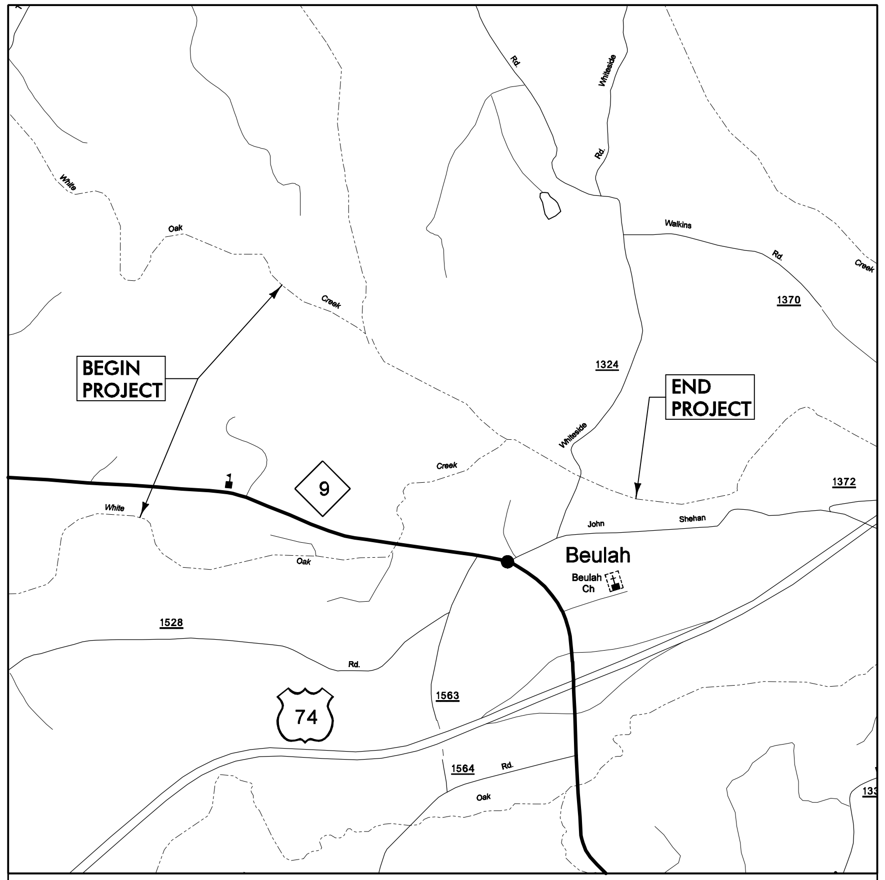
SCO ID NO. D06027-B

POLK COUNTY

LITTLE WHITE OAK CREEK STREAM RESTORATION SITE

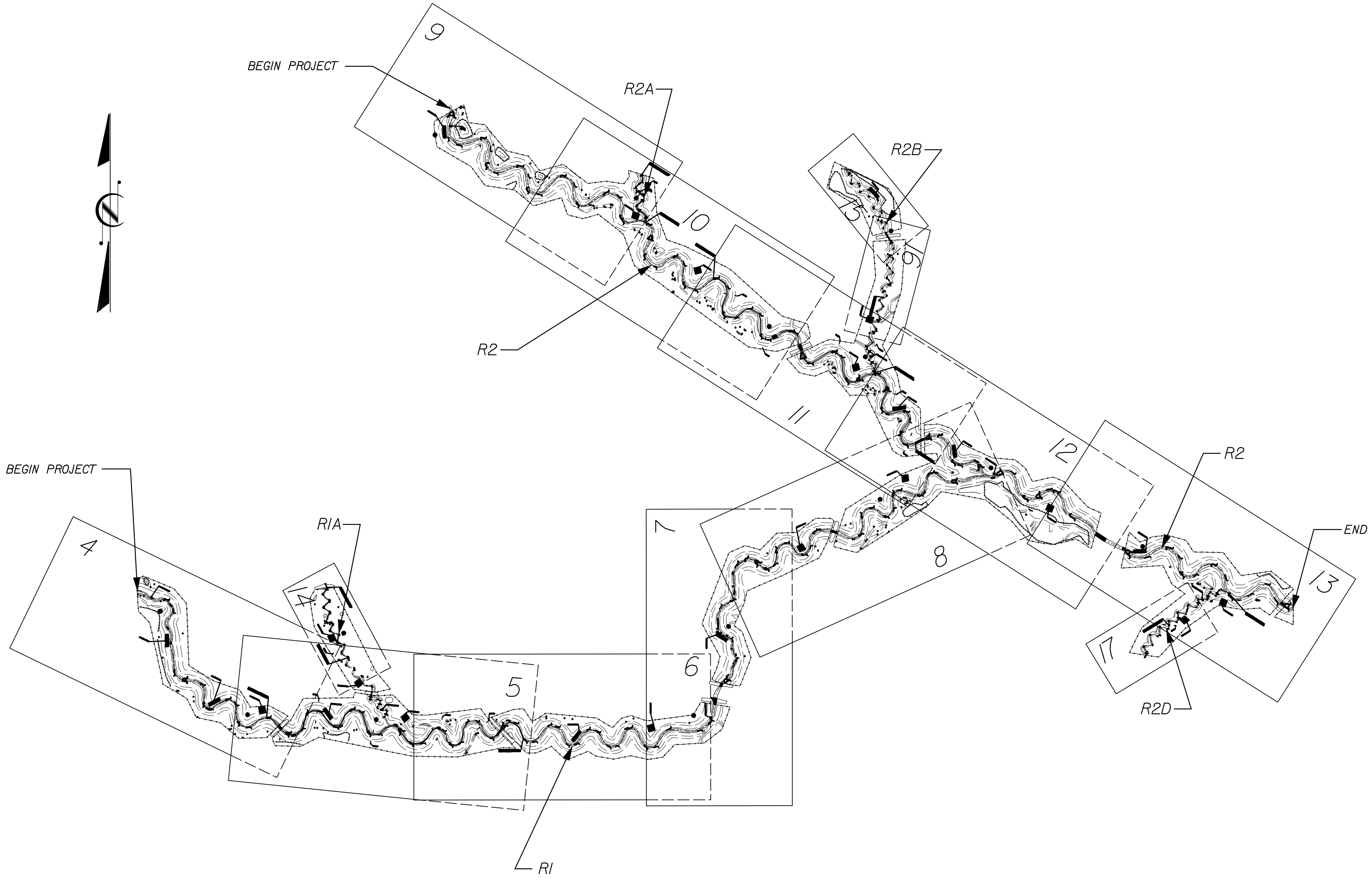
LOCATION: NORTHEAST OF THE INTERSECTION OF NC 9 AND US 74 (EXIT 167)

YEAR 2 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

REVISIONS

DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING
11/25/09	EMP	YEAR 2 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
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(919) 851-1918 (FAX)
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MULKEY PROJECT MANAGER
WENDEE B. SMITH

MULKEY SENIOR ENGINEER
WILLIAM SCOTT HUNT, III, PE

MULKEY SENIOR SCIENTIST
THOMAS BARRETT, RF

PROJECT ENGINEER

TITLE SHEET

1 SHEET OF 19

NOTE: NOT TO SCALE
Not all symbols used in plans

LEGEND

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

PROJECT ENGINEER

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

LEGEND

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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	FLOW
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	Ⓢ
Storm Sewer	S

UTILITIES:

POWER:

Existing Power Pole	●
Existing Joint Use Pole	●
Power Manhole	Ⓟ
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	Ⓣ
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	Ⓦ
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	Ⓢ
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:

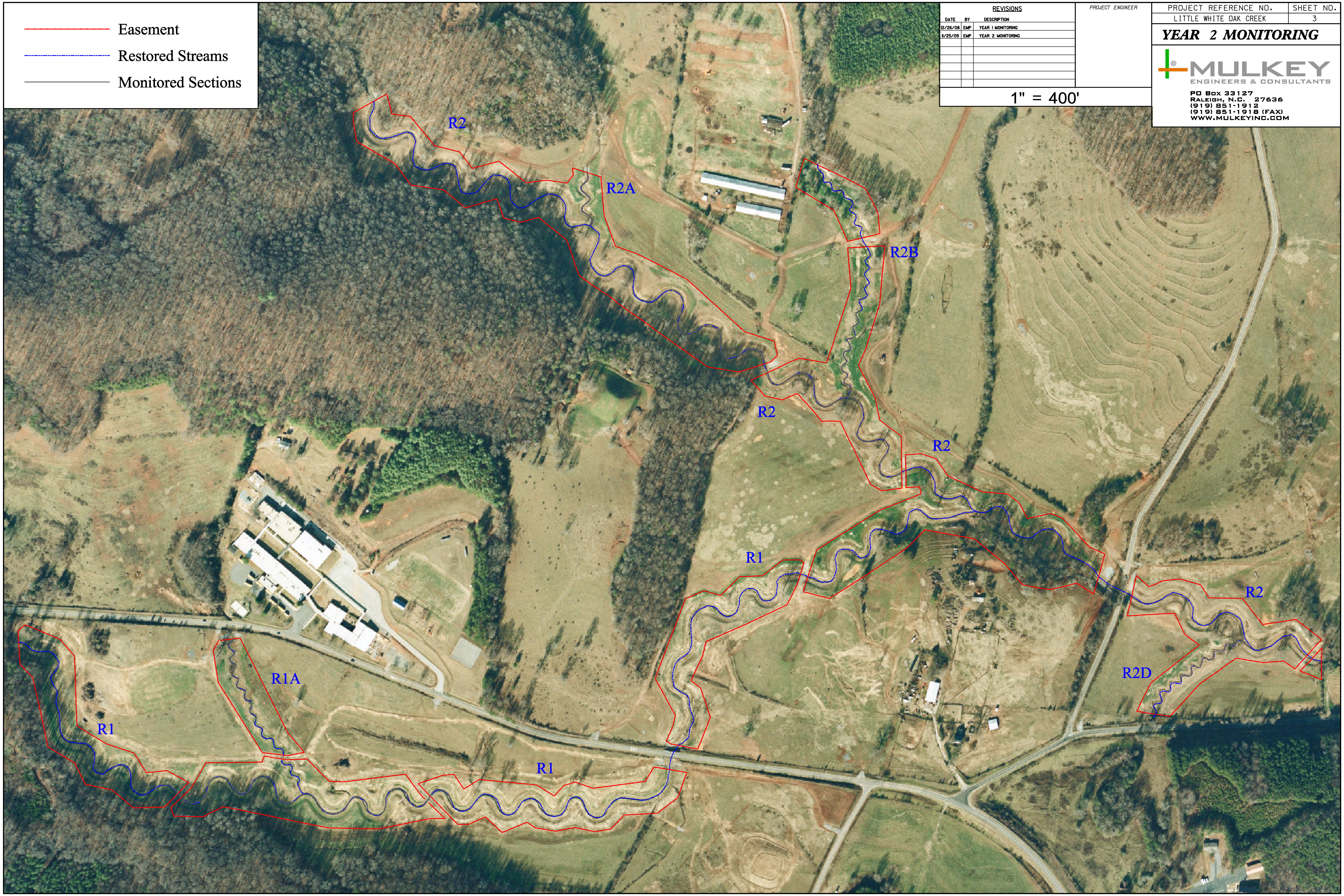
Rock Crossvane	
Rock Vane	
J Hook Rock Vane	
Flood Plane Interceptor	
Constructed Riffle	
Root Wad	
Structure Number	I
Constructed Flood Plane Interceptor	

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	



REVISIONS

DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING
11/25/09	EMP	YEAR 2 MONITORING

PROJECT ENGINEER

1" = 400'

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

YEAR 2 MONITORING

MULKEY
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$TIME$
$DATE$

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

YEAR 2 MONITORING

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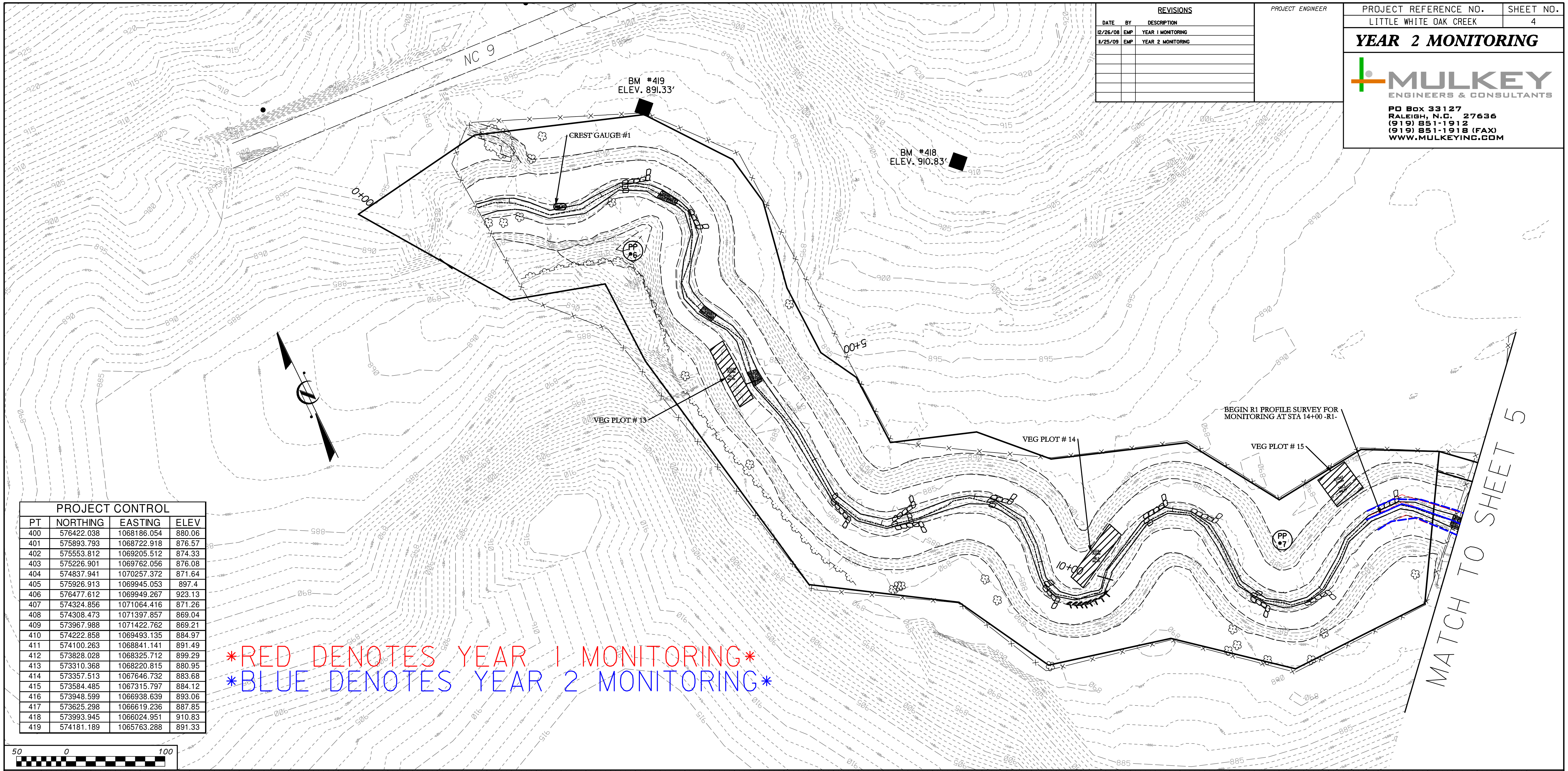
PROJECT ENGINEER

REVISIONS

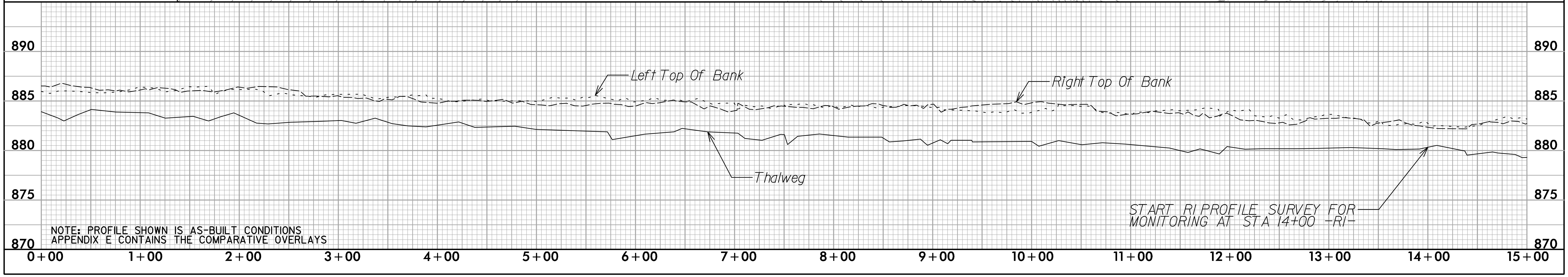
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING
11/25/09	EMP	YEAR 2 MONITORING



RED DENOTES YEAR 1 MONITORING
BLUE DENOTES YEAR 2 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
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: PROFILE SHOWN IS AS-BUILT CONDITIONS
APPENDIX E CONTAINS THE COMPARATIVE OVERLAYS

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING
11/25/09	EMP	YEAR 2 MONITORING

PROJECT ENGINEER

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

YEAR 2 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
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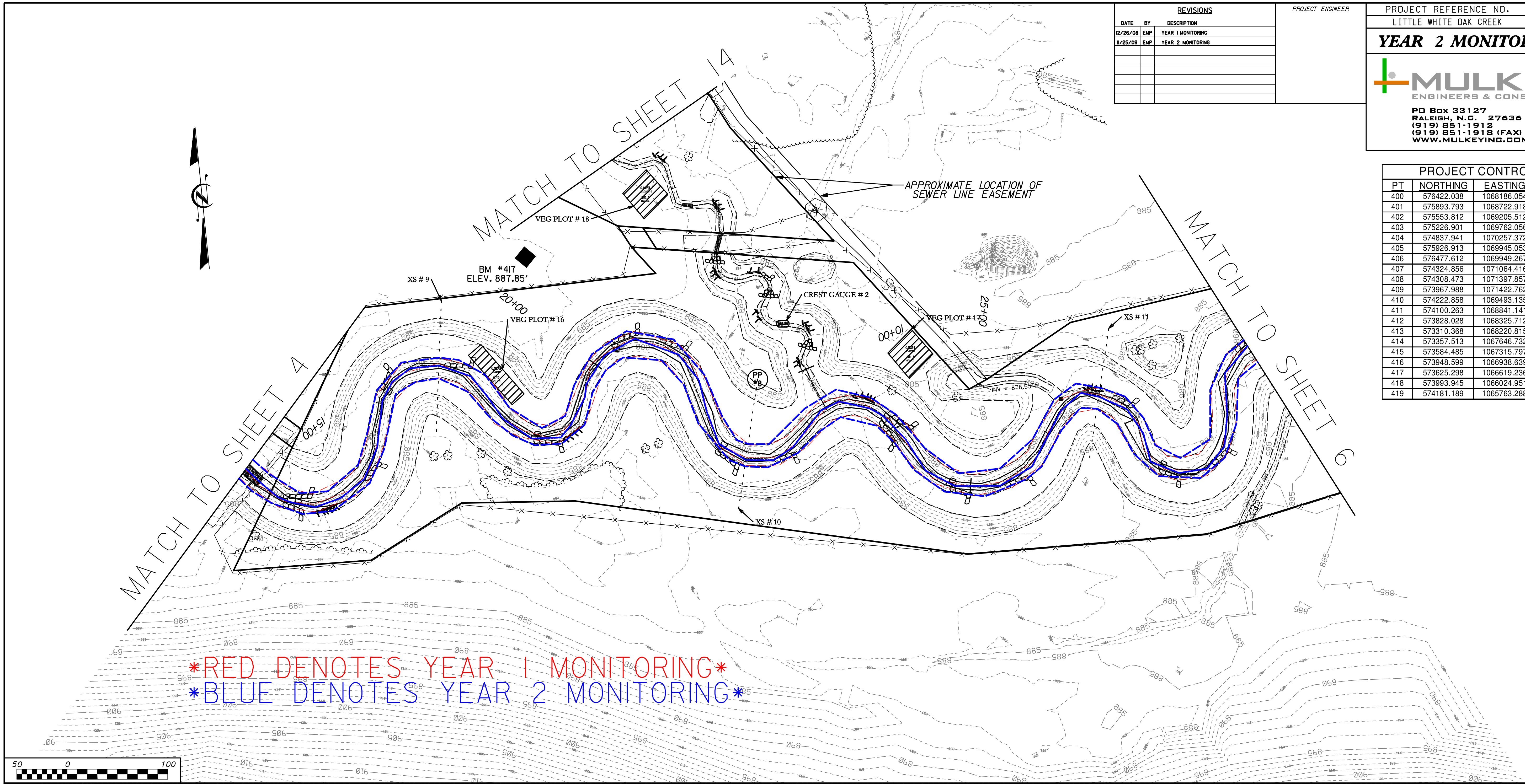
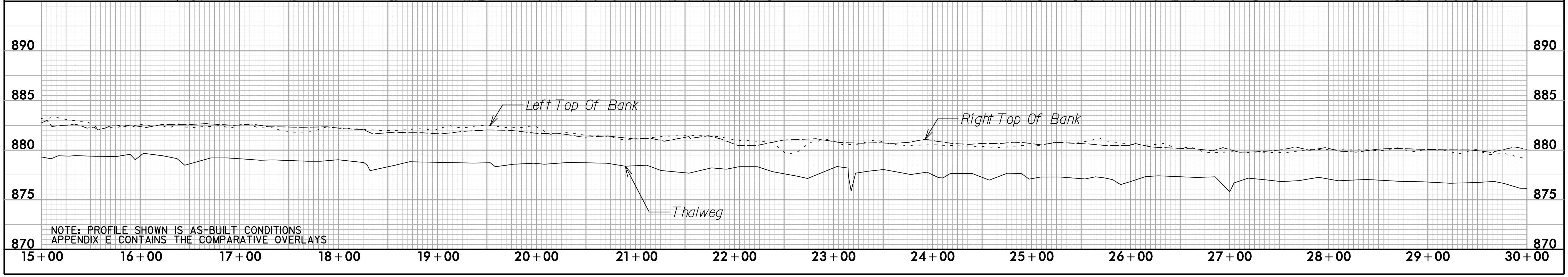
419	574181.189	1065763.288	891.33



RED DENOTES YEAR 1 MONITORING
BLUE DENOTES YEAR 2 MONITORING



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

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

YEAR 2 MONITORING

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REVISIONS

DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING
11/25/09	EMP	YEAR 2 MONITORING

PROJECT CONTROL

PT	NORTHING	EASTING	ELEV
400	576422.038	1068186.054	880.06
401	575893.793	1068722.918	876.57
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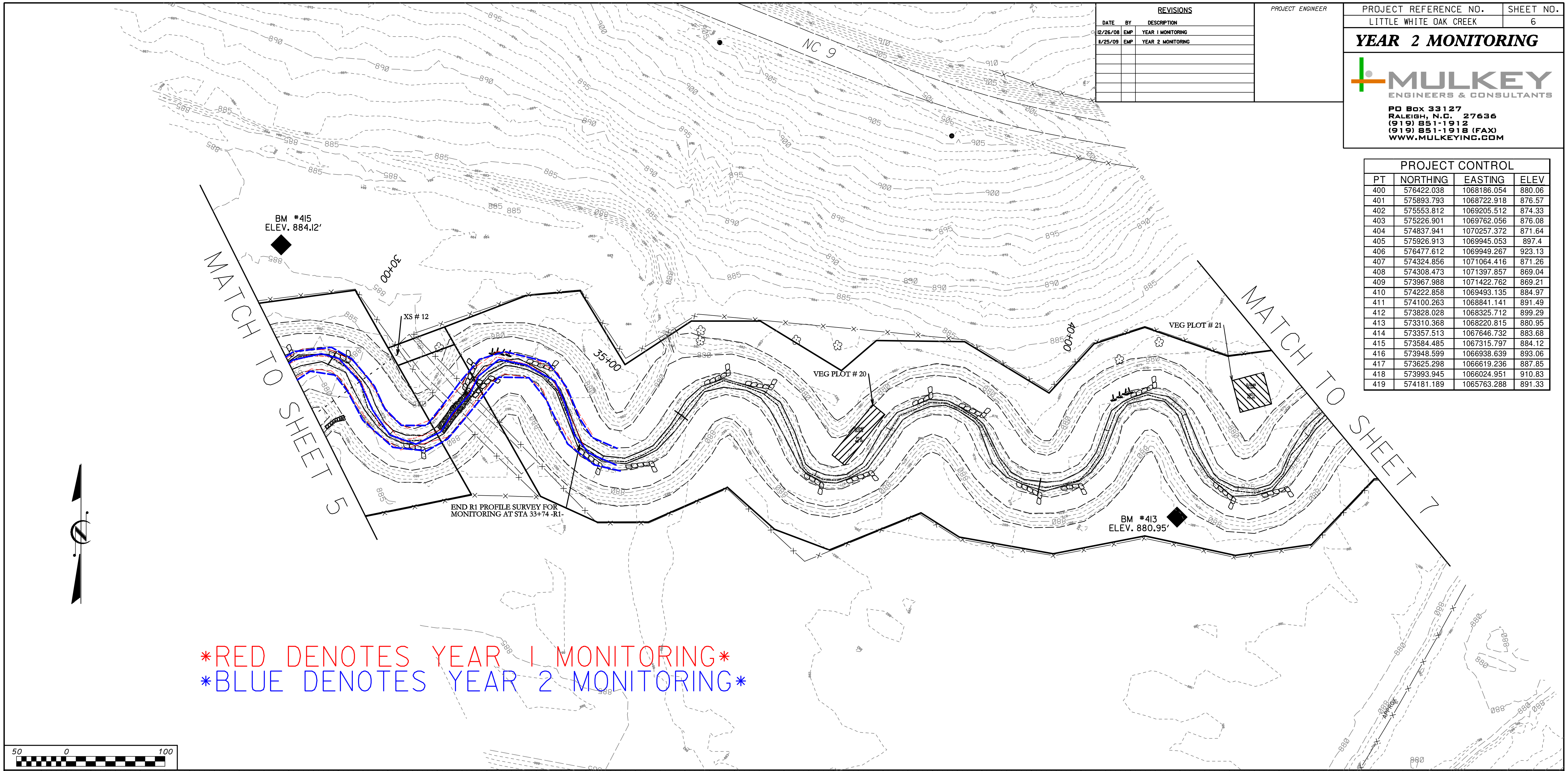
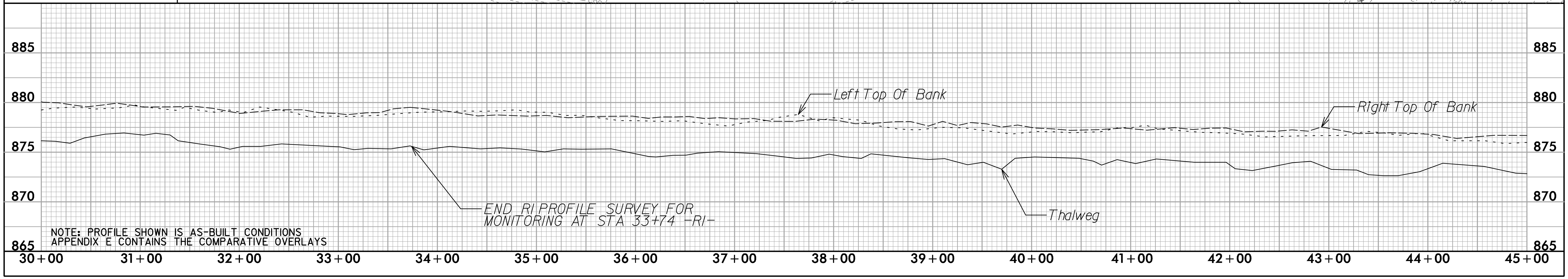


RED DENOTES YEAR 1 MONITORING
BLUE DENOTES YEAR 2 MONITORING



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

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

YEAR 2 MONITORING

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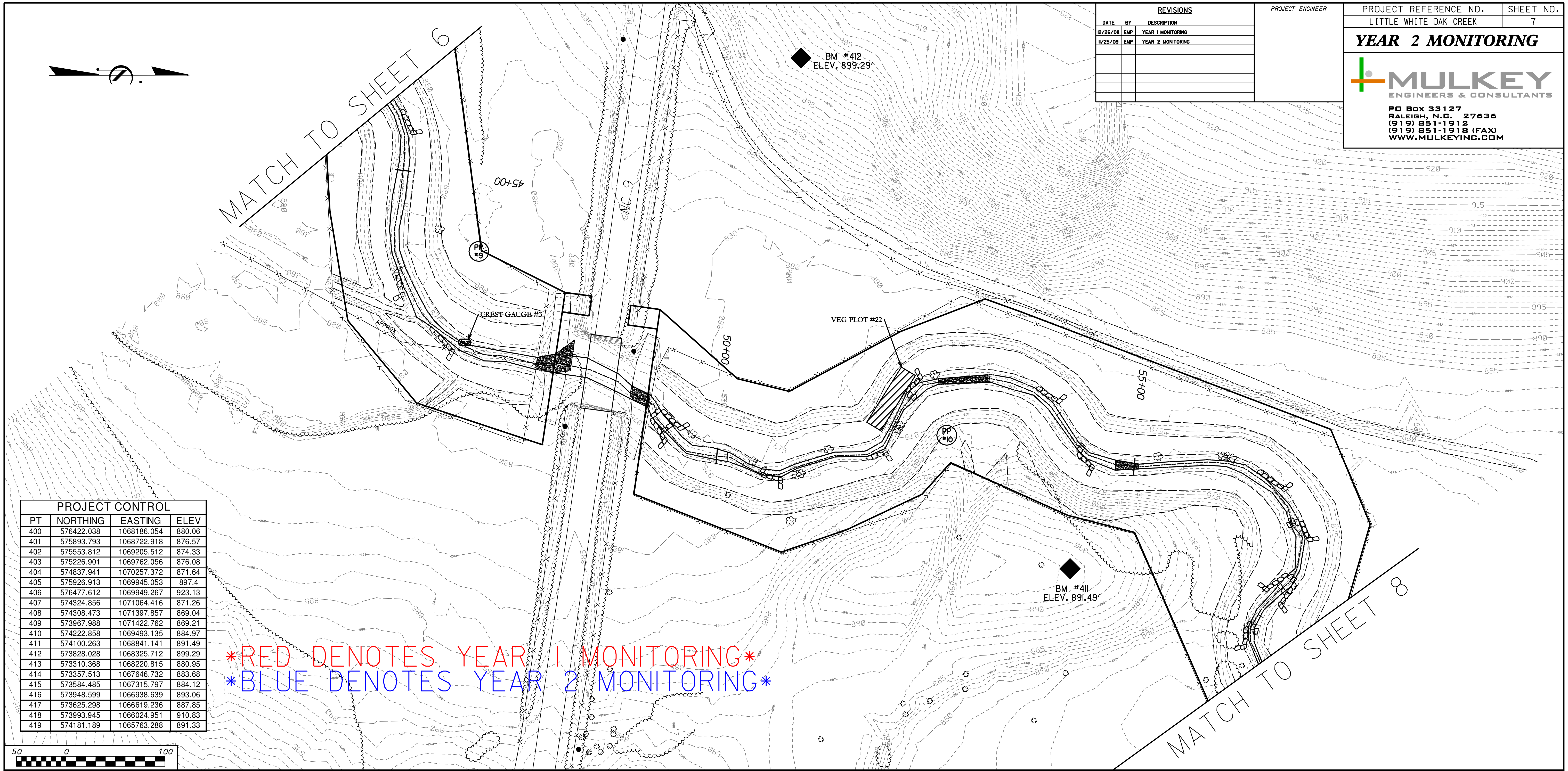
REVISIONS

DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING
11/25/09	EMP	YEAR 2 MONITORING



RED DENOTES YEAR 1 MONITORING
BLUE DENOTES YEAR 2 MONITORING

PROJECT CONTROL

PT	NORTHING	EASTING	ELEV
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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
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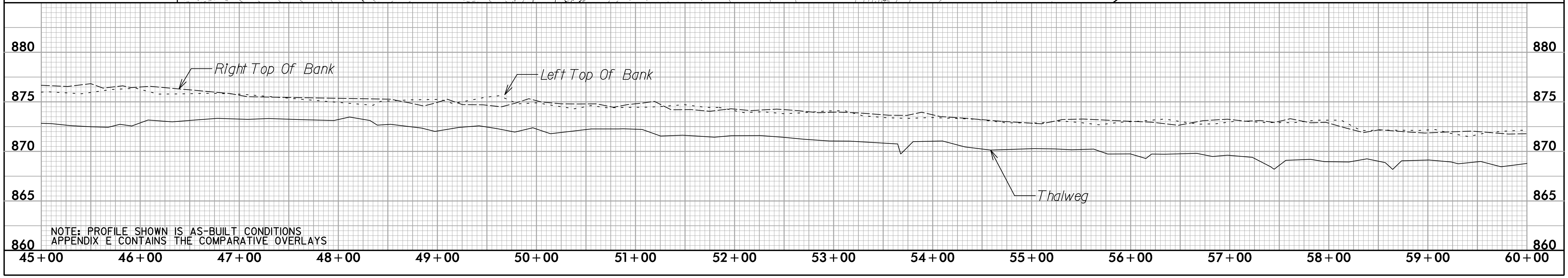

NOTE: PROFILE SHOWN IS AS-BUILT CONDITIONS
APPENDIX E CONTAINS THE COMPARATIVE OVERLAYS

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

YEAR 2 MONITORING

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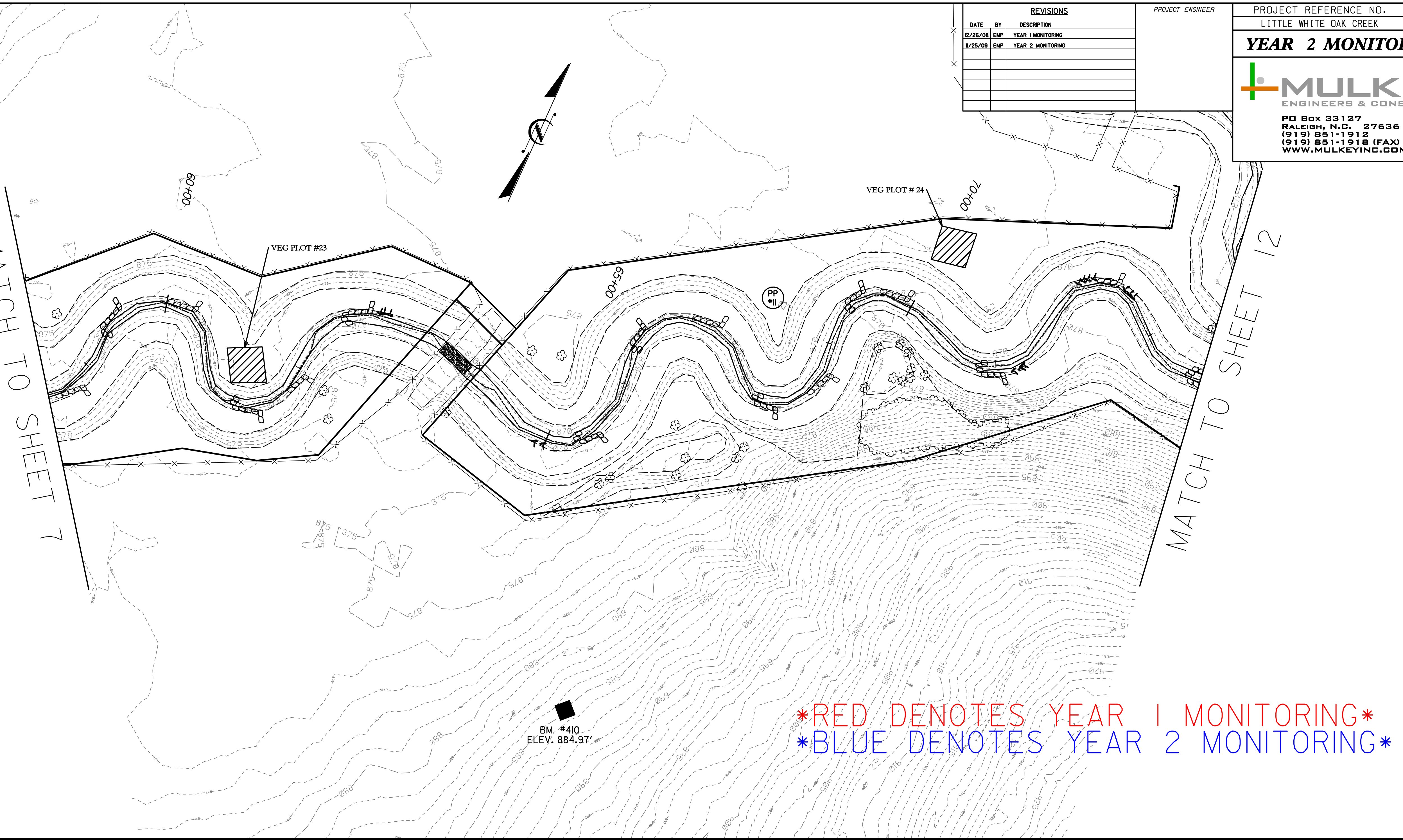
PROJECT ENGINEER

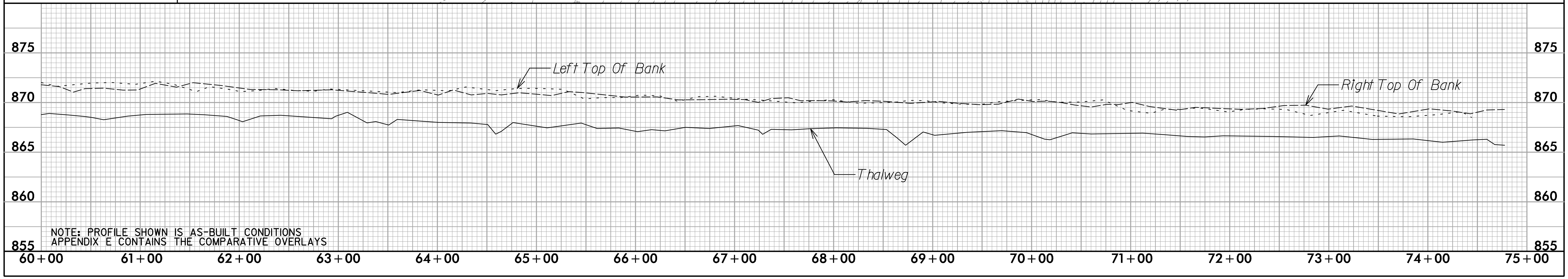
REVISIONS

DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING
11/25/09	EMP	YEAR 2 MONITORING



RED DENOTES YEAR 1 MONITORING
BLUE DENOTES YEAR 2 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
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: PROFILE SHOWN IS AS-BUILT CONDITIONS
APPENDIX E CONTAINS THE COMPARATIVE OVERLAYS

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING
11/25/09	EMP	YEAR 2 MONITORING

PROJECT ENGINEER

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

YEAR 2 MONITORING

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RED DENOTES YEAR 1 MONITORING
BLUE DENOTES YEAR 2 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
404	574837.941	1070257.372	871.64
405	575926.913	1069945.053	897.4
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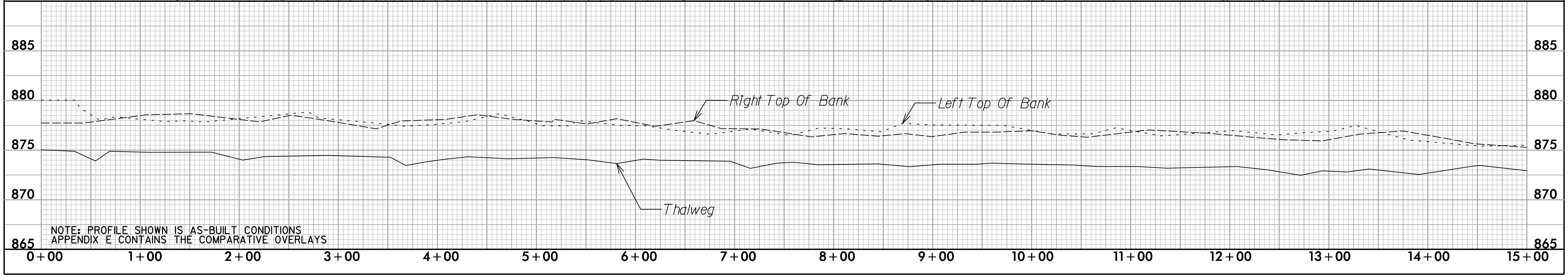
419	574181.189	1065763.288	891.33



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

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

YEAR 2 MONITORING

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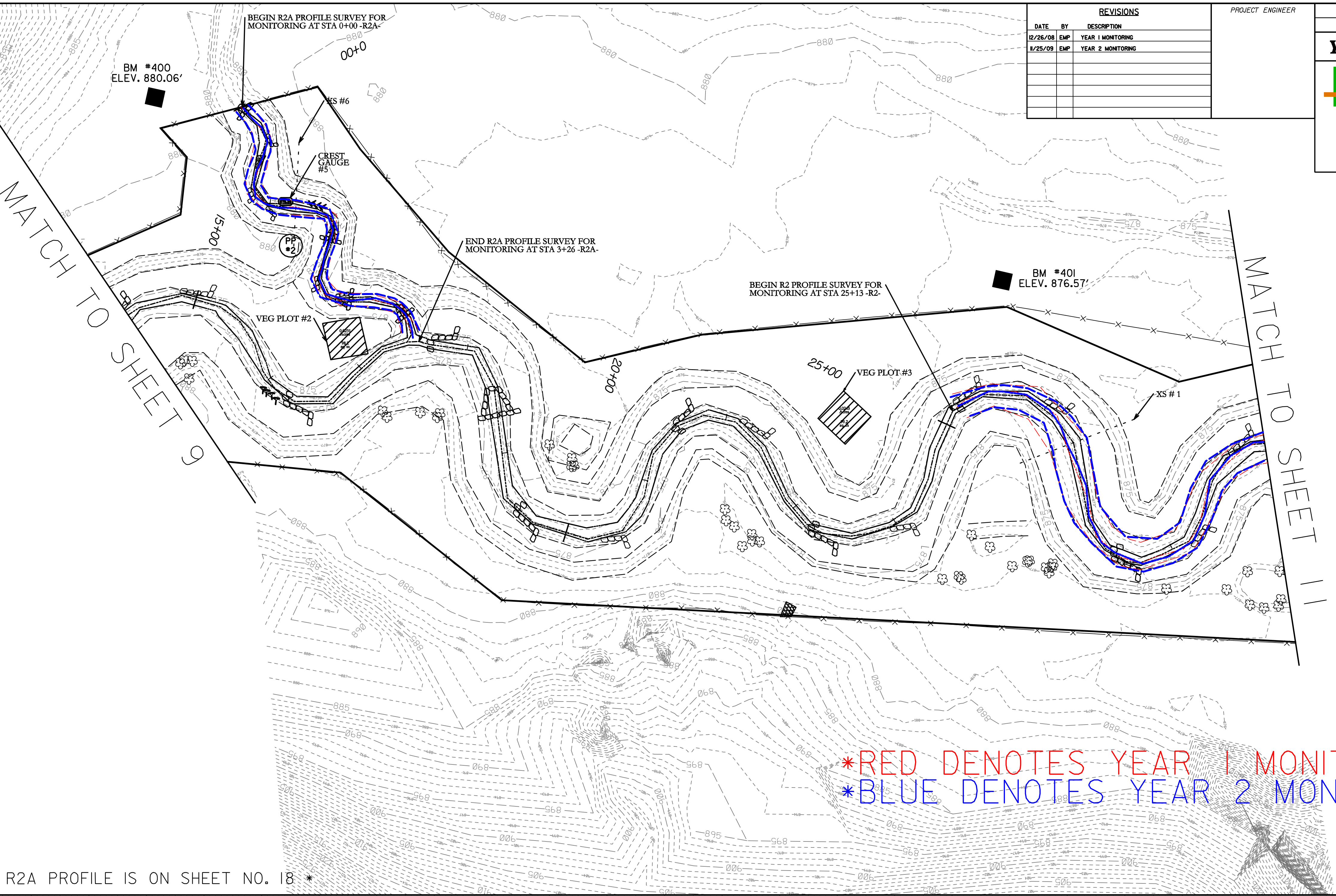
PROJECT ENGINEER

REVISIONS

DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING
11/25/09	EMP	YEAR 2 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
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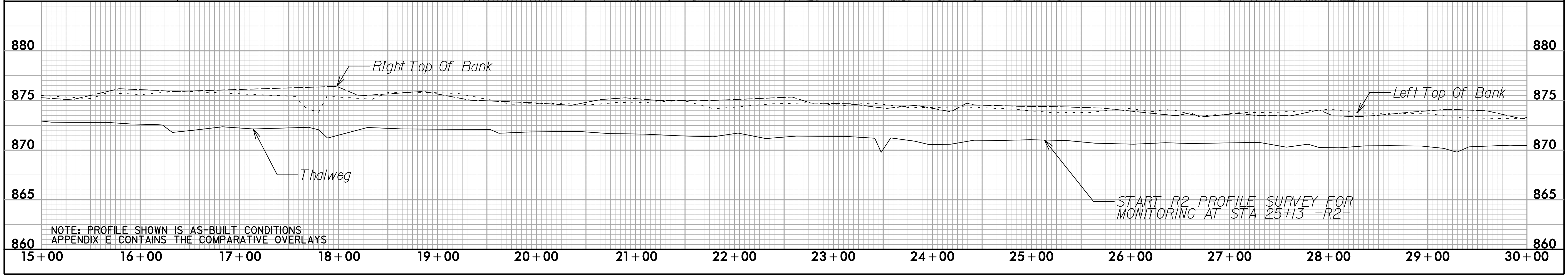
417	573625.298	1066619.236	887.85
418	573993.945	1066024.951	910.83
419	574181.189	1065763.288	891.33

RED DENOTES YEAR 1 MONITORING
BLUE DENOTES YEAR 2 MONITORING

50 0 100

* R2A PROFILE IS ON SHEET NO. 18 *



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

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING
11/25/09	EMP	YEAR 2 MONITORING

PROJECT ENGINEER

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

YEAR 2 MONITORING

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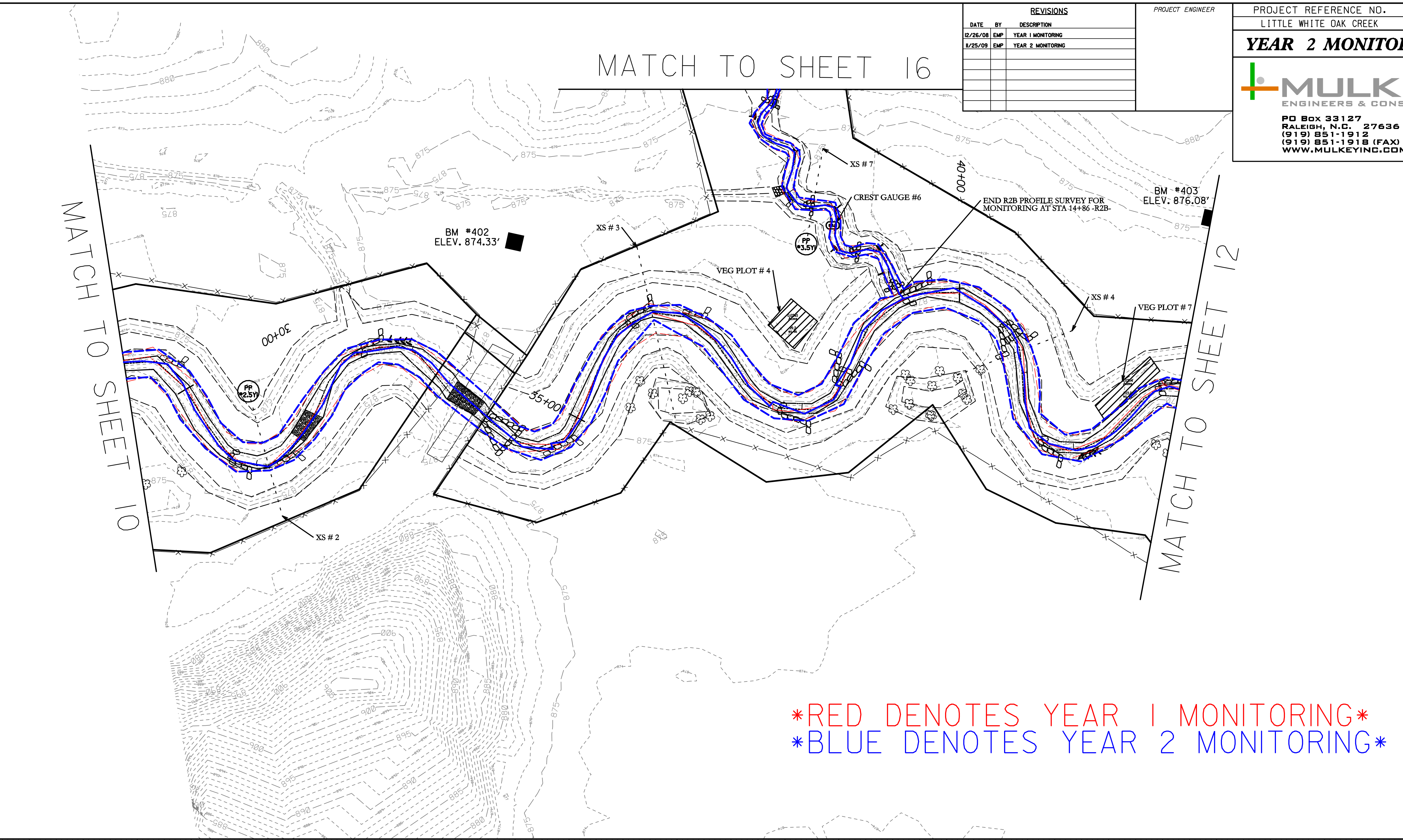

RED DENOTES YEAR 1 MONITORING
BLUE DENOTES YEAR 2 MONITORING

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
404	574837.941	1070257.372	871.64
405	575926.913	1069945.053	897.4
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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

50 0 100

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

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

YEAR 2 MONITORING

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PROJECT ENGINEER

REVISIONS

DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING
11/25/09	EMP	YEAR 2 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
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
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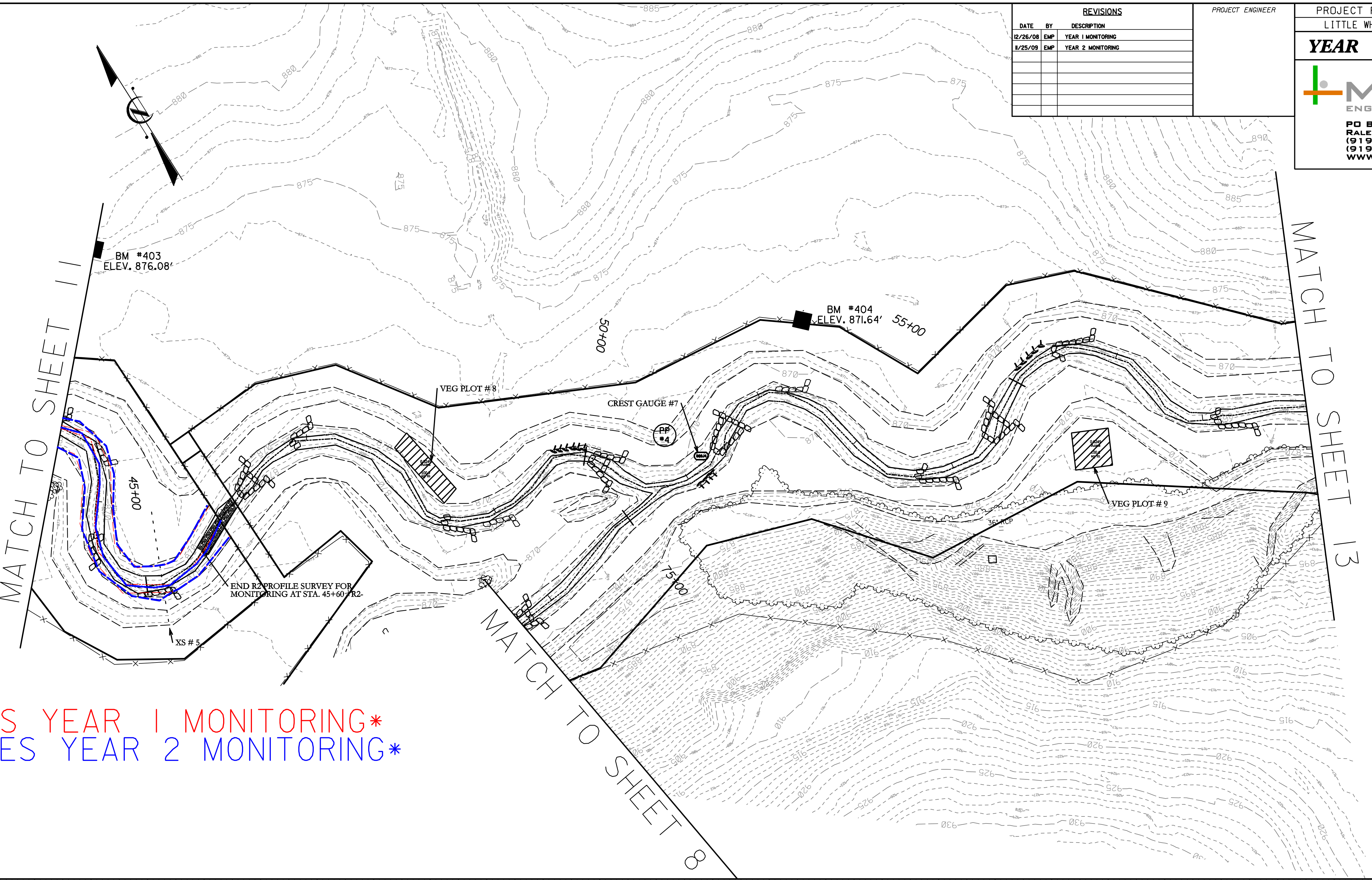
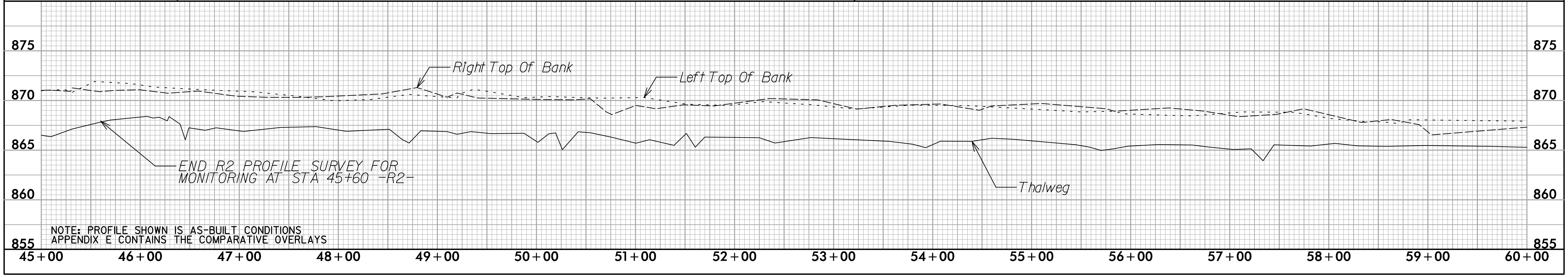
417	573625.298	1066619.236	887.85
418	573993.945	1066024.951	910.83
419	574181.189	1065763.288	891.33



RED DENOTES YEAR 1 MONITORING
BLUE DENOTES YEAR 2 MONITORING



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

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

YEAR 2 MONITORING

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PROJECT ENGINEER

REVISIONS

DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING
11/25/09	EMP	YEAR 2 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
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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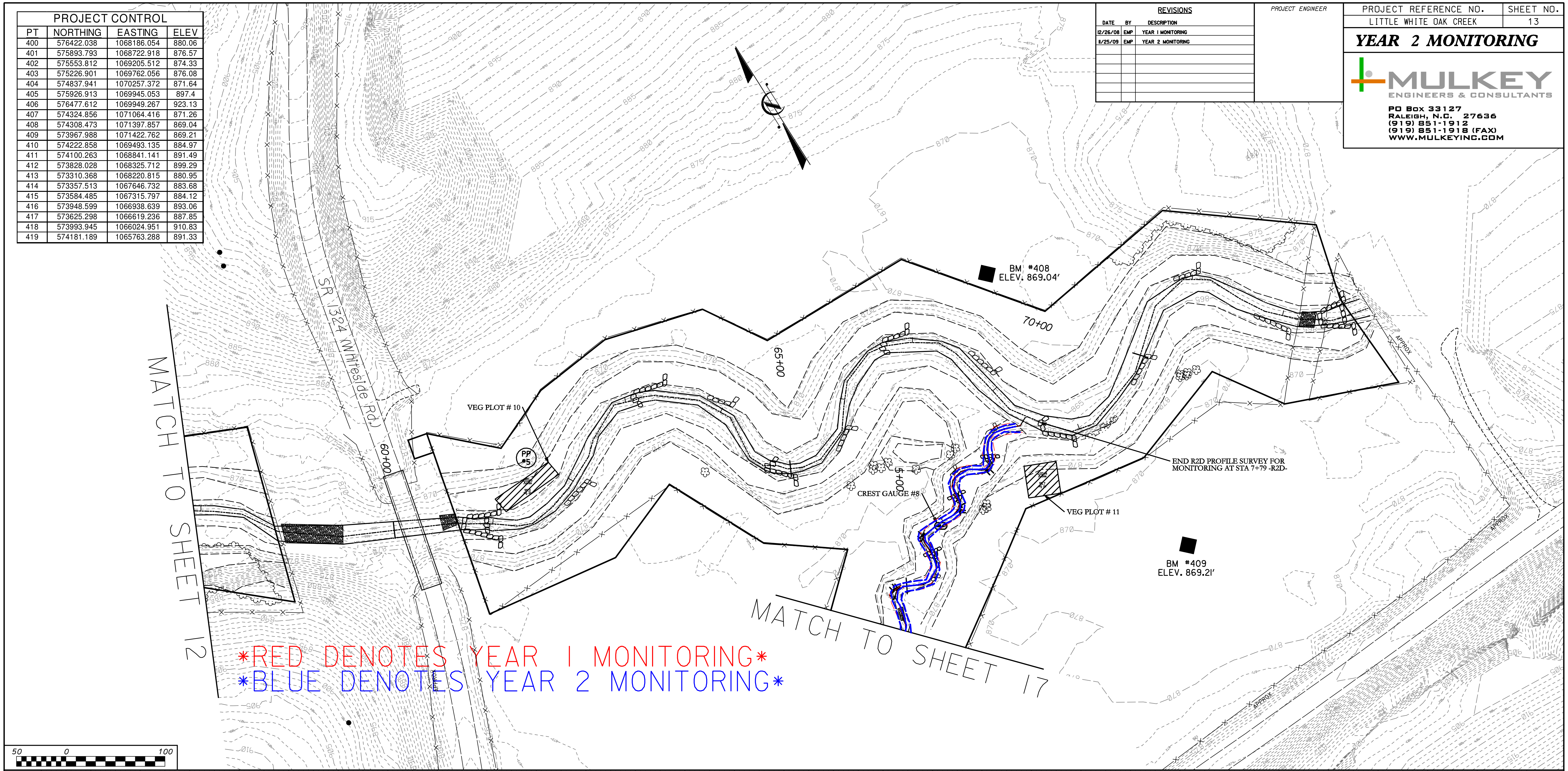
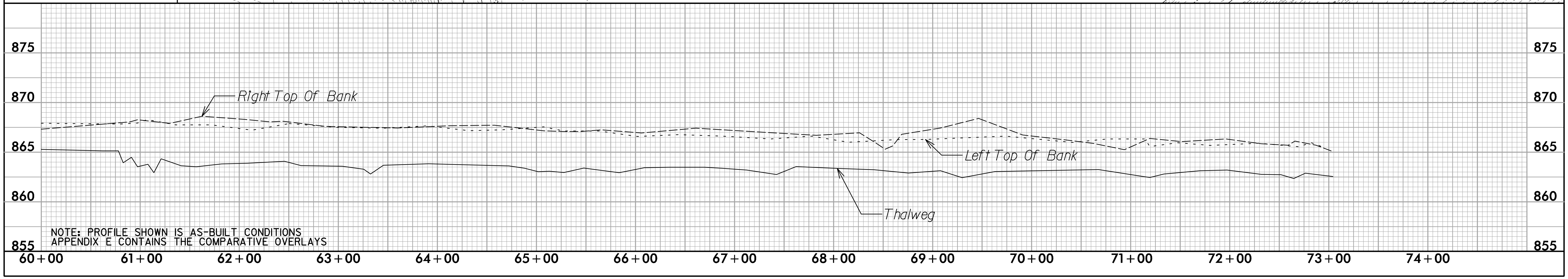
418	573993.945	1066024.951	910.83
419	574181.189	1065763.288	891.33



RED DENOTES YEAR 1 MONITORING

BLUE DENOTES YEAR 2 MONITORING



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

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

YEAR 2 MONITORING

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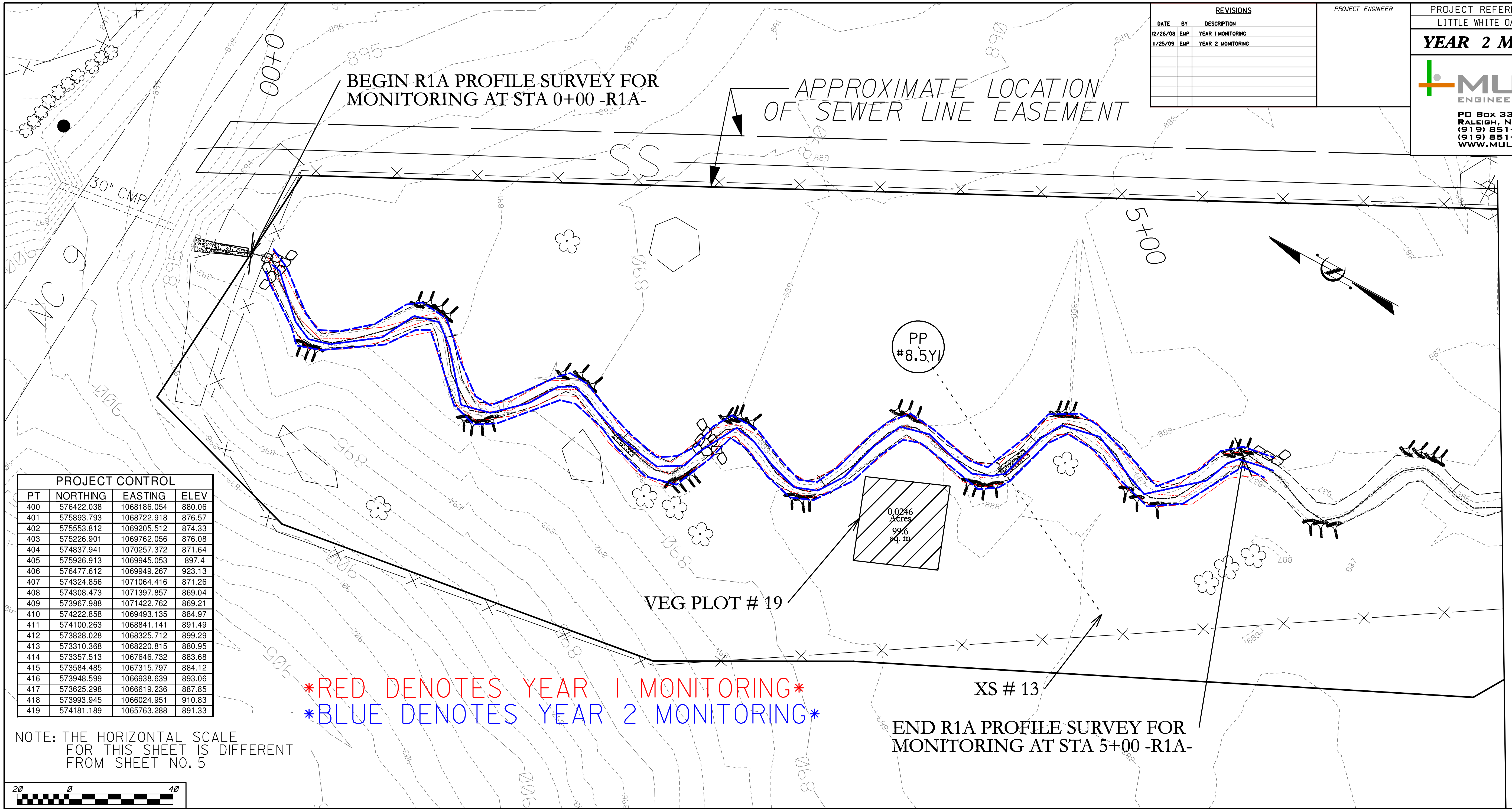
PROJECT ENGINEER

REVISIONS

DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING
11/25/09	EMP	YEAR 2 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
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
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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
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

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
11/25/09	EMP	YEAR 2 MONITORING

PROJECT ENGINEER

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

YEAR 2 MONITORING

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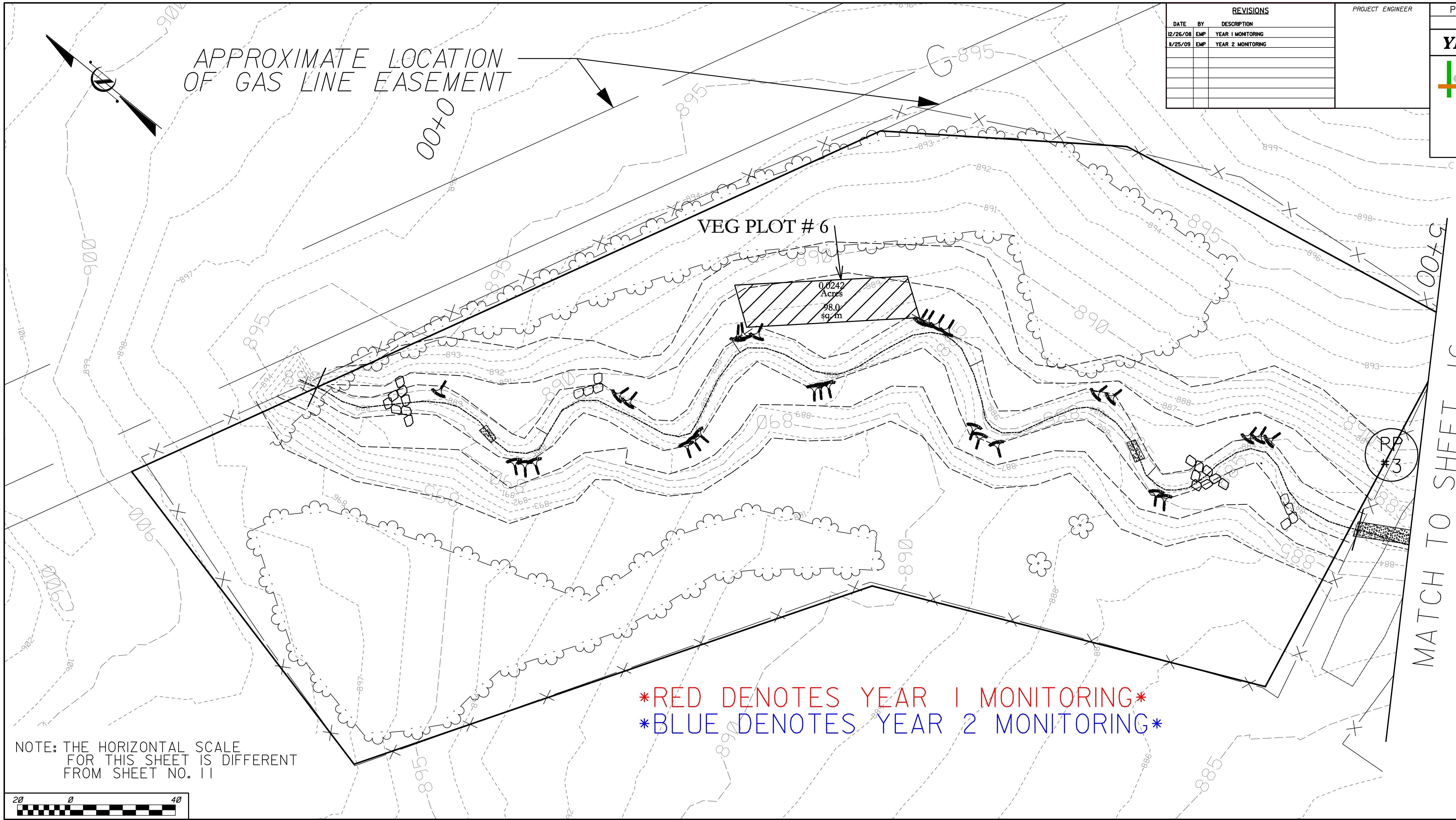

RED DENOTES YEAR 1 MONITORING
BLUE DENOTES YEAR 2 MONITORING

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

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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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

SEE SHEET NO. 19 FOR -R2B- PROFILE

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

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

YEAR 2 MONITORING

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PROJECT ENGINEER

REVISIONS

DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING
11/25/09	EMP	YEAR 2 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
404	574837.941	1070257.372	871.64
405	575926.913	1069945.053	897.4
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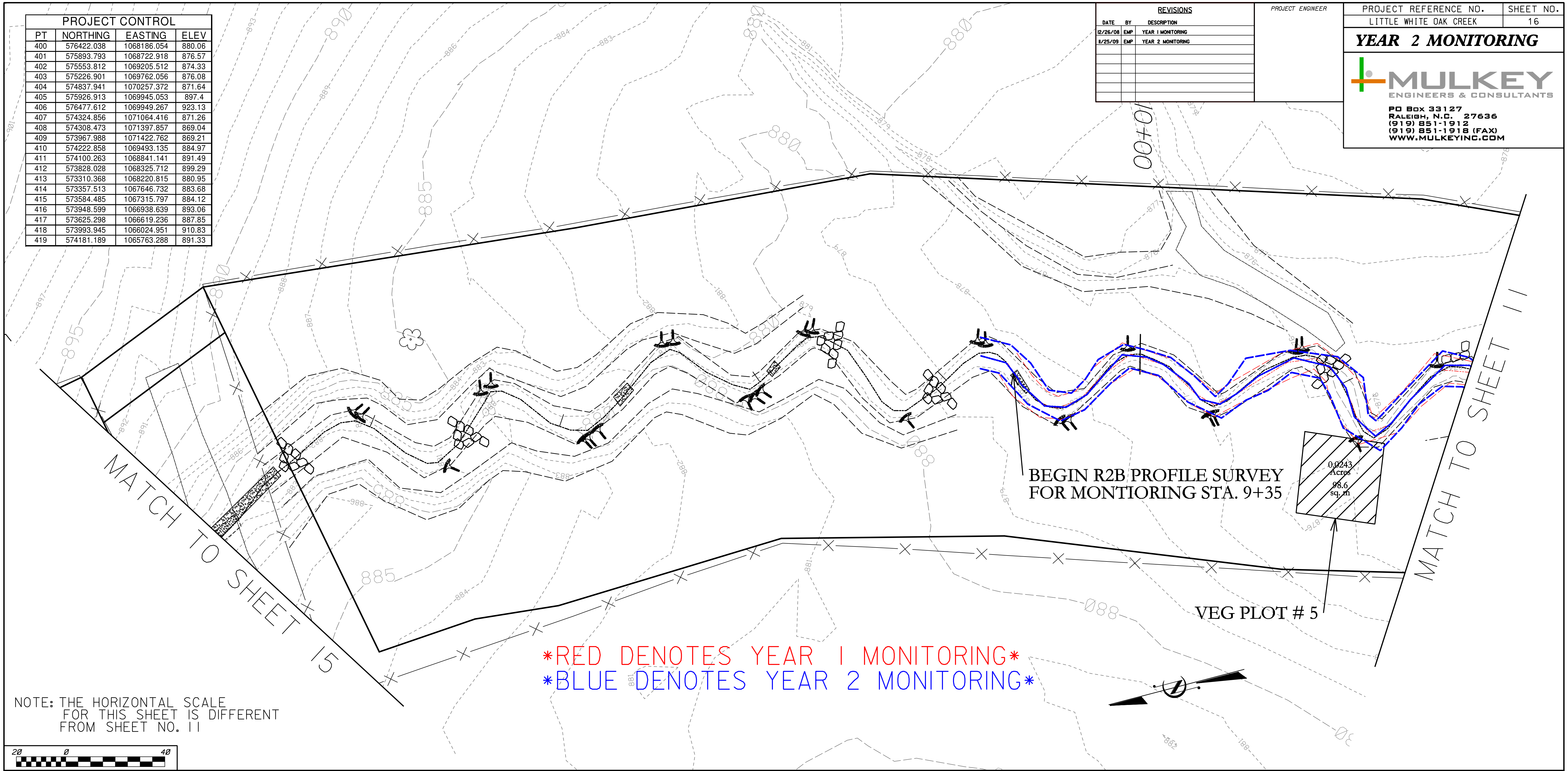
417	573625.298	1066619.236	887.85
418	573993.945	1066024.951	910.83
419	574181.189	1065763.288	891.33



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

SEE SHEET NO. 19 FOR -R2B- PROFILE

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

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

YEAR 2 MONITORING

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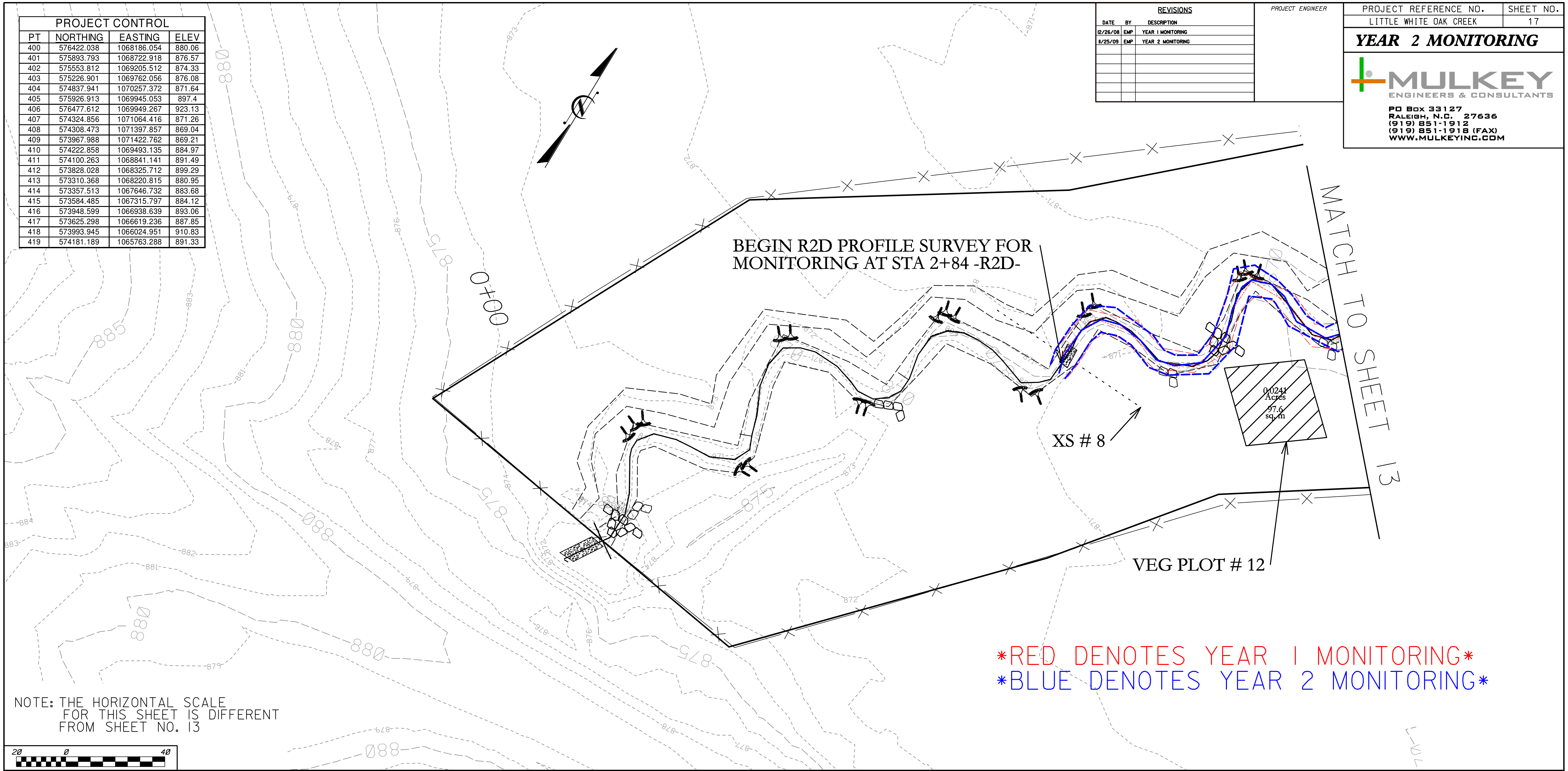
PROJECT ENGINEER

REVISIONS

DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING
11/25/09	EMP	YEAR 2 MONITORING



RED DENOTES YEAR 1 MONITORING
BLUE DENOTES YEAR 2 MONITORING

PROJECT CONTROL

PT	NORTHING	EASTING	ELEV
400	576422.038	1068186.054	880.06
401	575893.793	1068722.918	876.57
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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

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

20 0 40

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
11/25/09	EMP	YEAR 2 MONITORING

PROJECT ENGINEER

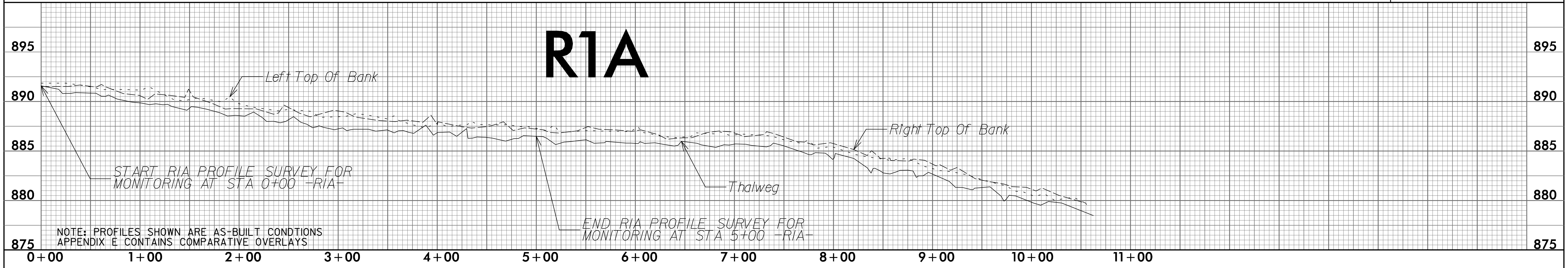
PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	18

YEAR 2 MONITORING

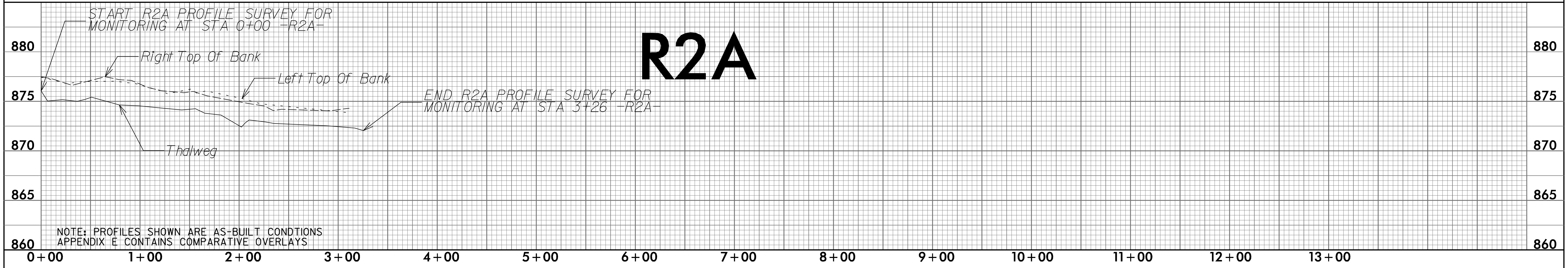
MULKEY ENGINEERS & CONSULTANTS

HORIZONTAL SCALE 50 0 100

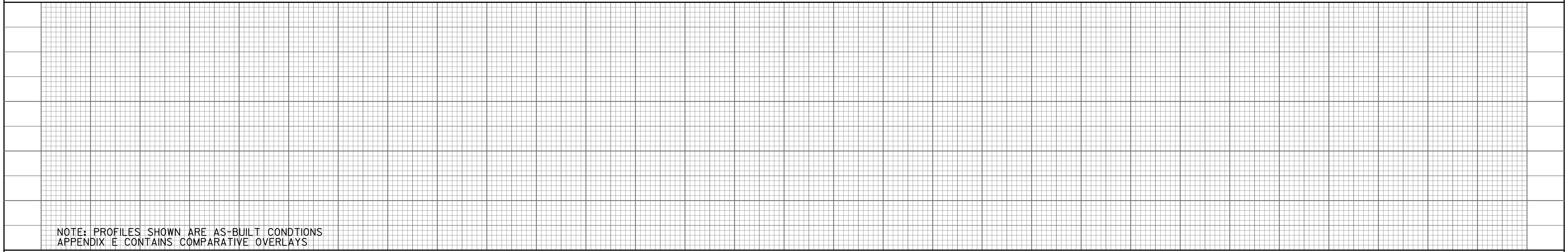
VERTICAL SCALE 5 0 10



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



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



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

AS-BUILT PROFILES

REVISIONS		
DATE	BY	DESCRIPTION
12/26/08	EMP	YEAR 1 MONITORING
11/25/09	EMP	YEAR 2 MONITORING

PROJECT ENGINEER

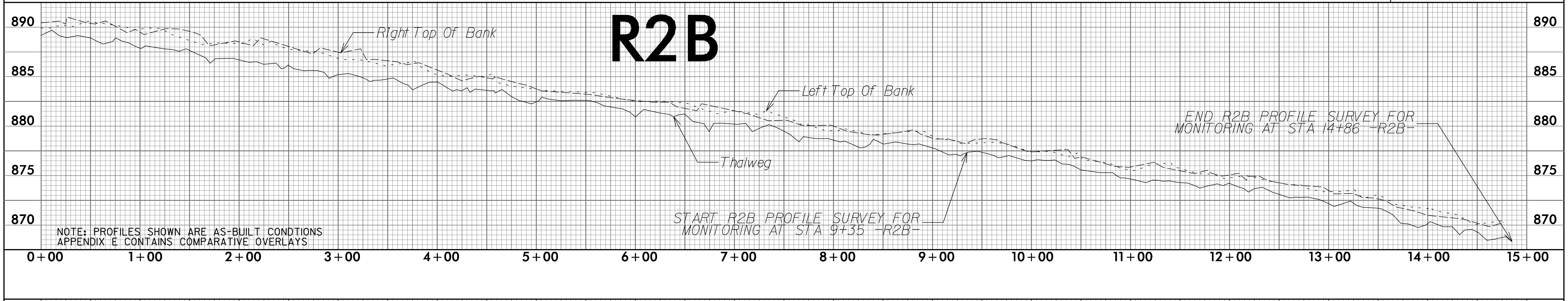
PROJECT REFERENCE NO.	SHEET NO.
LITTLE WHITE OAK CREEK	19

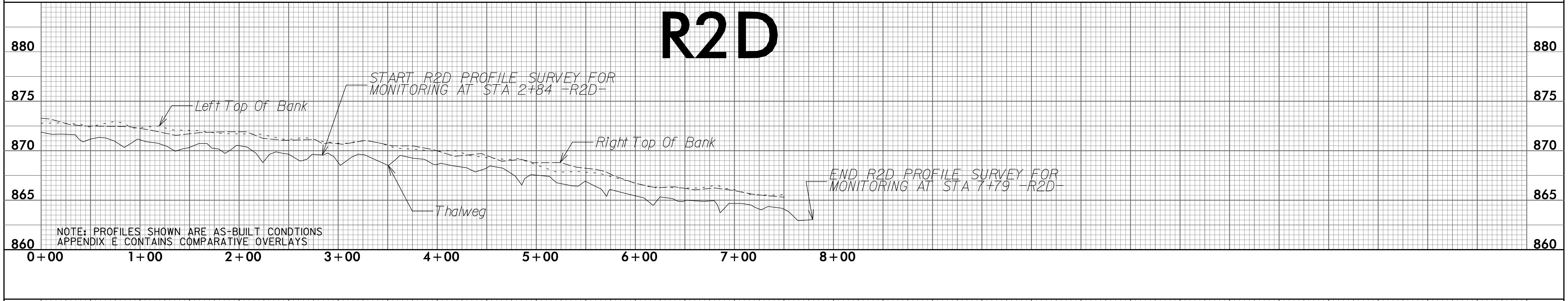
YEAR 2 MONITORING

MULKEY
ENGINEERS & CONSULTANTS

HORIZONTAL SCALE 50 0 100

VERTICAL SCALE 5 0 10





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

Vegetation Plot 1

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring: October 2009

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: October 2009

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: October 2009

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: October 2009

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 5


01/30/2008

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring: October 2009

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: October 2009

Year 3 Monitoring:

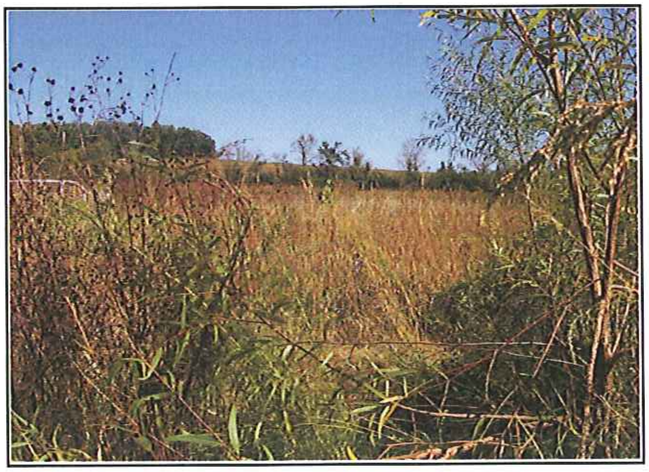
Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 7

As-built Survey: January 2008

Year 1 Monitoring: September 2008



Year 2 Monitoring: October 2009

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: October 2009

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: October 2009

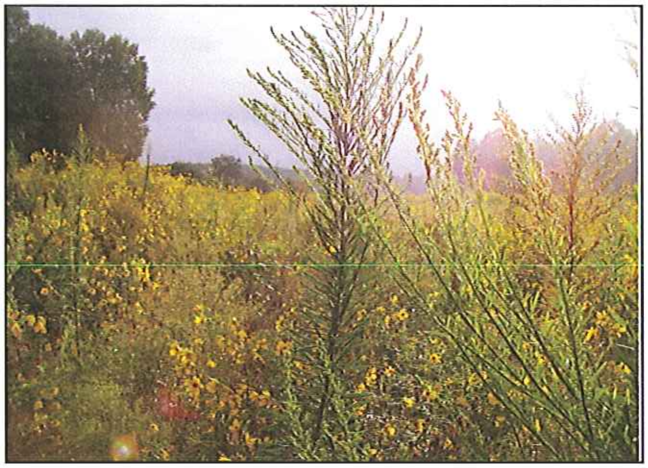
Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 10

As-built Survey: January 2008



Year 1 Monitoring: September 2008

Year 2 Monitoring: October 2009

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegetation Plot 11


01/31/2008

As-built Survey: January 2008

Year 1 Monitoring: September 2008

Year 2 Monitoring: October 2009

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: October 2009

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: October 2009

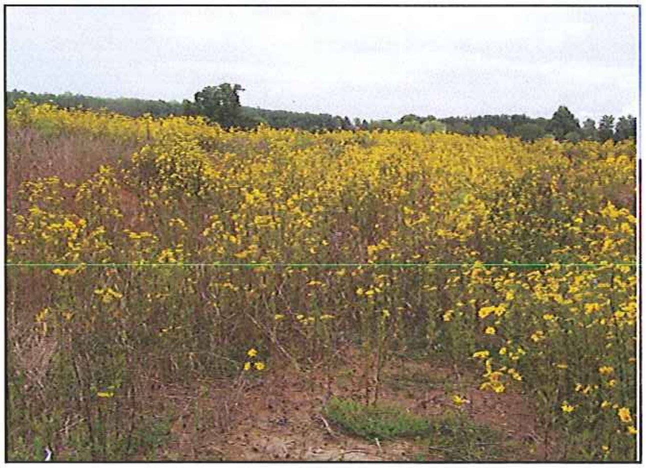
Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Vegeation Plot 14

As-built Survey: January 2008



Year 1 Monitoring: September 2008

Year 2 Monitoring: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

Year 3 Monitoring:

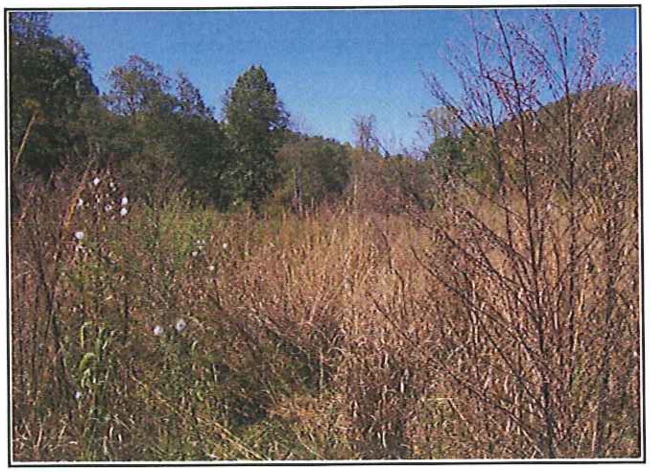
Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 2; Looking Upstream on Reach R2

As-built Survey: January 2008

Year 1 Monitoring: September 2008



Year 2 Monitoring: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

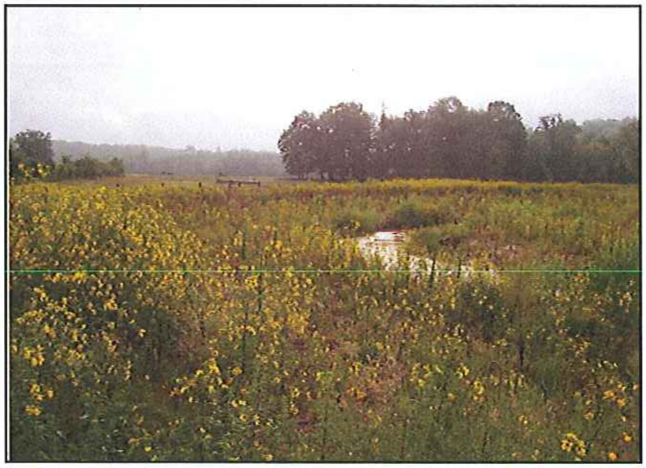
Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Photo Point 5; Looking Downstream

As-built Survey: January 2008



Year 1 Monitoring: September 2008

Year 2 Monitoring: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: November 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: October 2009

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: November 2009

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: November 2009

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: November 2009

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: November 2009

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

Permanent Cross Section 13

As-built Survey: January 2008

Year 1 Monitoring: September 2008

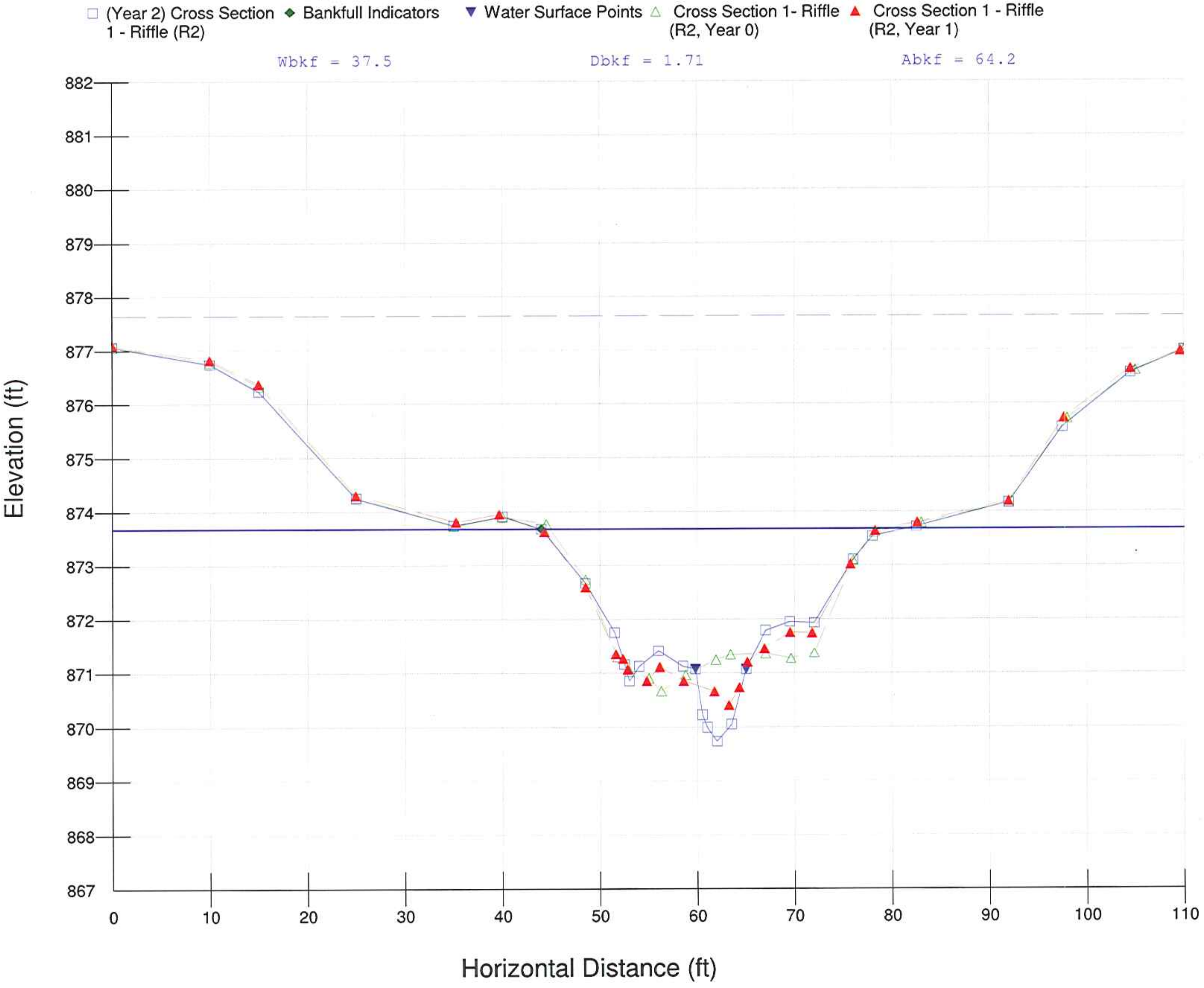
Year 2 Monitoring: October 2009

Year 3 Monitoring:

Year 4 Monitoring:

Year 5 Monitoring:

(Year 2) Cross Section 1 - Riffle (R2)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 2)
Reach Name: R2
Cross Section Name: (Year 2) Cross Section 1 - Riffle (R2)
Survey Date: 11/18/2009

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

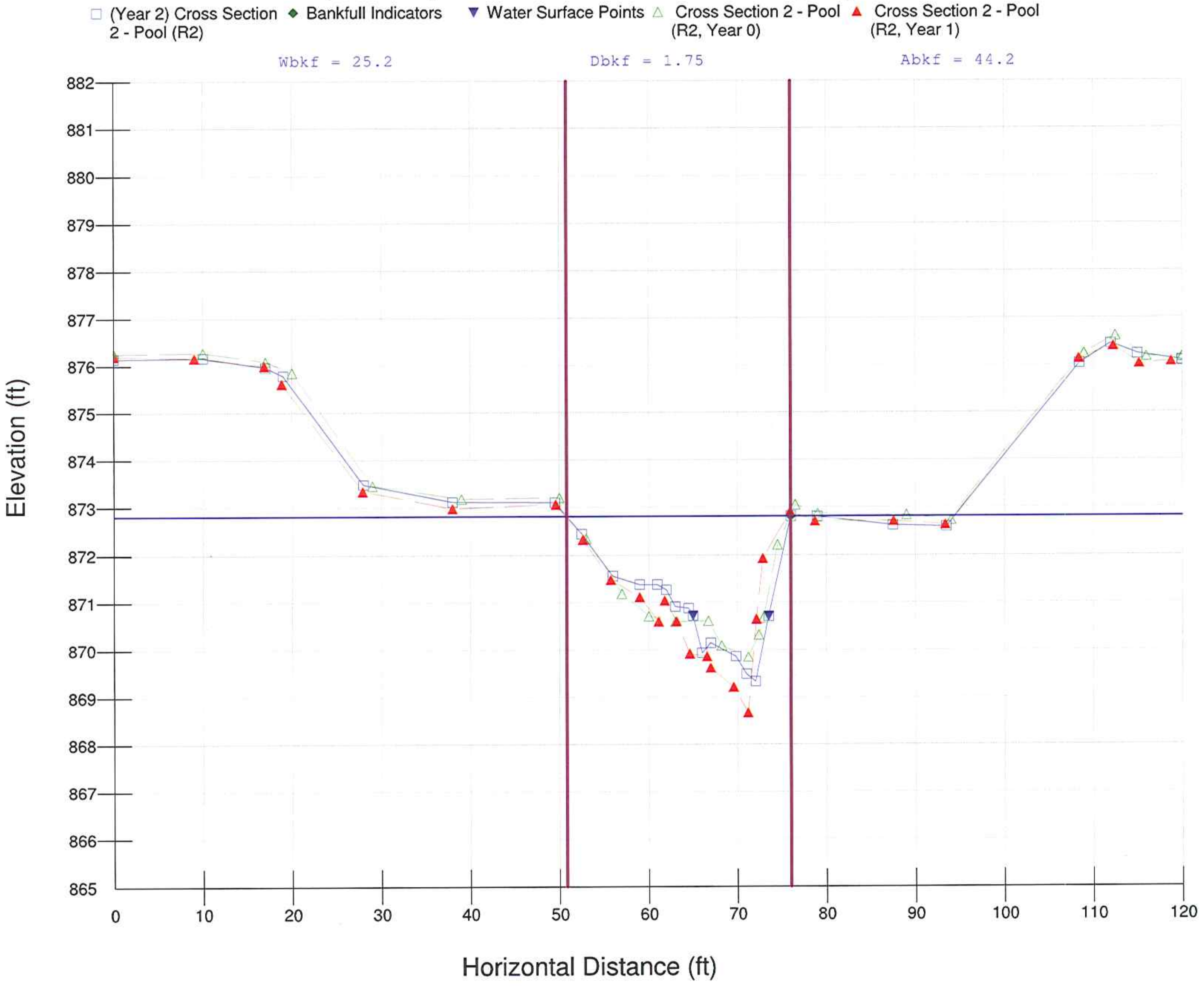
TAPE	FS	ELEV	NOTE
0	0	877.06	GS
10	0	876.74	GS
15	0	876.24	GS
25	0	874.25	GS
35	0	873.74	GS
40	0	873.91	GS
44	0	873.68	BKF
48.5	0	872.67	GS
51.5	0	871.75	GS
52.5	0	871.16	GS
53	0	870.85	GS
54	0	871.12	GS
56	0	871.41	GS
58.5	0	871.12	GS
59.8	0	871.07	LEW
60.5	0	870.22	GS
61	0	869.99	GS
62	0	869.73	TW
63.5	0	870.05	GS
65	0	871.07	REW
67	0	871.79	GS
69.5	0	871.95	GS
72	0	871.93	GS
76	0	873.11	RB
78	0	873.54	GS
82.5	0	873.72	GS
92	0	874.17	GS
97.5	0	875.56	GS
104.5	0	876.57	GS
110	0	876.99	GS

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	877.63	877.63	877.63
Bankfull Elevation (ft)	873.68	873.68	873.68
Floodprone Width (ft)	110	-----	-----
Bankfull Width (ft)	37.5	18.75	18.75
Entrenchment Ratio	2.93	-----	-----
Mean Depth (ft)	1.71	2.02	1.41
Maximum Depth (ft)	3.95	3.95	3.79
Width/Depth Ratio	21.93	9.28	13.3
Bankfull Area (sq ft)	64.23	37.8	26.43
Wetted Perimeter (ft)	39.26	23.62	23.22
Hydraulic Radius (ft)	1.64	1.6	1.14
Begin BKF Station	44	44	62.75

```
End BKF Station           81.5       62.75      81.5

--------------------------------------------------------------------
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 2) Cross Section 2 - Pool (R2)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 2)
Reach Name: R2
Cross Section Name: (Year 2) Cross Section 2 - Pool (R2)
Survey Date: 11/18/2009

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

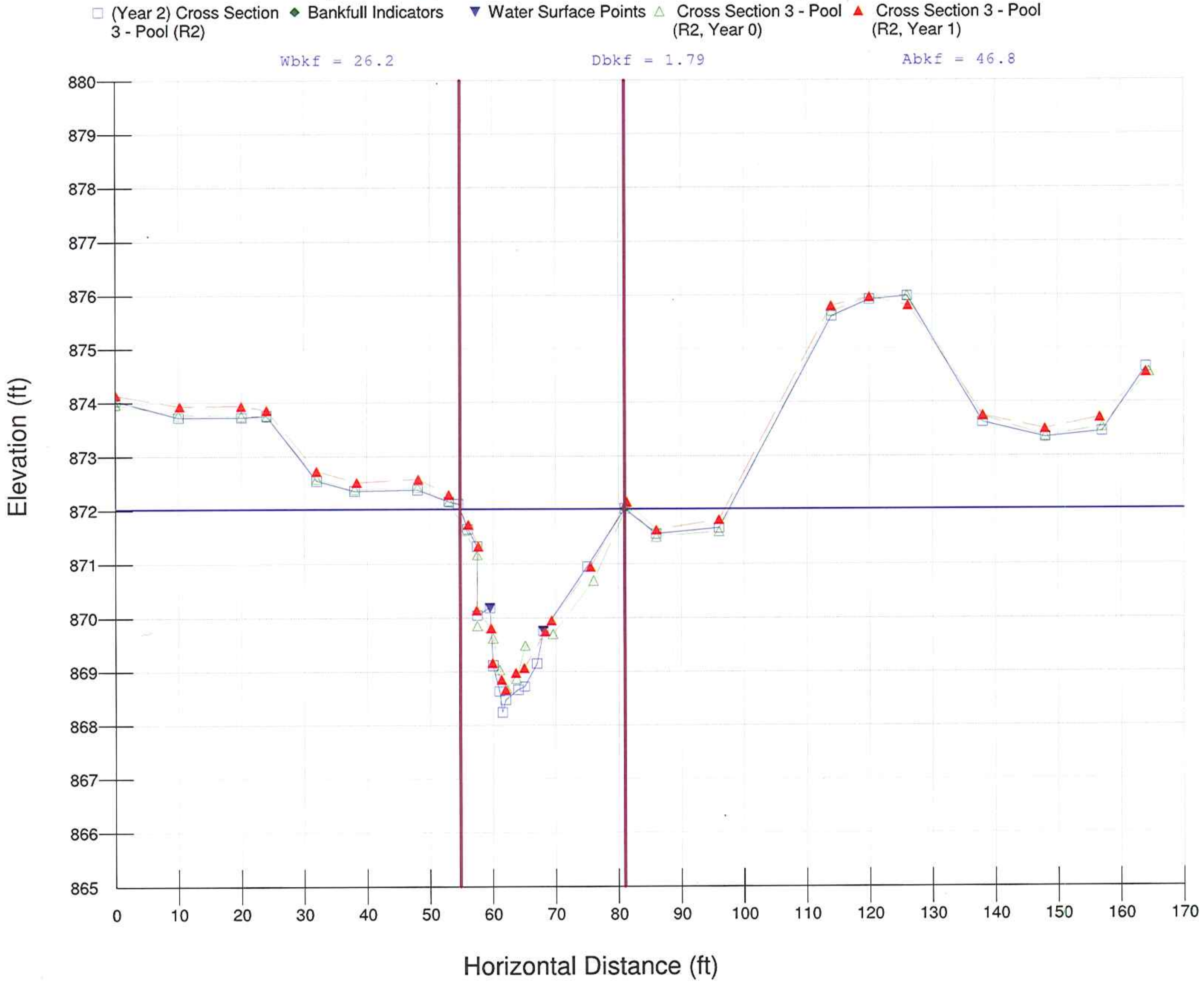
TAPE	FS	ELEV	NOTE
0	0	876.14	GS
10	0	876.16	GS
17	0	875.96	GS
19	0	875.79	GS
28	0	873.48	GS
38	0	873.11	GS
49.5	0	873.1	LB
52.5	0	872.44	GS
56	0	871.56	GS
59	0	871.38	GS
61	0	871.38	GS
62	0	871.27	GS
63	0	870.91	GS
64.5	0	870.88	GS
65	0	870.72	LEW
66	0	869.94	GS
67	0	870.15	GS
69.8	0	869.86	GS
71	0	869.49	GS
72	0	869.33	TW
73.5	0	870.71	REW
76	0	872.81	BKF
79	0	872.8	GS
87.5	0	872.62	GS
93.5	0	872.59	GS
108.5	0	876.03	GS
112	0	876.45	GS
115	0	876.23	GS
120	0	876.09	GS

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	876.29	876.29	876.29
Bankfull Elevation (ft)	872.81	872.81	872.81
Floodprone Width (ft)	116.48	-----	-----
Bankfull Width (ft)	25.18	12.59	12.59
Entrenchment Ratio	4.63	-----	-----
Mean Depth (ft)	1.75	1.11	2.4
Maximum Depth (ft)	3.48	1.91	3.48
Width/Depth Ratio	14.39	11.34	5.25
Bankfull Area (sq ft)	44.18	14.01	30.17
Wetted Perimeter (ft)	27.11	14.72	16.2
Hydraulic Radius (ft)	1.63	0.95	1.86
Begin BKF Station	50.82	50.82	63.41
End BKF Station	76	63.41	76

```
----------------------------------------------------------------------
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)
```

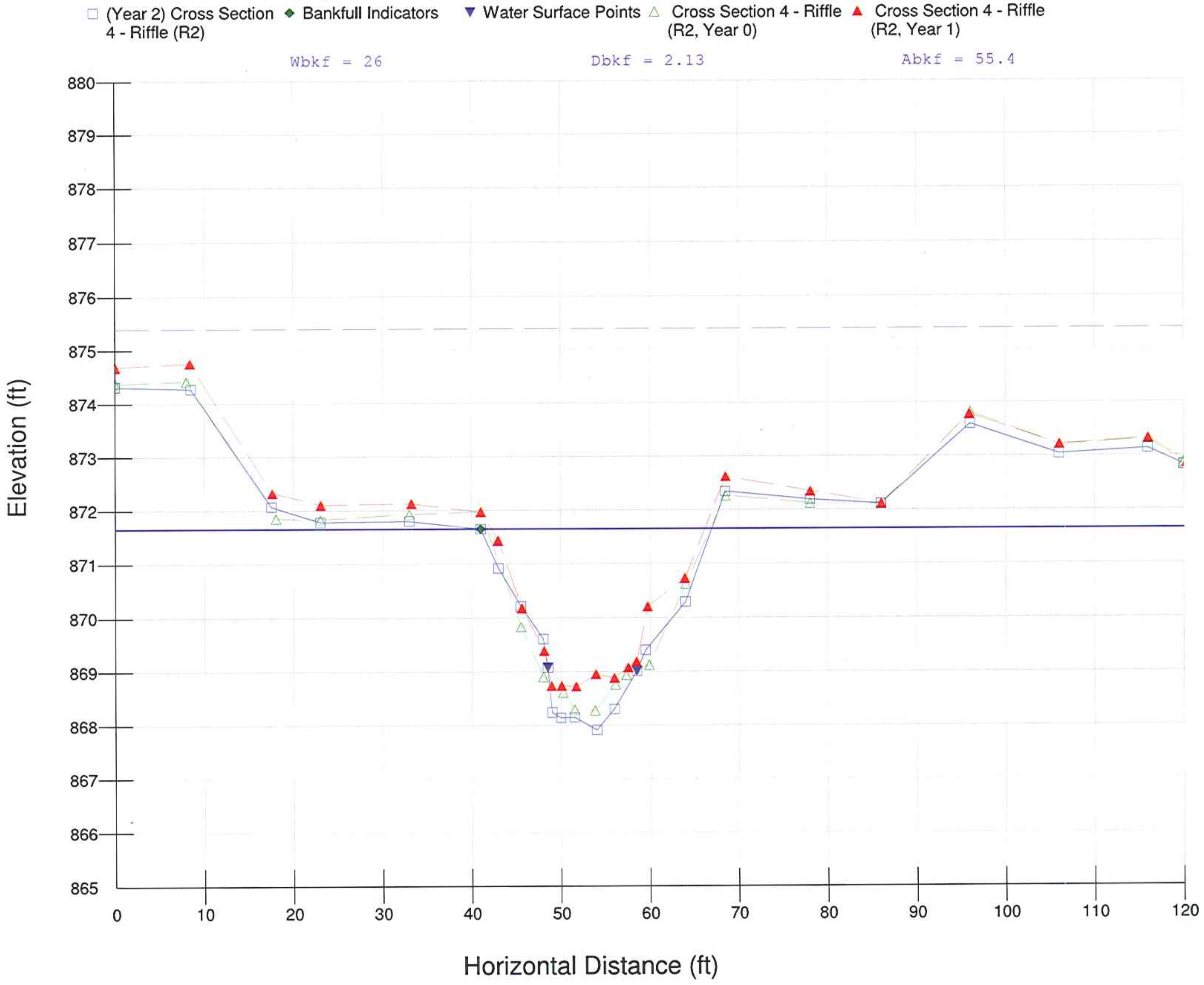
(Year 2) Cross Section 3 - Pool (R2)



```
                    RIVERMORPH CROSS SECTION SUMMARY

------------------------------------------------------------------------

River Name:          Little White Oak Creek (Year 2)
Reach Name:          R2
Cross Section Name: (Year 2) Cross Section 3 - Pool (R2)
Survey Date:         11/18/2009

------------------------------------------------------------------------
Cross Section Data Entry

BM Elevation:                    0 ft
Backsight Rod Reading:           0 ft

TAPE           FS              ELEV           NOTE
------------------------------------------------------------------------
0              0               874.04         GS
10             0               873.73         GS
20             0               873.73         GS
24             0               873.76         GS
32             0               872.55         GS
38             0               872.36         GS
48             0               872.38         GS
53             0               872.16         GS
54.5           0               872.12         GS
56             0               871.65         LB
57.5           0               871.33         GS
57.5           0               870.05         GS
59.5           0               870.19         LEW
60             0               869.11         GS
61             0               868.63         GS
61.5           0               868.24         TW
62             0               868.47         GS
64             0               868.66         GS
65             0               868.72         GS
67             0               869.15         GS
68             0               869.76         REW
75             0               870.95         GS
81             0               872.03         BKF
86             0               871.56         GS
96             0               871.67         GS
114            0               875.6          GS
120            0               875.92         GS
126            0               875.98         GS
138            0               873.63         GS
148            0               873.35         GS
157            0               873.46         GS
164            0               874.65         GS


------------------------------------------------------------------------
Cross Sectional Geometry
------------------------------------------------------------------------

                          Channel    Left      Right
Floodprone Elevation (ft) 875.82     875.82    875.82
Bankfull Elevation (ft)   872.03     872.03    872.03
Floodprone Width (ft)     155.31     -----     -----
Bankfull Width (ft)       26.2       13.1      13.1
Entrenchment Ratio        5.93       -----     -----
Mean Depth (ft)           1.79       2.42      1.16
Maximum Depth (ft)        3.79       3.79      2.33
Width/Depth Ratio         14.64      5.41      11.29
Bankfull Area (sq ft)     46.85      31.65     15.2
Wetted Perimeter (ft)     28.99      18.01     15.64
```

```
Hydraulic Radius (ft)        1.62        1.76        0.97
Begin BKF Station            54.8        54.8        67.9
End BKF Station              81          67.9        81

-----------------------------------------------------------------------
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 2) Cross Section 4 - Riffle (R2)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 2)
Reach Name: R2
Cross Section Name: (Year 2) Cross Section 4 - Riffle (R2)
Survey Date: 11/18/2009

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	874.32	GS
8.5	0	874.28	GS
17.5	0	872.07	GS
23	0	871.78	GS
33	0	871.8	GS
41	0	871.65	BKF
43	0	870.92	GS
45.5	0	870.21	GS
48	0	869.61	GS
48.5	0	869.08	LEW
49	0	868.24	GS
50	0	868.14	GS
51.5	0	868.15	GS
54	0	867.91	TW
56	0	868.3	GS
58.5	0	869.01	REW
59.5	0	869.4	GS
64	0	870.29	GS
68.5	0	872.34	RB
78	0	872.19	GS
86	0	872.11	GS
96	0	873.6	GS
106	0	873.04	GS
116	0	873.14	GS
120	0	872.83	GS

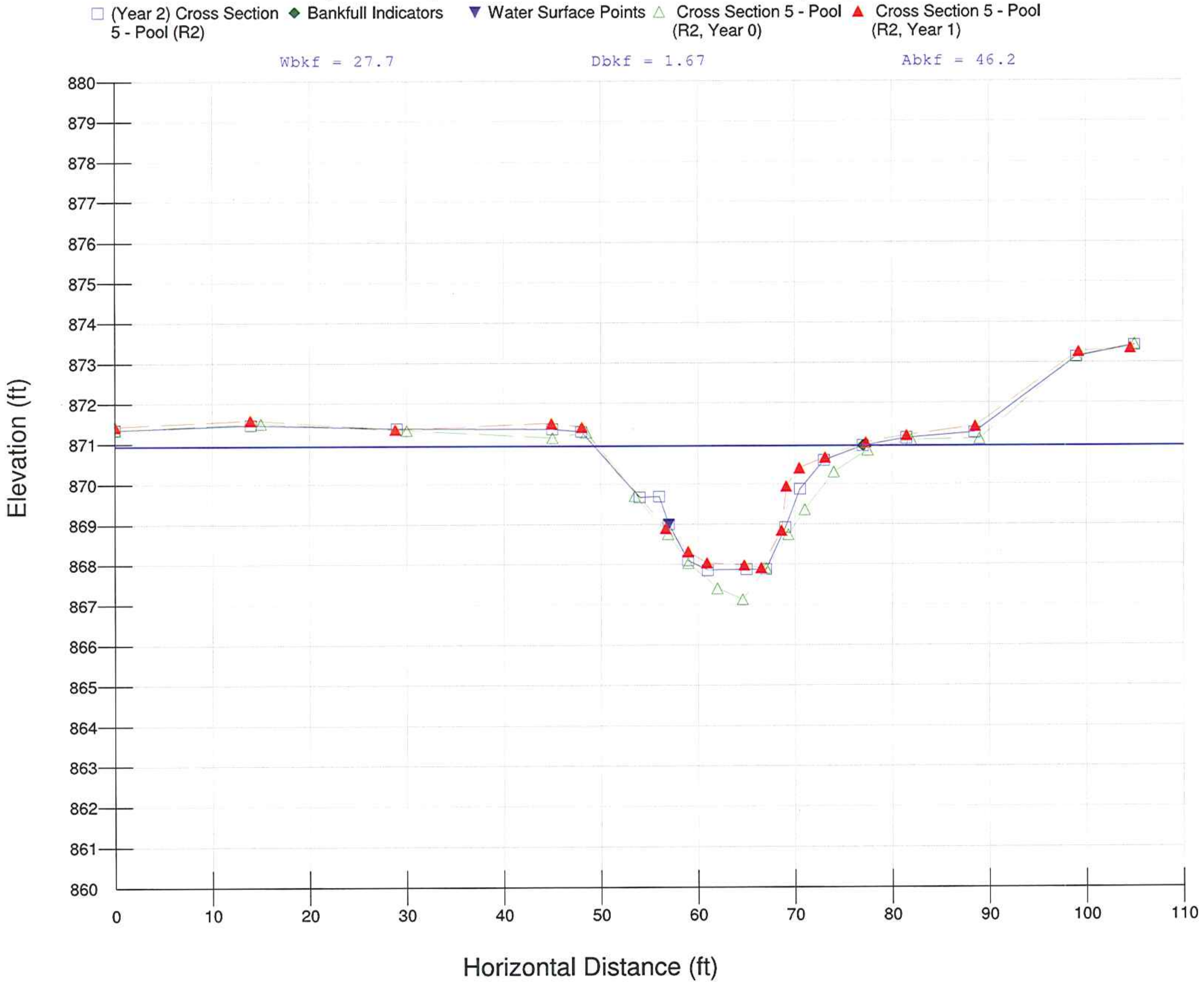
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	875.39	875.39	875.39
Bankfull Elevation (ft)	871.65	871.65	871.65
Floodprone Width (ft)	120	-----	-----
Bankfull Width (ft)	25.99	12.99	13
Entrenchment Ratio	4.62	-----	-----
Mean Depth (ft)	2.13	2.17	2.09
Maximum Depth (ft)	3.74	3.74	3.74
Width/Depth Ratio	12.2	5.99	6.22
Bankfull Area (sq ft)	55.38	28.17	27.21
Wetted Perimeter (ft)	27.6	17.75	17.33
Hydraulic Radius (ft)	2.01	1.59	1.57
Begin BKF Station	41	41	53.99
End BKF Station	66.99	53.99	66.99

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)
```

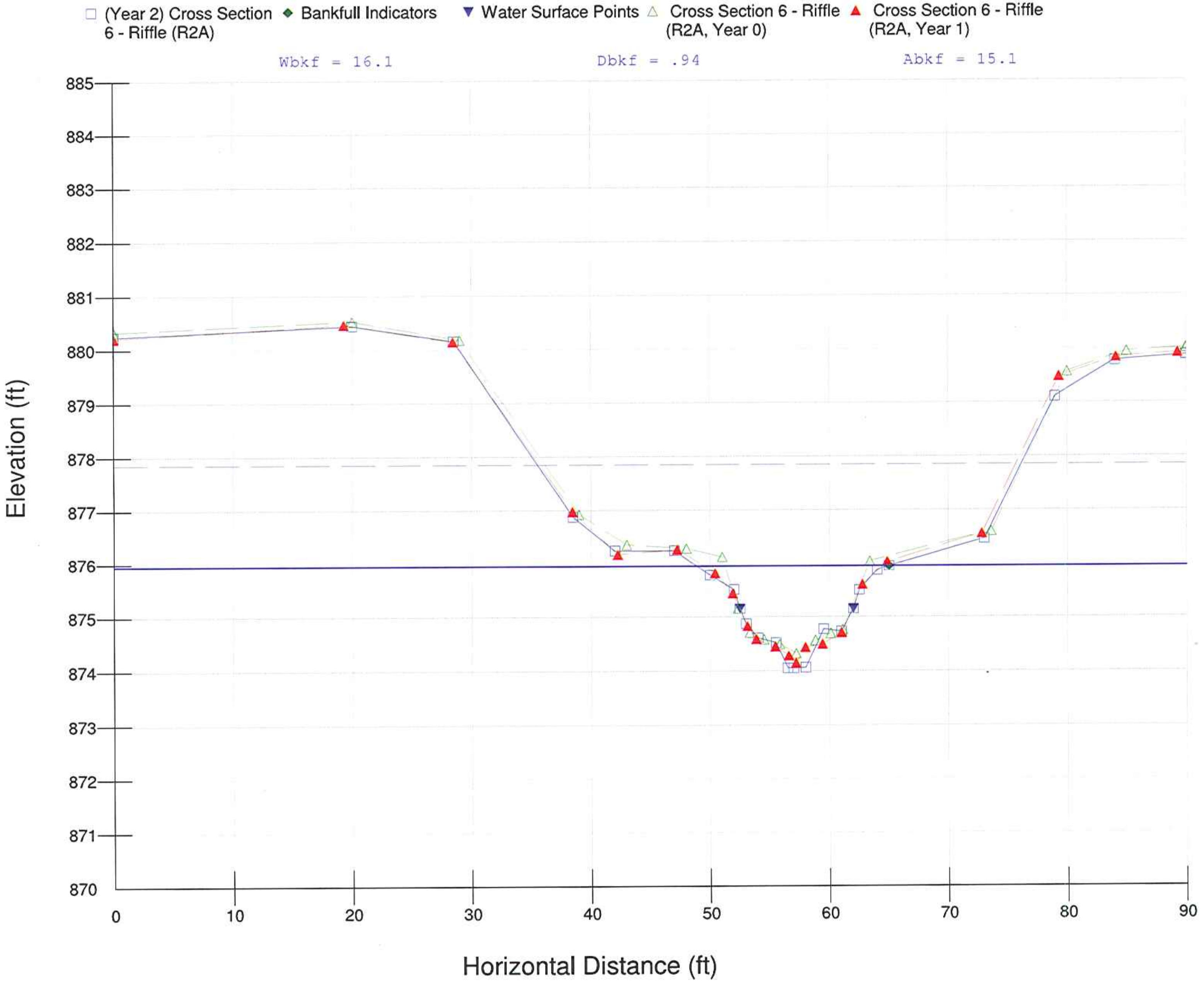
(Year 2) Cross Section 5 - Pool (R2)



```
                  RIVERMORPH CROSS SECTION SUMMARY

------------------------------------------------------------

River Name:         Little White Oak Creek (Year 2)
Reach Name:         R2
Cross Section Name: (Year 2) Cross Section 5 - Pool (R2)
Survey Date:        11/18/2009

------------------------------------------------------------
Cross Section Data Entry

BM Elevation:                0 ft
Backsight Rod Reading:       0 ft

TAPE          FS            ELEV          NOTE
------------------------------------------------------------
0             0             871.35        GS
14            0             871.47        GS
29            0             871.37        GS
45            0             871.36        GS
48            0             871.3         LB
54            0             869.67        GS
56            0             869.69        GS
57            0             869           LEW
59            0             868.09        GS
61            0             867.85        GS
65            0             867.87        GS
67            0             867.87        TW
69            0             868.92        GS
70.5          0             869.87        GS
73            0             870.58        GS
77            0             870.94        BKF
81.5          0             871.13        GS
88.5          0             871.26        GS
99            0             873.14        GS
105           0             873.43        GS


------------------------------------------------------------
Cross Sectional Geometry
------------------------------------------------------------

                            Channel     Left       Right
Floodprone Elevation (ft)   874.03      874.03     874.03
Bankfull Elevation (ft)     870.94      870.94     870.94
Floodprone Width (ft)       105         -----      -----
Bankfull Width (ft)         27.67       13.83      13.84
Entrenchment Ratio          3.79        -----      -----
Mean Depth (ft)             1.67        1.77       1.57
Maximum Depth (ft)          3.09        3.09       3.08
Width/Depth Ratio           16.57       7.81       8.82
Bankfull Area (sq ft)       46.19       24.48      21.71
Wetted Perimeter (ft)       28.92       17.51      17.57
Hydraulic Radius (ft)       1.6         1.4        1.24
Begin BKF Station           49.33       49.33      63.16
End BKF Station             77          63.16      77

------------------------------------------------------------
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 2) Cross Section 6 - Riffle (R2A)

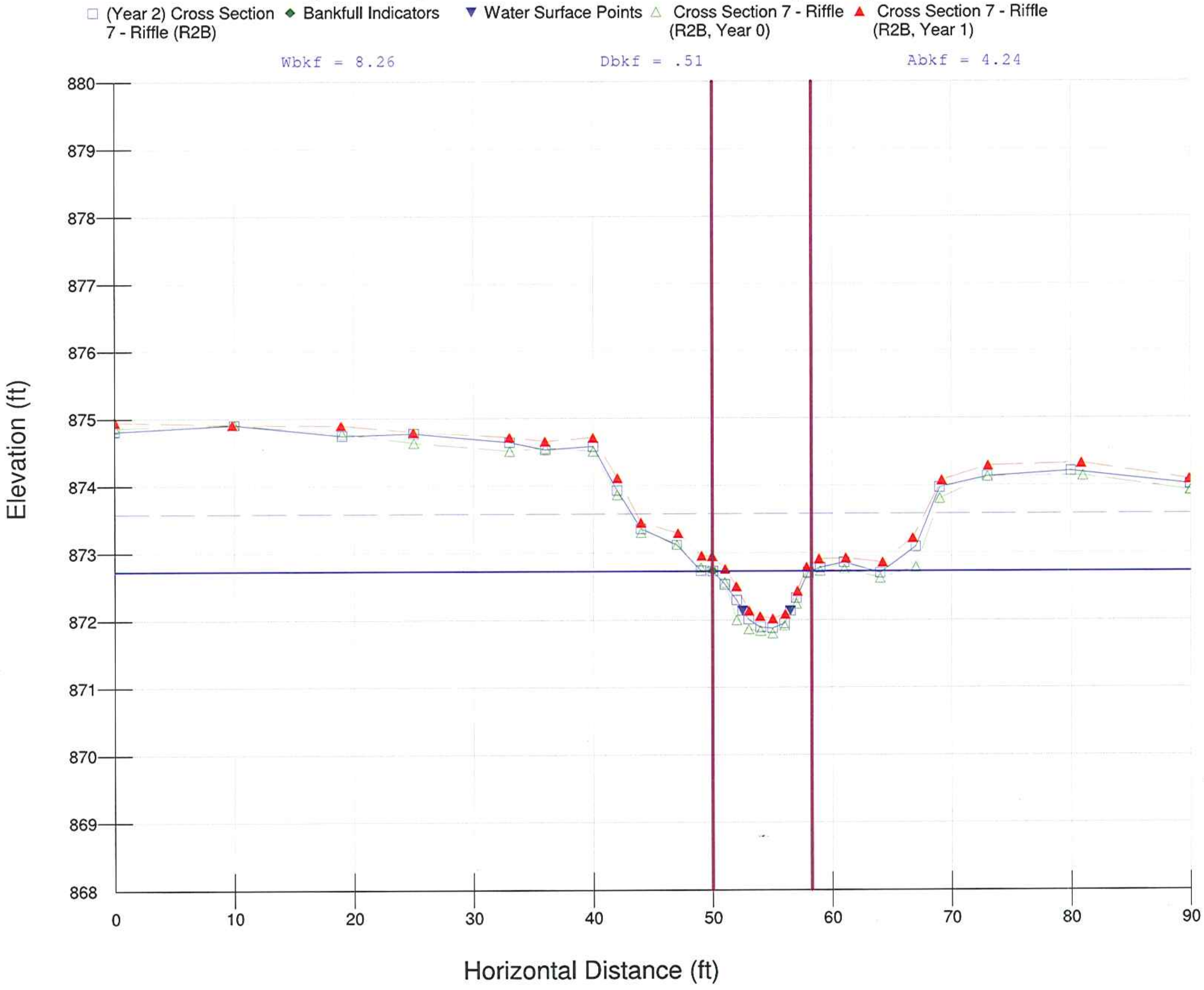


```
                   RIVERMORPH CROSS SECTION SUMMARY

----------------------------------------------------------------------

River Name:          Little White Oak Creek (Year 2)
Reach Name:          R2A
Cross Section Name: (Year 2) Cross Section 6 - Riffle (R2A)
Survey Date:         11/18/2009

----------------------------------------------------------------------
Cross Section Data Entry

BM Elevation:                  0 ft
Backsight Rod Reading:         0 ft

TAPE           FS             ELEV           NOTE
----------------------------------------------------------------------
0              0              880.24         GS
20                            880.44         GS
28.5                          880.16         GS
38.5                          876.88         GS
42                            876.24         GS
47                            876.24         GS
50                            875.78         LB
52                            875.51         GS
52.5                          875.15         LEW
53                            874.87         GS
54                            874.61         GS
55.5                          874.52         GS
56.5                          874.05         GS
57                            874.05         TW
58                            874.06         GS
59.5                          874.77         GS
61                            874.73         GS
62                            875.15         REW
62.5                          875.5          GS
64                            875.87         GS
65                            875.95         BKF
73                            876.46         GS
79                            879.11         GS
84                            879.78         GS
90                            879.88         GS


----------------------------------------------------------------------
Cross Sectional Geometry
----------------------------------------------------------------------

                            Channel     Left        Right
Floodprone Elevation (ft)   877.85      877.85      877.85
Bankfull Elevation (ft)     875.95      875.95      875.95
Floodprone Width (ft)       40.6        -----       -----
Bankfull Width (ft)         16.11       8.06        8.05
Entrenchment Ratio          2.52        -----       -----
Mean Depth (ft)             0.94        0.9         0.98
Maximum Depth (ft)          1.9         1.9         1.9
Width/Depth Ratio           17.14       8.96        8.21
Bankfull Area (sq ft)       15.14       7.29        7.85
Wetted Perimeter (ft)       16.87       10.32       10.35
Hydraulic Radius (ft)       0.9         0.71        0.76
Begin BKF Station           48.89       48.89       56.95
End BKF Station             65          56.95       65

----------------------------------------------------------------------
Entrainment Calculations
----------------------------------------------------------------------
```

Entrainment Formula: Rosgen Modified Shields Curve

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

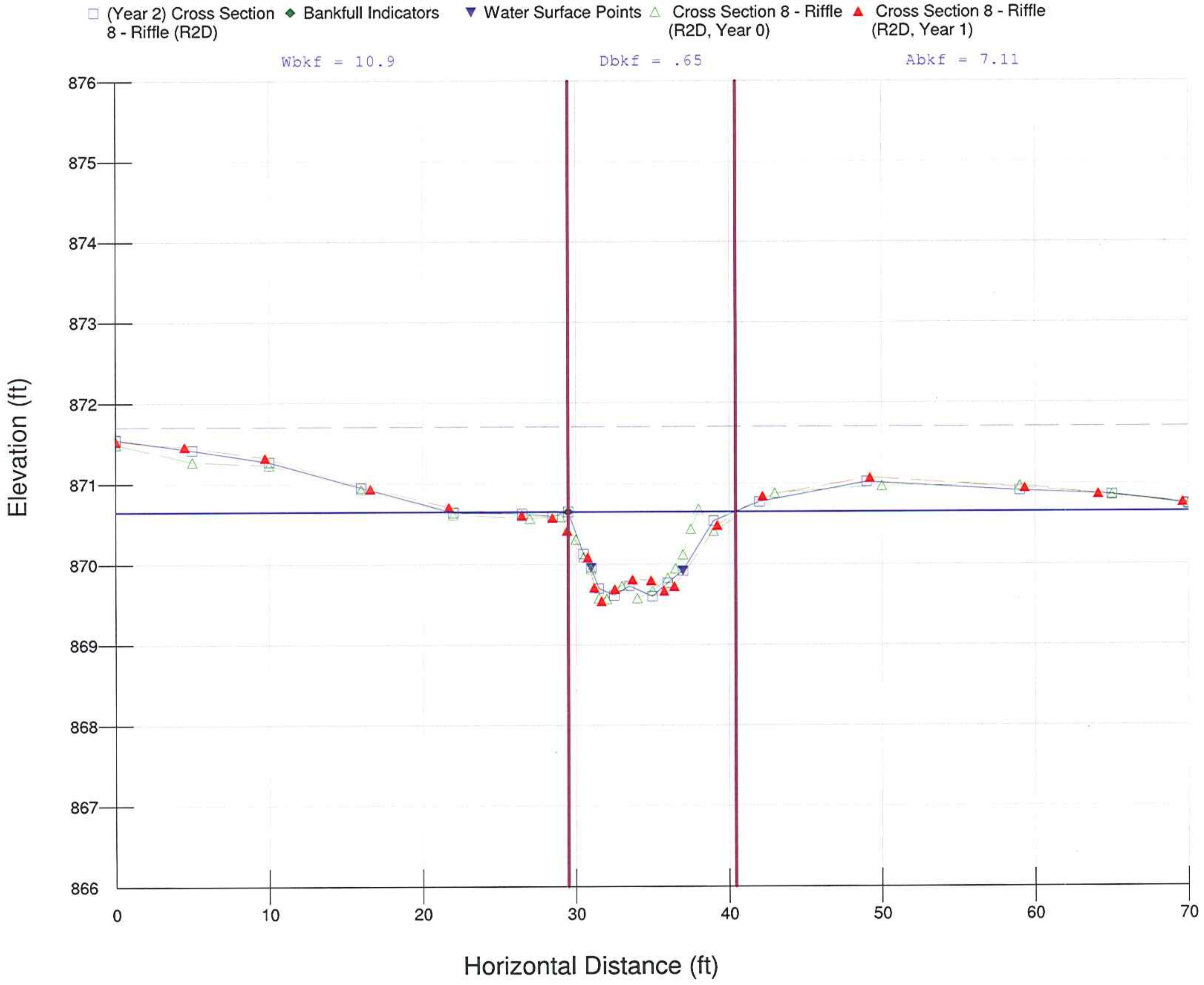
(Year 2) Cross Section 7 - Riffle (R2B)



```
                 RIVERMORPH CROSS SECTION SUMMARY

------------------------------------------------------------------

River Name:          Little White Oak Creek (Year 2)
Reach Name:          R2B
Cross Section Name: (Year 2) Cross Section 7 - Riffle (R2B)
Survey Date:         11/18/2009

------------------------------------------------------------------
Cross Section Data Entry

BM Elevation:                0 ft
Backsight Rod Reading:       0 ft

TAPE          FS            ELEV          NOTE
------------------------------------------------------------------
0             0             874.81        GS
10                          874.9         GS
19                          874.74        GS
25                          874.77        GS
33                          874.64        GS
36                          874.53        GS
40                          874.58        GS
42                          873.93        GS
44                          873.36        GS
47                          873.12        GS
49                          872.74        GS
50                          872.73        BKF
51                          872.53        GS
52                          872.3         GS
52.5                        872.14        LEW
53                          872.01        GS
54                          871.89        GS
55                          871.88        TW
56                          871.95        GS
56.5                        872.14        REW
57                          872.33        GS
58                          872.71        RB
59                          872.78        GS
61                          872.86        GS
64                          872.7         GS
67                          873.09        GS
69                          873.97        GS
73                          874.13        GS
80                          874.21        GS
90                          874.01        GS


------------------------------------------------------------------
Cross Sectional Geometry
------------------------------------------------------------------

                          Channel    Left       Right
Floodprone Elevation (ft) 873.58     873.58     873.58
Bankfull Elevation (ft)   872.73     872.73     872.73
Floodprone Width (ft)     24.89      -----      -----
Bankfull Width (ft)       8.26       4.13       4.13
Entrenchment Ratio        3.01       -----      -----
Mean Depth (ft)           0.51       0.46       0.57
Maximum Depth (ft)        0.85       0.84       0.85
Width/Depth Ratio         16.2       8.98       7.25
Bankfull Area (sq ft)     4.24       1.89       2.35
Wetted Perimeter (ft)     8.5        5.07       5.12
Hydraulic Radius (ft)     0.5        0.37       0.46
Begin BKF Station         50         50         54.13
```

```
End BKF Station              58.26      54.13      58.26

----------------------------------------------------------------------
Entrainment Calculations
----------------------------------------------------------------------

Entrainment Formula: Rosgen Modified Shields Curve

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

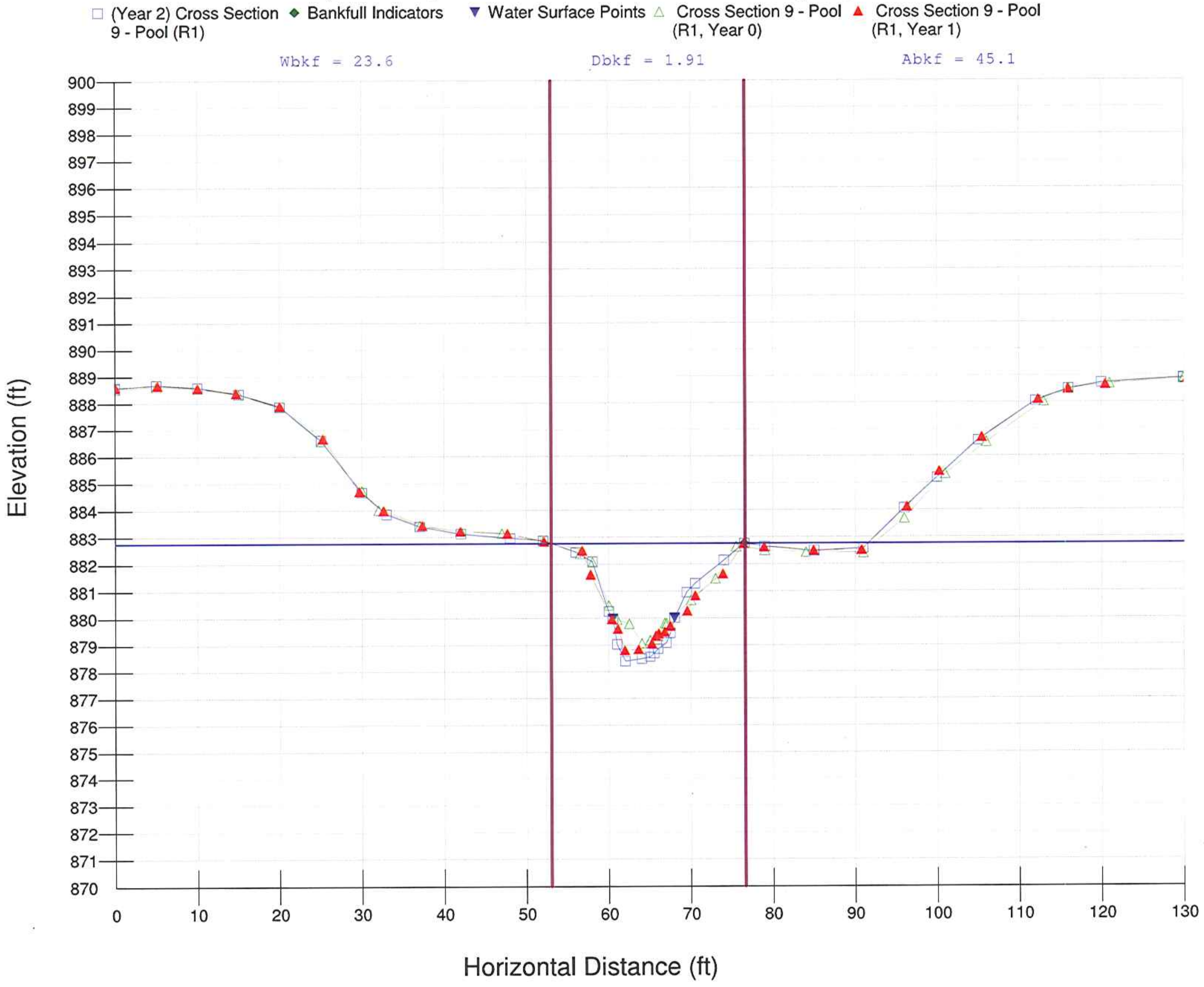
(Year 2) Cross Section 8 - Riffle (R2D)



```
                 RIVERMORPH CROSS SECTION SUMMARY

------------------------------------------------------------------

River Name:           Little White Oak Creek (Year 2)
Reach Name:           R2D
Cross Section Name: (Year 2) Cross Section 8 - Riffle (R2D)
Survey Date:          11/18/2009

------------------------------------------------------------------
Cross Section Data Entry

BM Elevation:                  0 ft
Backsight Rod Reading:         0 ft

TAPE           FS             ELEV           NOTE
------------------------------------------------------------------
0              0              871.55         GS
5              0              871.42         GS
10             0              871.27         GS
16             0              870.95         GS
22             0              870.64         GS
26.5           0              870.63         GS
28.5           0              870.6          GS
29.5           0              870.65         BKF
30.5           0              870.13         GS
31             0              869.96         LEW
31.5           0              869.7          GS
32.5           0              869.61         TW
33.5           0              869.73         GS
35             0              869.6          GS
36             0              869.77         GS
37             0              869.92         REW
39             0              870.54         RB
42             0              870.77         GS
49             0              871.02         GS
59             0              870.91         GS
65             0              870.86         GS
70             0              870.74         GS


------------------------------------------------------------------
Cross Sectional Geometry
------------------------------------------------------------------

                          Channel     Left        Right
Floodprone Elevation (ft) 871.7       871.7       871.7
Bankfull Elevation (ft)   870.65      870.65      870.65
Floodprone Width (ft)     70          -----       -----
Bankfull Width (ft)       10.93       5.47        5.46
Entrenchment Ratio        6.4         -----       -----
Mean Depth (ft)           0.65        0.8         0.5
Maximum Depth (ft)        1.05        1.05        1.05
Width/Depth Ratio         16.82       6.84        10.92
Bankfull Area (sq ft)     7.11        4.39        2.72
Wetted Perimeter (ft)     11.29       6.75        6.63
Hydraulic Radius (ft)     0.63        0.65        0.41
Begin BKF Station         29.5        29.5        34.97
End BKF Station           40.43       34.97       40.43

------------------------------------------------------------------
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 2) Cross Section 9 - Pool (R1)



RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 2)
Reach Name: R1
Cross Section Name: (Year 2) Cross Section 9 - Pool (R1)
Survey Date: 11/17/2009

Cross Section Data Entry

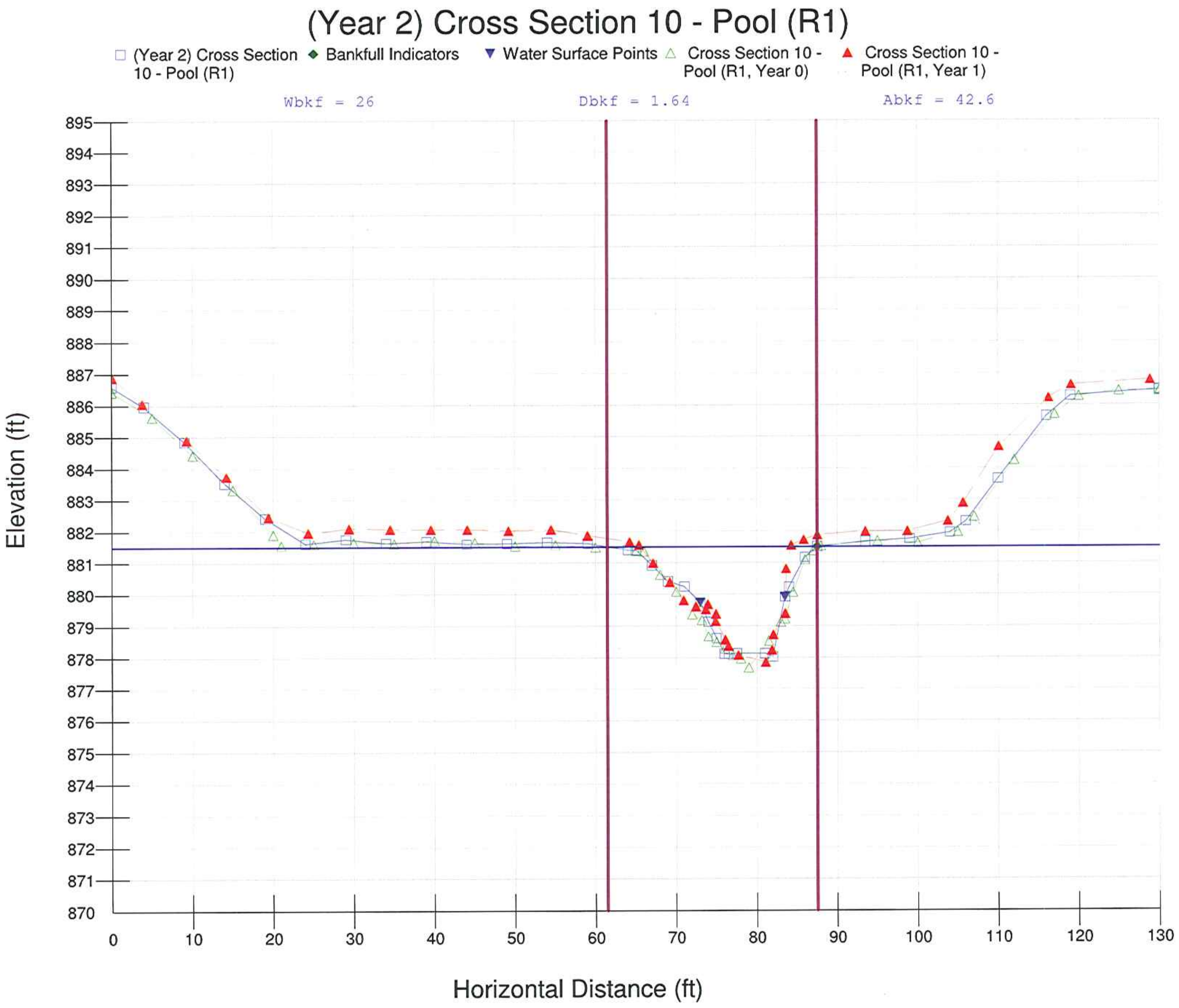
BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	888.59	GS
5	0	888.7	GS
10	0	888.61	GS
15	0	888.36	GS
20	0	887.88	GS
25	0	886.61	GS
30	0	884.66	GS
33	0	883.87	GS
37	0	883.41	GS
42	0	883.14	GS
48	0	882.97	GS
52	0	882.87	GS
56	0	882.44	LB
58	0	882.1	GS
60	0	880.25	GS
60.5	0	879.99	LEW
61	0	879.03	GS
62	0	878.38	TW
64	0	878.48	GS
65	0	878.55	GS
65.5	0	878.69	GS
66	0	878.86	GS
67	0	879.09	GS
67.5	0	879.45	GS
68	0	880.02	REW
69.5	0	880.96	GS
70.5	0	881.28	GS
74	0	882.14	GS
76.5	0	882.76	BKF
79	0	882.64	GS
85	0	882.48	GS
91	0	882.58	GS
96	0	884.07	GS
100	0	885.2	GS
105	0	886.58	GS
112	0	888.06	GS
116	0	888.51	GS
120	0	888.73	GS
130	0	888.9	GS

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	887.14	887.14	887.14
Bankfull Elevation (ft)	882.76	882.76	882.76
Floodprone Width (ft)	84.74	-----	-----

```
Bankfull Width (ft)        23.6       11.8       11.8
Entrenchment Ratio         3.59       -----      -----
Mean Depth (ft)            1.91       2.02       1.81
Maximum Depth (ft)         4.38       4.38       4.22
Width/Depth Ratio          12.36      5.84       6.52
Bankfull Area (sq ft)      45.13      23.77      21.36
Wetted Perimeter (ft)      26.16      17.63      16.98
Hydraulic Radius (ft)      1.72       1.35       1.26
Begin BKF Station          53.02      53.02      64.82
End BKF Station            76.62      64.82      76.62

----------------------------------------------------------------------
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 2) Cross Section 10 - Pool (R1)
□ (Year 2) Cross Section 10 - Pool (R1)
◆ Bankfull Indicators
▼ Water Surface Points
△ Cross Section 10 - Pool (R1, Year 0)
▲ Cross Section 10 - Pool (R1, Year 1)
Wbkf = 26
Dbkf = 1.64
Abkf = 42.6
Elevation (ft)
895
894
893
892
891
890
889
888
887
886
885
884
883
882
881
880
879
878
877
876
875
874
873
872
871
870
0
10
20
30
40
50
60
70
80
90
100
110
120
130
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: Little White Oak Creek (Year 2)
Reach Name: R1
Cross Section Name: (Year 2) Cross Section 10 - Pool (R1)
Survey Date: 11/17/2009

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

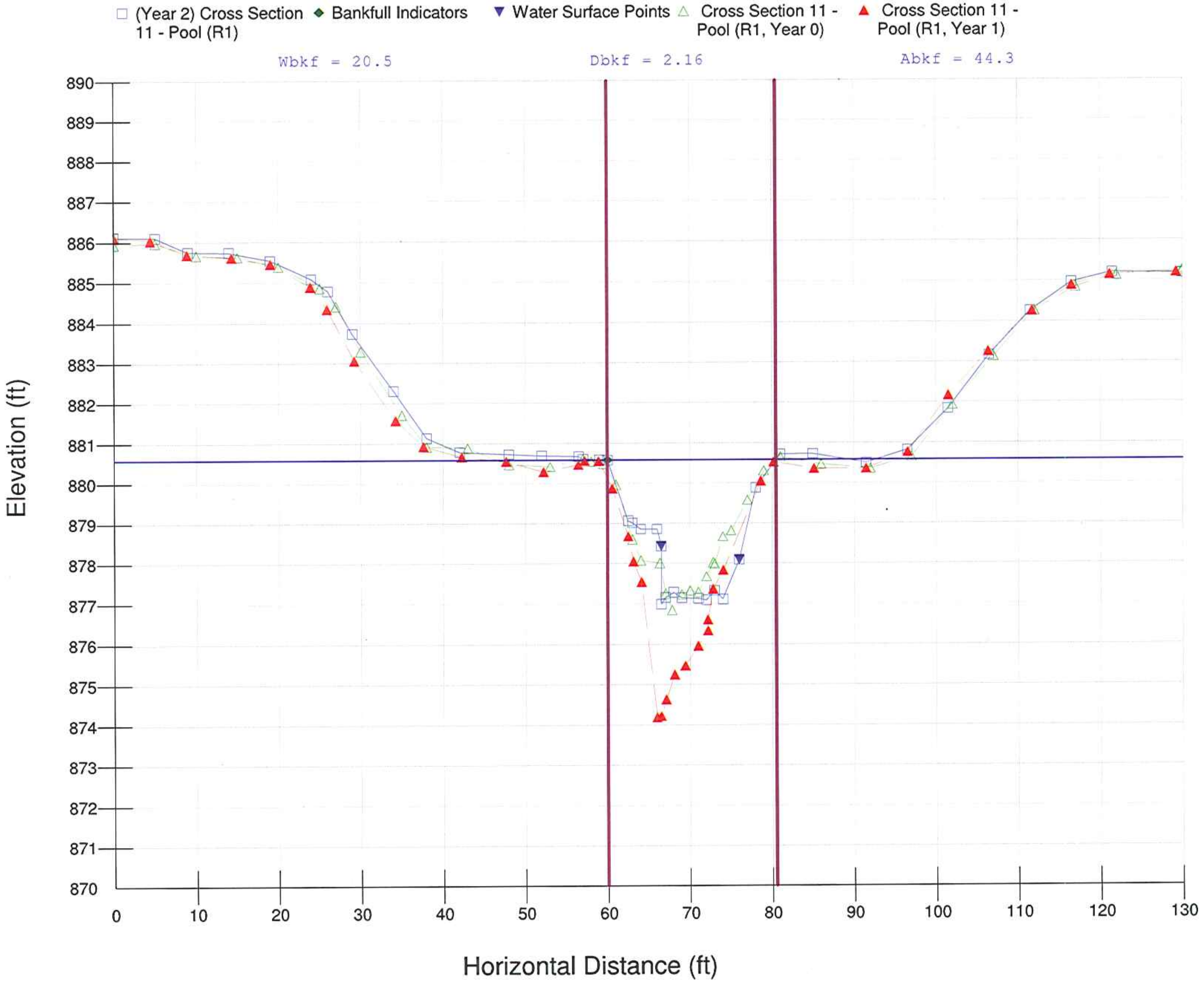
TAPE	FS	ELEV	NOTE
0	0	886.58	GS
4	0	885.97	GS
9	0	884.85	GS
14	0	883.53	GS
19	0	882.42	GS
24	0	881.61	GS
29	0	881.75	GS
34	0	881.63	GS
39	0	881.68	GS
44	0	881.6	GS
49	0	881.61	GS
54	0	881.65	GS
59	0	881.61	GS
64	0	881.41	GS
65	0	881.4	LB
67	0	880.92	GS
69	0	880.41	GS
71	0	880.25	GS
73	0	879.74	LEW
74	0	879.13	GS
75	0	878.61	GS
76	0	878.12	GS
76.5	0	878.11	GS
77.5	0	878.13	GS
81	0	878.13	GS
82	0	878.03	TW
83.5	0	879.91	REW
84	0	880.23	GS
86	0	881.17	GS
87.5	0	881.51	BKF
93.5	0	881.67	GS
99	0	881.75	GS
104	0	881.95	GS
106	0	882.31	GS
110	0	883.66	GS
116	0	885.64	GS
119	0	886.27	GS
130	0	886.46	GS

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	884.99	884.99	884.99
Bankfull Elevation (ft)	881.51	881.51	881.51
Floodprone Width (ft)	105.66	-----	-----
Bankfull Width (ft)	26	13	13

```
Entrenchment Ratio         4.06        -----       -----
Mean Depth (ft)            1.64        0.87        2.41
Maximum Depth (ft)         3.48        2.64        3.48
Width/Depth Ratio          15.85       14.94       5.39
Bankfull Area (sq ft)      42.62       11.34       31.28
Wetted Perimeter (ft)      27.86       16.07       17.07
Hydraulic Radius (ft)      1.53        0.71        1.83
Begin BKF Station          61.5        61.5        74.5
End BKF Station            87.5        74.5        87.5

--------------------------------------------------------------------
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)
```

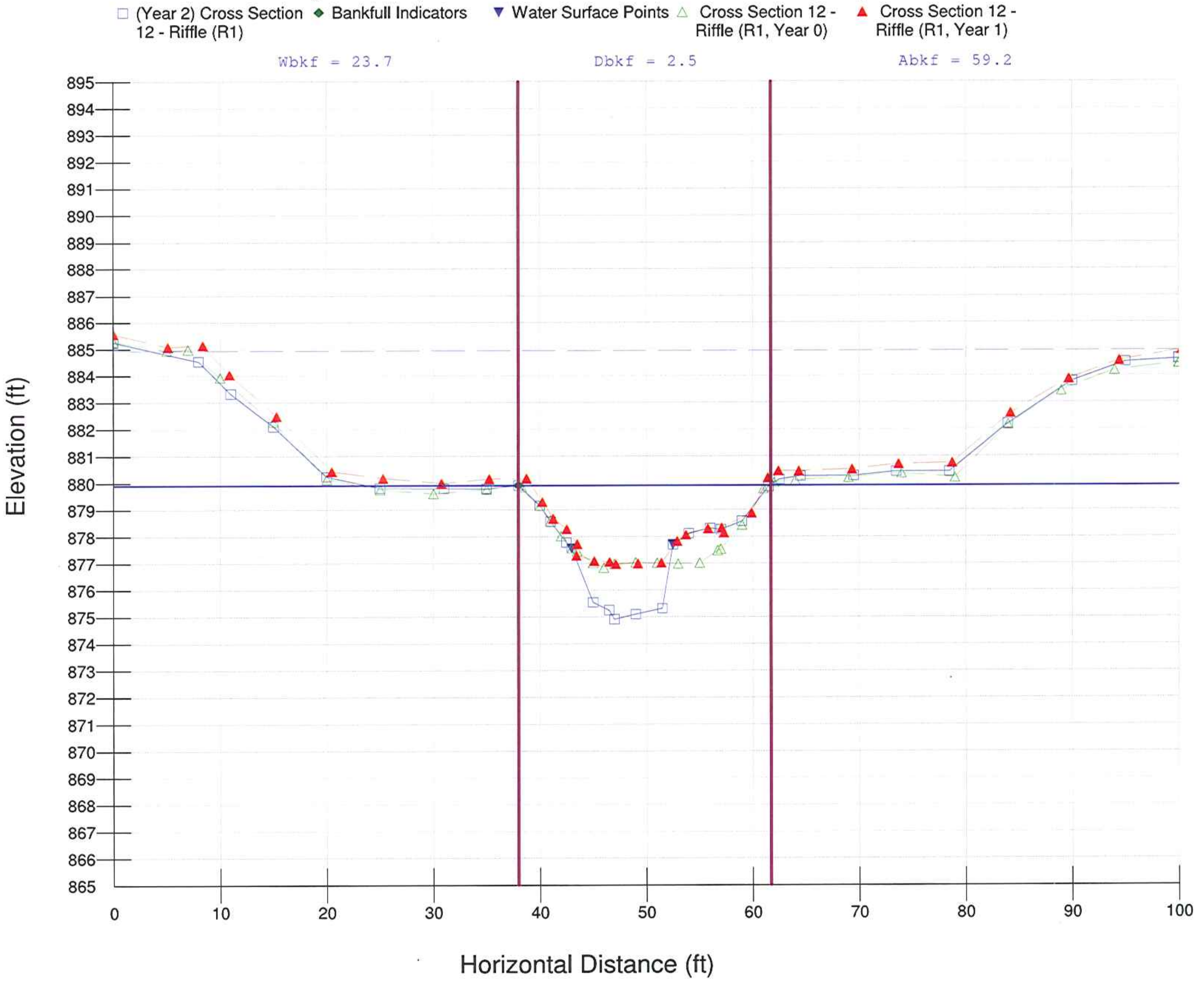
(Year 2) Cross Section 11 - Pool (R1)



```
                    RIVERMORPH CROSS SECTION SUMMARY

----------------------------------------------------------------------

River Name:         Little White Oak Creek (Year 2)
Reach Name:         R1
Cross Section Name: (Year 2) Cross Section 11 - Pool (R1)
Survey Date:        11/17/2009

----------------------------------------------------------------------
Cross Section Data Entry

BM Elevation:                 0 ft
Backsight Rod Reading:        0 ft

TAPE          FS            ELEV          NOTE
----------------------------------------------------------------------
0             0             886.11        GS
5             0             886.1         GS
9             0             885.76        GS
14            0             885.75        GS
19            0             885.55        GS
24            0             885.08        GS
26            0             884.79        GS
29            0             883.73        GS
34            0             882.31        GS
38            0             881.13        GS
42            0             880.78        GS
48            0             880.73        GS
52            0             880.69        GS
56.5          0             880.67        GS
57            0             880.61        GS
59            0             880.59        GS
60            0             880.58        BKF
62.5          0             879.06        GS
63            0             879.01        GS
64            0             878.85        GS
66            0             878.85        GS
66.5          0             878.42        LEW
66.5          0             876.99        GS
67            0             877.16        GS
68            0             877.28        GS
69            0             877.15        GS
71            0             877.13        GS
72            0             877.09        TW
73            0             877.32        GS
74            0             877.11        GS
76            0             878.09        REW
78            0             879.88        GS
81            0             880.72        RB
85            0             880.73        GS
91.5          0             880.5         GS
96.5          0             880.82        GS
101.5         0             881.85        GS
106.5         0             883.17        GS
111.5         0             884.26        GS
116.5         0             884.96        GS
121.5         0             885.2         GS
130           0             885.18        GS


----------------------------------------------------------------------
Cross Sectional Geometry
----------------------------------------------------------------------

                          Channel     Left       Right
```

```
Floodprone Elevation (ft)  884.17     884.17     884.17
Bankfull Elevation (ft)    880.58     880.58     880.58
Floodprone Width (ft)      83.33      -----      -----
Bankfull Width (ft)        20.5       5.31       15.19
Entrenchment Ratio         4.06       -----      -----
Mean Depth (ft)            2.16       1.24       2.49
Maximum Depth (ft)         3.59       1.73       3.59
Width/Depth Ratio          9.49       4.28       6.1
Bankfull Area (sq ft)      44.35      6.59       37.76
Wetted Perimeter (ft)      23.63      7.48       19.61
Hydraulic Radius (ft)      1.88       0.88       1.93
Begin BKF Station          60         60         65.31
End BKF Station            80.5       65.31      80.5

----------------------------------------------------------------------
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)
```

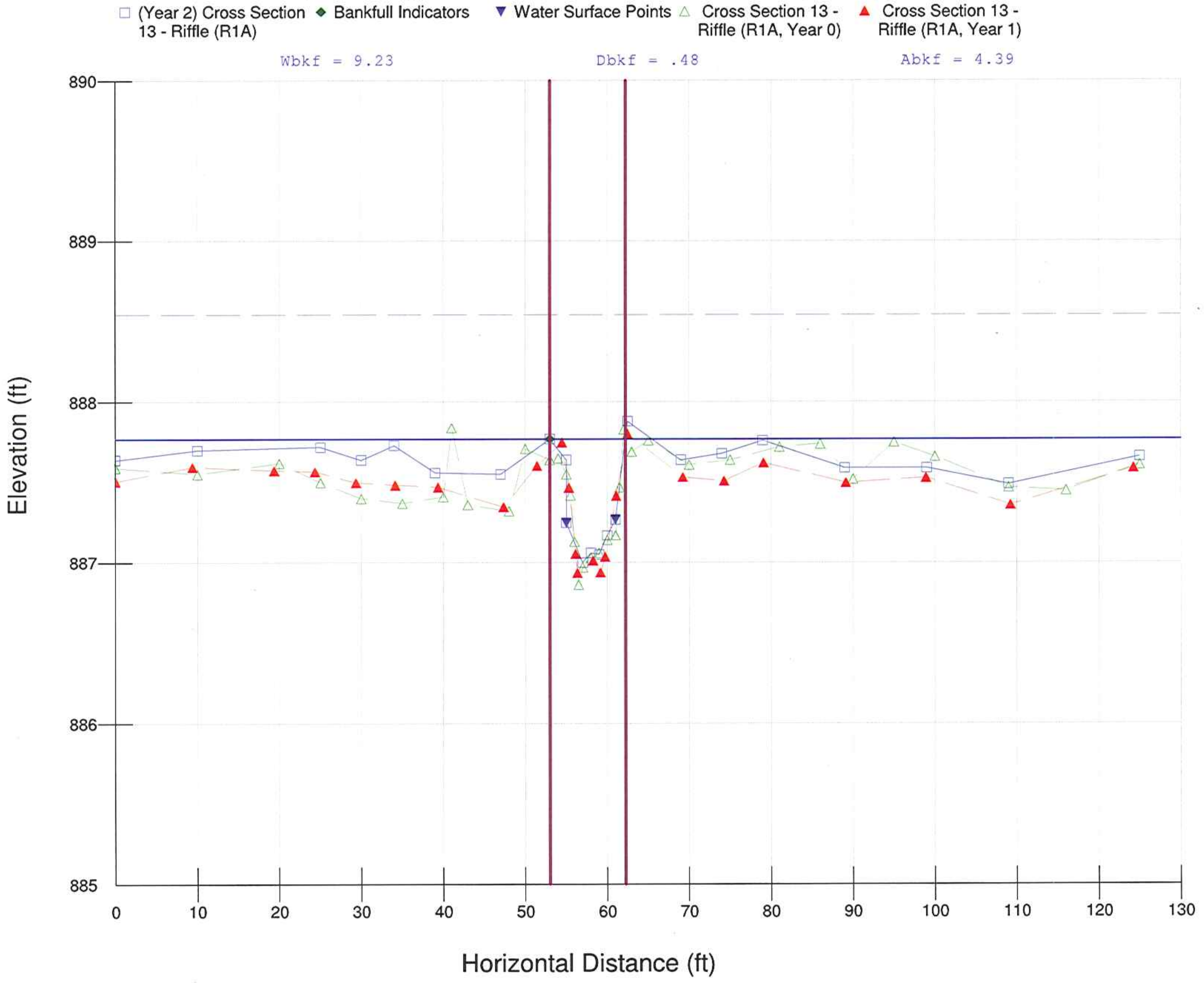
(Year 2) Cross Section 12 - Riffle (R1)



```
                    RIVERMORPH CROSS SECTION SUMMARY

----------------------------------------------------------------------

River Name:          Little White Oak Creek (Year 2)
Reach Name:          R1
Cross Section Name:  (Year 2) Cross Section 12 - Riffle (R1)
Survey Date:         11/17/2009

----------------------------------------------------------------------
Cross Section Data Entry

BM Elevation:                  0 ft
Backsight Rod Reading:         0 ft

TAPE           FS             ELEV           NOTE
----------------------------------------------------------------------
0              0              885.24         GS
8              0              884.54         GS
11             0              883.34         GS
15             0              882.11         GS
20             0              880.24         GS
25             0              879.82         GS
31             0              879.81         GS
35             0              879.8          GS
38             0              879.92         BKF
40             0              879.15         GS
41             0              878.56         GS
42.5           0              877.79         GS
43             0              877.57         LEW
45             0              875.55         GS
46.5           0              875.25         GS
47             0              874.91         TW
49             0              875.1          GS
51.5           0              875.32         GS
52.5           0              877.71         REW
54             0              878.13         GS
56             0              878.32         GS
57             0              878.27         GS
59             0              878.58         GS
61.5           0              879.88         GS
62.5           0              880.13         RB
64.5           0              880.26         GS
69.5           0              880.27         GS
73.5           0              880.43         GS
78.5           0              880.43         GS
84             0              882.21         GS
90             0              883.79         GS
95             0              884.51         GS
100            0              884.63         GS


----------------------------------------------------------------------
Cross Sectional Geometry
----------------------------------------------------------------------

                           Channel    Left       Right
Floodprone Elevation (ft)  884.93     884.93     884.93
Bankfull Elevation (ft)    879.92     879.92     879.92
Floodprone Width (ft)      96.46      -----      -----
Bankfull Width (ft)        23.66      12.17      11.49
Entrenchment Ratio         4.08       -----      -----
Mean Depth (ft)            2.5        3.03       1.94
Maximum Depth (ft)         5.01       5.01       4.72
Width/Depth Ratio          9.46       4.02       5.92
Bankfull Area (sq ft)      59.24      36.9       22.33
```

```
Wetted Perimeter (ft)      27.2       18.41      18.22
Hydraulic Radius (ft)      2.18       2          1.23
Begin BKF Station          38         38         50.17
End BKF Station            61.66      50.17      61.66

----------------------------------------------------------------------
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 2) Cross Section 13 - Riffle (R1A)



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                    RIVERMORPH CROSS SECTION SUMMARY

---------------------------------------------------------------------

River Name:          Little White Oak Creek (Year 2)
Reach Name:          R1A
Cross Section Name:  (Year 2) Cross Section 13 - Riffle (R1A)
Survey Date:         11/18/2009

---------------------------------------------------------------------
Cross Section Data Entry

BM Elevation:                  0 ft
Backsight Rod Reading:         0 ft

TAPE           FS             ELEV           NOTE
---------------------------------------------------------------------
0              0              887.64         GS
10                            887.7          GS
25                            887.72         GS
30                            887.64         GS
34                            887.73         GS
39                            887.56         GS
47                            887.55         GS
53                            887.77         BKF
55                            887.64         GS
55                            887.25         LEW
57                            887            GS
58                            887.06         GS
59                            887.05         TW
60                            887.17         GS
61                            887.27         REW
62.5                          887.88         RB
69                            887.64         GS
74                            887.68         GS
79                            887.76         GS
89                            887.59         GS
99                            887.59         GS
109                           887.49         GS
125                           887.66         GS


---------------------------------------------------------------------
Cross Sectional Geometry
---------------------------------------------------------------------

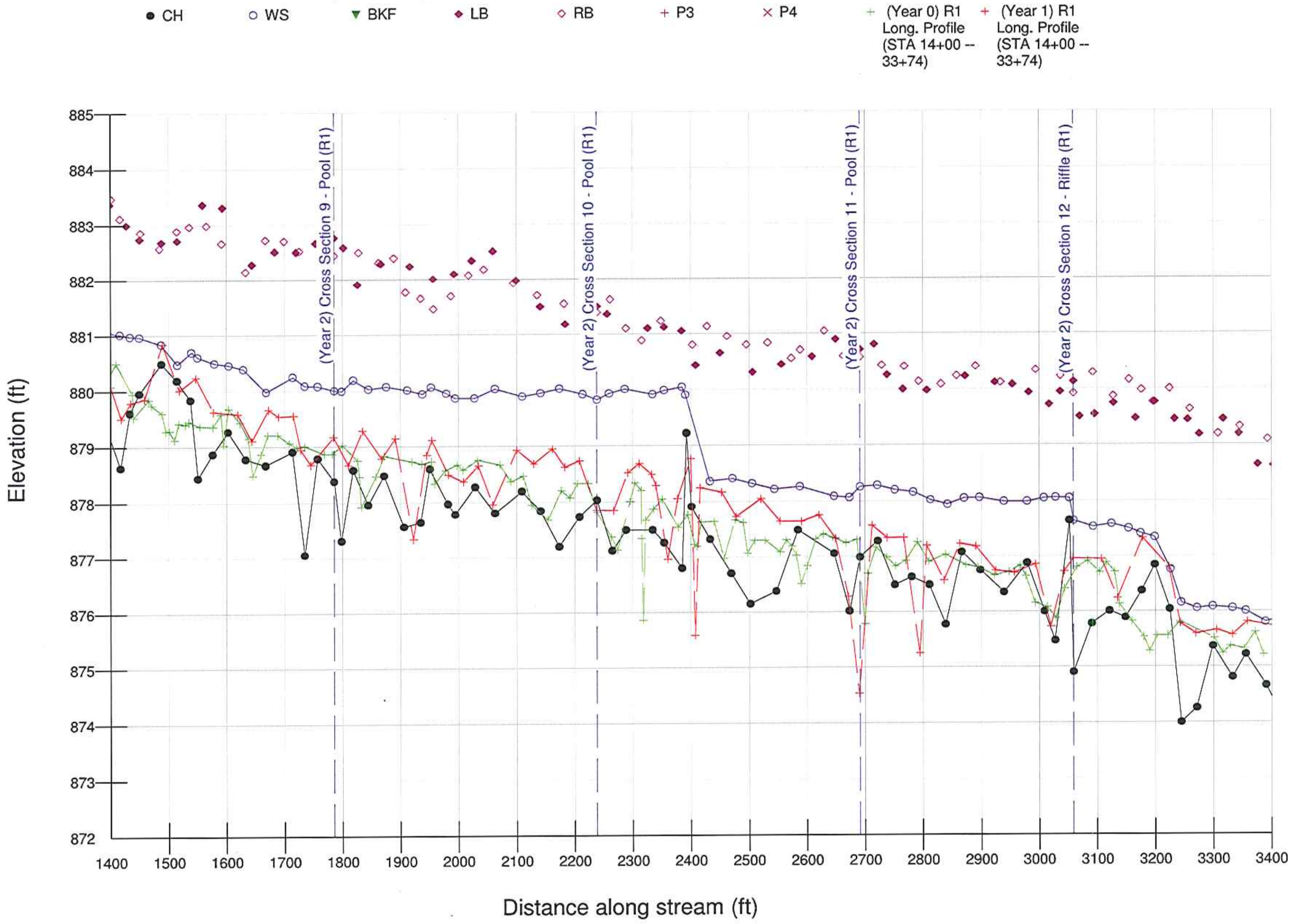
                            Channel    Left       Right
Floodprone Elevation (ft)   888.54     888.54     888.54
Bankfull Elevation (ft)     887.77     887.77     887.77
Floodprone Width (ft)       125        -----      -----
Bankfull Width (ft)         9.23       4.61       4.62
Entrenchment Ratio          13.54      -----      -----
Mean Depth (ft)             0.48       0.41       0.54
Maximum Depth (ft)          0.77       0.77       0.73
Width/Depth Ratio           19.23      11.24      8.56
Bankfull Area (sq ft)       4.39       1.88       2.51
Wetted Perimeter (ft)       9.75       5.75       5.46
Hydraulic Radius (ft)       0.45       0.33       0.46
Begin BKF Station           53         53         57.61
End BKF Station             62.23      57.61      62.23

---------------------------------------------------------------------
Entrainment Calculations
---------------------------------------------------------------------

Entrainment Formula: Rosgen Modified Shields Curve
```

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

(Year 2) R1 Long. Profile (STA 14+00 -- 33+74)



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                      RIVERMORPH PROFILE SUMMARY

----------------------------------------------------------------------

River Name:   Little White Oak Creek (Year 2)
Reach Name:   R1
Profile Name: (Year 2) R1 Long. Profile (STA 14+00 -- 33+74)
Survey Date:  11/17/2009

----------------------------------------------------------------------

Survey Data

DIST      CH      WS      BKF     LB      RB      P3      P4
----------------------------------------------------------------------
1394.07   879.32
1394.59           881.06
1398.482                          883.37
1400.829                                  883.47
1416.009          881.02
1416.103                                  883.12
1416.874  878.63
1427.139                          883
1433.115          880.98
1433.115  879.61
1449.442  879.96
1449.442          880.97
1450.065                          882.74
1451.697                                  882.86
1484.464                                  882.57
1487.122          880.84
1487.442                          882.68
1487.457  880.5
1514.31   880.19
1514.31                                   882.89
1514.919                          882.71
1515.049          880.48
1535.774                                  882.97
1537.593  879.84
1539.585          880.7
1549.845          880.61
1550.312  878.44
1558.395                          883.36
1565.211                                  882.99
1575.872  878.87
1579.182          880.5
1591.52                                   882.66
1593.136                          883.31
1602.541  879.27
1603.612          880.46
1628.726          880.39
1632.887  878.78
1632.887                                  882.15
1643.739                          882.28
1667.126                                  882.72
1667.126  878.67
1668.126          879.98
1683.098                          882.51
1699.21                                   882.7
1713.544  878.91
1714.154          880.25
1720.047                          882.5
1725.54                                   882.52
1734.829  877.06
1734.829          880.09
```

1753.569			882.66	
1757.147		880.08		
1757.311	878.79			
1762.948				882.76
1785.563	878.38	880.005	882.76	882.44
1798.287	877.31			
1798.528		879.99		
1801.657			882.58	
1818.37		880.19		
1818.383	878.58			
1825.981			881.91	
1828.08				882.49
1844.31	877.96			
1844.997		880.03		
1862.549				882.31
1866.15			882.29	
1871.585	878.48			
1875.67		880.07		
1888.755				882.39
1906.223	877.56			
1908.76				881.77
1911.627		880.01		
1916.461			882.24	
1934.802	877.64			
1934.802				881.66
1938.015		879.94		
1950.407	878.6			
1952.865		880.06		
1956.373			882.01	
1957.1				881.47
1979.235		879.95		
1981.897	877.97			
1987.163				881.7
1992.637			882.1	
1994.159		879.86		
1994.159	877.78			
2017.625				882.08
2023.114			882.34	
2027.575		879.86		
2028.573	878.27			
2043.825				882.18
2059.345			882.51	
2062.995		880.03		
2062.995	877.8			
2095.108				881.93
2099.33			881.98	
2109.172	878.19			
2109.99		879.89		
2135.633				881.71
2141.111			881.51	
2141.431	877.84			
2141.431		879.95		
2173.445	877.2			
2173.973		880.03		
2181.981				881.56
2183.673			881.19	
2208.203	877.73			
2213.987		879.93		
2222.847				881.31
2224.19			881.45	
2238.435	878.03	879.825	881.51	881.4
2255.906			881.37	
2259.177		879.94		
2261.224				881.63
2264.807	877.12			
2286.239		880.02		

2288.135	877.49			
2288.135				881.11
2315.546				880.89
2325.692			881.11	
2334.105		879.92		
2334.105	877.49			
2348.565				881.24
2353.966			881.13	
2353.966		879.99		
2353.966	877.26			
2383.897			881.06	
2384.81	876.8			
2384.81		880.05		
2390.626		879.91		
2392.469	879.22			
2401.04	877.91			
2402.781				880.81
2408.245			880.44	
2427.898				881.14
2432.738		878.36		
2433.015	877.32			
2450.334			880.66	
2462.42				880.96
2469.514	876.7			
2471.675		878.41		
2495.839				880.81
2502.392	876.15			
2505.434		878.32		
2506.328			880.31	
2532.417				880.84
2543.775		878.22		
2546.87	876.38			
2555.868			880.45	
2572.977				880.56
2584.2	877.48			
2587.718		878.26		
2588.525				880.71
2608.644			880.59	
2629.778				881.05
2646.534	877.06			
2646.534		878.09		
2649.113			880.9	
2662.891				880.6
2673.124			880.87	
2673.124	876.02			
2673.124		878.07		
2691.273	876.99	878.255	880.72	880.58
2715.666			880.81	
2720.918		878.28		
2721.736	877.28			
2728.867				880.43
2738.234			880.26	
2751.008		878.2		
2751.008	876.49			
2765.217			880	
2767.621				880.41
2780.063	876.63			
2782.959		878.16		
2792.627				880.14
2806.448			879.98	
2810.652	876.49			
2812.712		878.02		
2830.818				880.09
2838.408	875.77			
2842.059		877.94		
2857.961				880.24

2866.51	877.08			
2870.454		878.05		
2872.467			880.23	
2890.631				880.41
2897.36		878.06		
2898.404	876.75			
2923.69			880.12	
2933.445				880.12
2939.328		877.99		
2939.328	876.35			
2953.911			880.08	
2979.092	876.88			
2979.092		877.99		
2982.387			879.94	
2994.257				880.34
3008.216		878.05		
3009.043	876			
3017.239			879.72	
3027.485	875.48			
3028.393		878.06		
3036.515			879.95	
3037.147				880.23
3052.069		878.05		
3052.069	877.64			
3059.309	874.91	877.64	880.13	879.92
3070.016			879.5	
3090.46	875.78			
3092.943				880.29
3093.134		877.53		
3095.832			879.54	
3121.019	876.01			
3124.819		877.58		
3127.782				879.87
3128.403			879.74	
3148.683	875.89			
3154.116		877.5		
3155.262				880.16
3166.561			879.47	
3174.939		877.41		
3176.641	876.37			
3176.641				879.98
3196.684				879.76
3199.098			879.76	
3199.098		877.34		
3199.098	876.84			
3225.277	876.04			
3225.277				880
3226.653		876.76		
3233.822			879.45	
3244.947		876.16		
3244.947	874			
3256.503			879.44	
3260.049				879.63
3271.669	874.26			
3271.936		876.06		
3276.122			879.18	
3299.042		876.09		
3299.433	875.37			
3308.548				879.19
3317.51			879.45	
3333.174		876.06		
3333.174	874.81			
3344.473			879.19	
3346.146				879.32
3355.854	875.22			
3355.854		876.01		

3376.843			878.64	
3389.938		875.81		
3390.947	874.66			
3393.851				879.09
3404.071			878.62	
3414.328	874.17			
3416.612		875.88		
3424.168				878.92
3438.545			878.93	
3443.835		875.8		
3444.314				879.2
3444.314	874.72			

Cross Section / Bank Profile Locations

Name	Type	Profile Station
(Year 2) Cross Section 9 - Pool	(R1)Riffle XS	1785
(Year 2) Cross Section 10 - Pool	(R1)Riffle XS	2238
(Year 2) Cross Section 11 - Pool	(R1)Riffle XS	2691
(Year 2) Cross Section 12 - Riffle	(R1)Riffle XS	3059

Measurements from Graph

Bankfull Slope: 0.00205

Variable	Min	Avg	Max
S riffle	0.00236	0.01813	0.02762
S pool	0	0	0
S run	0	0	0
S glide	0	0	0
P - P	33.74	89.61	168.72
Pool length	37.49	54.74	88.11
Riffle length	13.12	22.5	30
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.

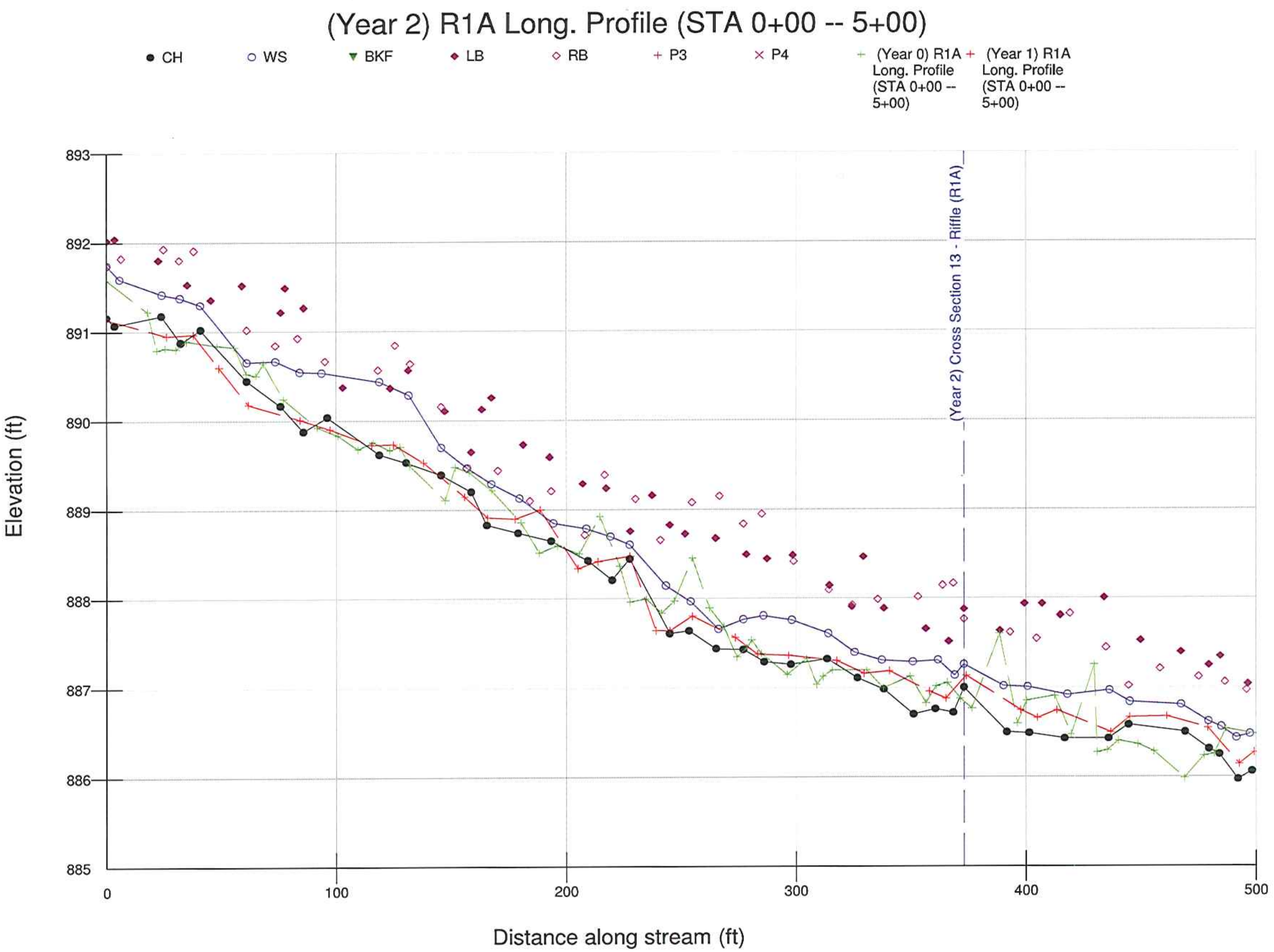
RIVERMORPH PROFILE SUMMARY

Notes

River Name: Little White Oak Creek (Year 2)
Reach Name: R1
Profile Name: (Year 2) R1 Long. Profile (STA 14+00 -- 33+74)
Survey Date: 11/17/2009

DIST	Note
1394.59	REW
1416.009	REW
1433.115	REW
1449.442	REW
1487.122	REW
1515.049	REW
1539.585	REW
1549.845	REW
1579.182	REW
1603.612	REW

1628.726	REW
1668.126	REW
1714.154	REW
1734.829	REW
1757.147	REW
1785.563	XS9 - TW Intersect @ station 1785
1798.528	REW
1818.37	REW
1844.997	REW
1875.67	REW
1911.627	REW
1938.015	REW
1952.865	REW
1979.235	REW
1994.159	REW
2027.575	REW
2062.995	REW
2109.99	REW
2141.431	REW
2173.973	REW
2213.987	REW
2238.435	XS10 - TW Intersect @ station 2238
2259.177	REW
2286.239	REW
2334.105	REW
2353.966	REW
2384.81	REW
2390.626	REW
2432.738	REW
2471.675	REW
2505.434	REW
2543.775	REW
2587.718	REW
2646.534	REW
2673.124	REW
2691.273	XS11 - TW Intersect @ station 2691
2720.918	REW
2751.008	REW
2782.959	REW
2812.712	REW
2842.059	REW
2870.454	REW
2897.36	REW
2939.328	REW
2979.092	REW
3008.216	REW
3028.393	REW
3052.069	REW
3059.309	XS12 - TW Intersect @ station 1665.239
3093.134	REW
3124.819	REW
3154.116	REW
3174.939	REW
3199.098	REW
3226.653	REW
3244.947	REW
3271.936	REW
3299.042	REW
3333.174	REW
3355.854	REW
3389.938	REW
3416.612	REW
3443.835	REW


(Year 2) R1A Long. Profile (STA 0+00 -- 5+00)
● CH
○ WS
▼ BKF
◆ LB
◇ RB
+ P3
× P4
+ (Year 0) R1A Long. Profile (STA 0+00 -- 5+00)
+ (Year 1) R1A Long. Profile (STA 0+00 -- 5+00)
(Year 2) Cross Section 13 - Riffle (R1A)
Elevation (ft)
893
892
891
890
889
888
887
886
885
0
100
200
300
400
500
Distance along stream (ft)

```
                     RIVERMORPH PROFILE SUMMARY

----------------------------------------------------------------------

River Name:   Little White Oak Creek (Year 2)
Reach Name:   R1A
Profile Name: (Year 2) R1A Long. Profile (STA 0+00 -- 5+00)
Survey Date:  11/18/2009

----------------------------------------------------------------------

Survey Data


DIST      CH      WS      BKF     LB      RB      P3      P4
----------------------------------------------------------------------
0         891.16
0                 891.75
0                                         891.74
0                                 892.02
3.478     891.07
3.478                             892.04
5.646             891.59
6.22                                      891.83
22.455                            891.81
23.801    891.18
23.994            891.42
24.729                                    891.93
31.471                                    891.81
31.863            891.38
32.291    890.88
35.042                            891.53
37.849                                    891.91
40.741            891.3
40.883    891.02
45.303                            891.36
58.854                            891.52
60.927    890.45
60.927                                    891.02
60.927            890.66
73.439                                    890.85
73.481            890.67
75.742                            891.22
75.742    890.17
77.703                            891.49
83.181                                    890.93
84.023            890.55
85.742    889.88
85.742                            891.27
93.631            890.54
95.089                                    890.67
96.074    890.04
102.823                           890.38
118.159                                   890.57
118.865           890.44
118.865   889.62
123.459                           890.37
125.565                                   890.85
130.502   889.53
131.314                           890.57
131.565           890.29
132.186                                   890.64
145.666           889.7
145.707   889.39
145.707                                   890.16
147.2                             890.11
```

156.73				889.47
157.004		889.47		
158.687	889.2			
158.687			889.65	
163.372			890.13	
165.544	888.83			
167.539			890.26	
167.579		889.29		
170.337				889.44
179.161	888.74			
179.75		889.13		
181.38			889.73	
184.2				889.1
192.846			889.59	
193.465	888.65			
193.465				889.21
194.455		888.85		
207.217			889.29	
208.082				888.72
208.773		888.79		
209.445	888.43			
216.729				889.39
217.338			889.24	
219.252		888.7		
220.002	888.21			
227.607		888.61		
227.607	888.45			
227.891			888.76	
230.088				889.12
237.375			889.16	
240.882				888.66
243.347		888.15		
244.996			888.83	
244.996	887.61			
251.69			888.73	
253.421	887.64			
254.114		887.97		
254.602				889.08
264.92			888.68	
265.185	887.44			
266.159		887.66		
266.609				889.15
277.036	887.43			
277.036		887.77		
277.036				888.84
278.289			888.5	
285.006				888.95
285.705		887.81		
286.062	887.29			
287.301			888.45	
297.623	887.26			
298.077		887.76		
298.509			888.49	
298.841				888.42
313.409	887.32			
313.983		887.61		
314.166				888.1
314.411			888.15	
324.151			887.91	
324.357				887.93
325.36		887.4		
326.579	887.11			
329.213			888.47	
335.47				887.99
337.246		887.31		
338.07			887.89	

338.07	886.98			
350.717		887.29		
350.999	886.7			
352.978				888.02
356.383			887.66	
360.505	886.76			
361.686		887.31		
363.622				888.15
366.298			887.52	
368.321	886.72			
368.321				888.17
368.97		887.14		
372.927	887	887.26	887.88	887.77
388.614			887.64	
390.214		887.02		
391.638	886.5			
393.048				887.62
399.317			887.94	
400.748		887.01		
401.394	886.49			
404.604				887.55
406.933			887.94	
414.89			887.81	
416.798	886.43			
418.036		886.92		
419.099				887.83
433.996			888.01	
434.79				887.45
435.837	886.43			
436.317		886.97		
444.602	886.58			
444.674				887.02
445.164		886.84		
449.861			887.53	
458.336				887.21
467.374			887.4	
467.475		886.81		
469.215	886.5			
475.126				887.12
479.417		886.62		
479.567	886.31			
479.567			887.25	
484.123	886.25			
484.516			887.35	
484.981		886.56		
486.555				887.06
491.516		886.44		
492.201	885.97			
495.94				886.97
496.484			887.04	
497.42		886.48		
498.252	886.06			

Cross Section / Bank Profile Locations

Name	Type	Profile Station
(Year 2) Cross Section 13 - Riffle (R1A)	Riffle XS	373

Measurements from Graph

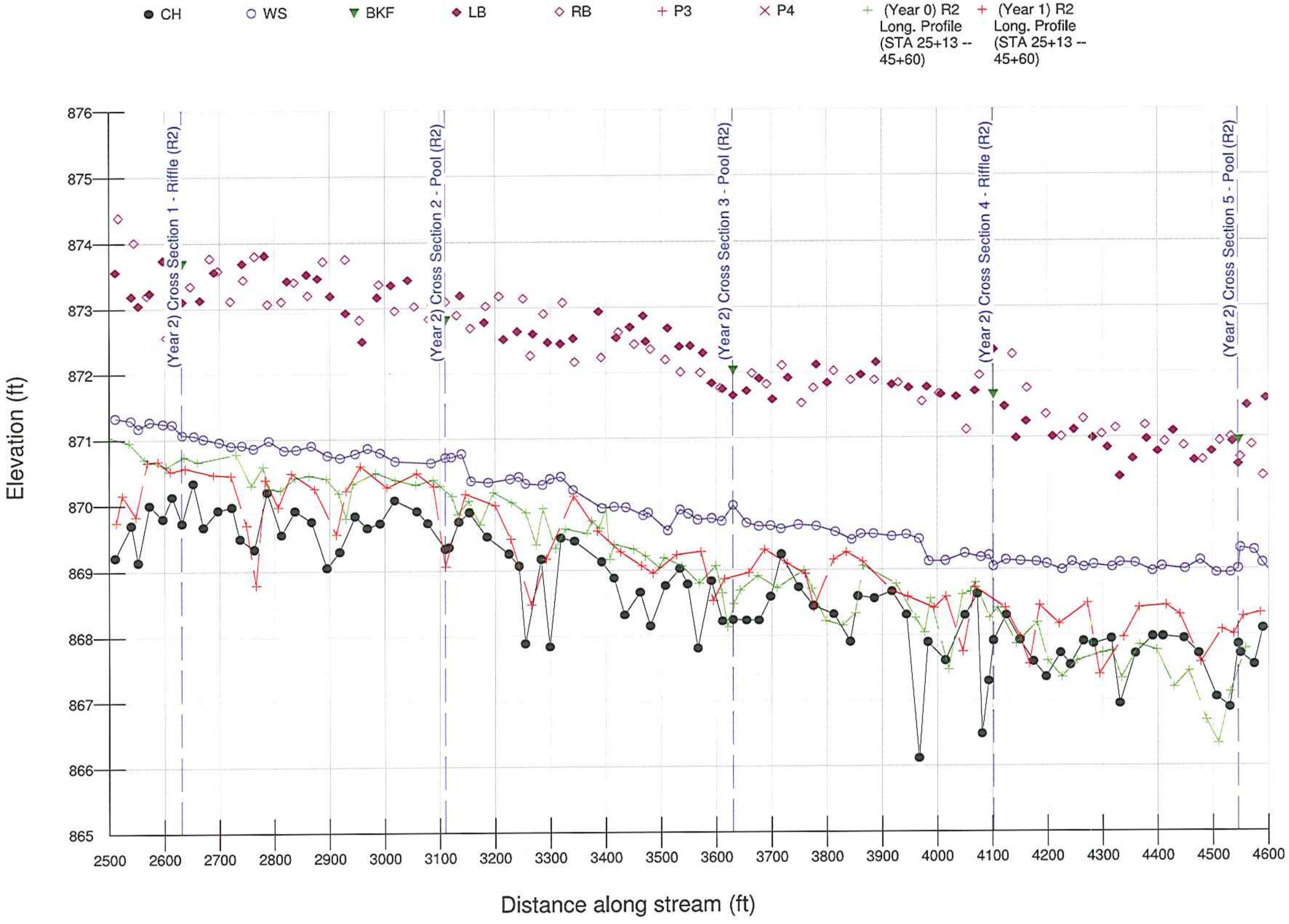
Bankfull Slope: 0.01056

Variable	Min	Avg	Max

```
S riffle       0.01311        0.02236        0.03303
S pool         0              0              0
S run          0              0              0
S glide        0              0              0
P - P          25.67          50.58          73.63
Pool length    11.14          16.63          24.70
Riffle length  11.63          14.90          19.38
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 2)
Reach Name:    R1A
Profile Name:  (Year 2) R1A Long. Profile (STA 0+00 -- 5+00)
Survey Date:   11/18/2009

DIST        Note
---------------------------------------------------------------------
0           REW
5.646       REW
23.994      REW
31.863      REW
40.741      REW
60.927      REW
73.481      REW
84.023      REW
93.631      REW
118.865     REW
131.565     REW
145.666     REW
157.004     REW
167.579     REW
179.75      REW
194.455     REW
208.773     REW
219.252     REW
227.607     REW
243.347     REW
254.114     REW
266.159     REW
277.036     REW
285.705     REW
298.077     REW
313.983     REW
325.36      REW
337.246     REW
350.717     REW
361.686     REW
368.97      REW
372.927     XS13 - TW Intersect @ station 372.927
390.214     REW
400.748     REW
418.036     REW
436.317     REW
445.164     REW
467.475     REW
479.417     REW
```

484.981	REW
491.516	REW
497.42	REW

(Year 2) R2 Long. Profile (STA 25+13 -- 45+60)



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                      RIVERMORPH PROFILE SUMMARY

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River Name:   Little White Oak Creek (Year 2)
Reach Name:   R2
Profile Name: (Year 2) R2 Long. Profile (STA 25+13 -- 45+60)
Survey Date:  11/18/2009

----------------------------------------------------------------------

Survey Data

DIST      CH      WS      BKF     LB      RB      P3      P4
----------------------------------------------------------------------
2510.76   869.21
2510.76                           873.56
2510.76           871.33
2516.46                                   874.39
2539.066          871.29
2539.94                           873.19
2540.034  869.7
2544.977                                  874.01
2552.347          871.17
2552.447  869.14
2552.447                          873.05
2568.001                                  873.2
2572.916          871.27
2572.977  870
2572.977                          873.24
2597.252  869.8
2597.252                          873.74
2597.252          871.24
2603.537                                  872.56
2612.705                          873.57
2613.849          871.23
2614.064  870.13
2631.852  869.73  871.07  873.68  873.11
2646.801                                  873.34
2652.444  870.34
2653.404          871.06
2664.367                          873.13
2670.369          871.01
2670.85   869.67
2682.113                                  873.77
2689.913                          873.56
2697.073                                  873.58
2697.073  869.92
2699.411          870.96
2719.592                                  873.12
2720.654          870.9
2722.592  869.97
2737.227  869.49
2740.286          870.91
2740.691                          873.69
2743.113                                  873.44
2761.49           870.86
2763.281                                  873.8
2763.281  869.33
2781.207                          873.81
2786.443  870.2
2786.9                                    873.07
2789.319          870.98
2812.169                                  873.11
2812.432  869.55
```

2816.811		870.83			
2822.337				873.42	
2835.329					873.4
2836.879	869.91				
2839.434		870.84			
2857.999				873.52	
2859.995					873.2
2866.554		870.9			
2867.221	869.75				
2877.669				873.46	
2887.48					873.72
2895.117	869.05				
2895.816		870.75			
2900.732				873.19	
2918.128	869.29				
2918.51		870.71			
2928.17					873.75
2928.774				872.93	
2945.972	869.83				
2945.972		870.78			
2953.845					872.82
2958.922				872.49	
2968.285	869.65				
2968.52		870.86			
2985.88				873.17	
2988.865					873.36
2991.366	869.72				
2991.366		870.79			
3010.951				873.35	
3017.779	870.07				
3017.881					872.96
3018.547		870.66			
3041.613				873.43	
3053.069					873.03
3058.219	869.9				
3077.755	869.72				
3080.04					872.83
3083.613		870.63			
3085.104				873.05	
3109.508	869.33	870.715	872.81		873.1
3116.421	869.35				
3120.208		870.72			
3130.217					872.89
3134.155	869.74				
3136.098				873.19	
3138.906		870.77			
3153.222	869.88				
3155.041					872.69
3156.304		870.36			
3180.195				872.78	
3182.764					873.03
3185.244	869.51				
3187.378		870.34			
3206.789					873.18
3214.974				872.52	
3225.056	869.25				
3226.745		870.39			
3239.903				872.64	
3242.561		870.42			
3243.104	869.07				
3250.399					873.14
3254.638	867.89				
3254.769		870.32			
3263.678					872.27
3267.942				872.6	
3283.275	869.17				

3285.459		870.3			
3287.429					872.91
3295.166				872.47	
3298.828		870.39			
3298.863	867.84				
3317.74				872.45	
3318.785		870.42			
3318.785	869.49				
3321.913					873.08
3340.645		870.22			
3340.977				872.53	
3343.359	869.44				
3343.359					872.17
3387.129				872.94	
3391.667					872.24
3392.522	869.13				
3392.667		869.94			
3414.845	868.88				
3415.024		869.96			
3419.134				872.54	
3422.94					872.62
3433.936	868.32				
3436.569		869.95			
3443.976				872.7	
3451.892					872.44
3462.255	868.66				
3468.012				872.87	
3468.012		869.83			
3471.987				872.48	
3476.71		869.87			
3480.758					872.36
3480.758	868.15				
3507.752					872.2
3507.752	868.76				
3512.092				872.68	
3512.255		869.6			
3533.189				872.4	
3534.097	869.02				
3534.402		869.91			
3535.389					872.01
3547.894	868.78				
3549.31		869.85			
3553.073				872.41	
3566.19		869.76			
3566.764	867.81				
3571.273					872
3575.861				872.3	
3591.034	868.83				
3591.805				871.84	
3591.912		869.78			
3606.652					871.76
3610.214		869.74			
3611.203	868.22				
3611.203				871.75	
3630.288	868.24	869.975	872.03	871.65	
3654.763	868.23				
3654.763				871.72	
3654.763		869.71			
3664.474					871.99
3677.014		869.66			
3677.416				871.91	
3677.416	868.23				
3691.051					871.82
3698.57	868.59				
3698.57		869.67			
3701.746				871.59	

3716.896		869.62			
3717.761	869.23				
3718.997					872.11
3729.458				871.92	
3748.513		869.68			
3749.053	868.73				
3754.312					871.53
3775.924	868.45				
3775.924					871.76
3781.228		869.66			
3781.228				872.12	
3801.023				871.84	
3812.457					872.02
3812.457	868.32				
3815.665		869.57			
3842.559	867.9				
3843.459					871.88
3845.273		869.45			
3856.326	868.59				
3861.595				871.96	
3861.595		869.54			
3884.481		869.54			
3886.172	868.56				
3886.292					871.88
3889.302				872.15	
3917.707	868.66				
3917.707		869.5			
3917.813				871.81	
3929.798					871.84
3944.218	868.31				
3944.218		869.53			
3948.555				871.76	
3967.158	866.12				
3967.158		869.46			
3972.522					871.55
3981.325				871.77	
3983.167	867.89				
3984.895		869.12			
4003.753					871.67
4007.046				871.66	
4014.971	867.61				
4014.971		869.13			
4034.402				871.62	
4049.991		869.24			
4050.113	868.3				
4053.147					871.12
4068.631				871.71	
4072.517	868.62				
4076.683					871.95
4079.424		869.18			
4081.106	866.49				
4093.009	867.3				
4094.449		869.21			
4102.196	867.91	869.045	871.65	872.34	
4122.194				871.47	
4124.578		869.14			
4124.873	868.3				
4136.424					872.27
4143.415				870.99	
4149.724	867.92				
4151.359		869.12			
4161.349				871.24	
4162.914					871.75
4174.421	867.59				
4180.044		869.11			
4197.426	867.36				

4197.426					871.35
4198.893		869.08			
4209.809				871.01	
4223.629	867.72				
4225.416					871.01
4227.071		868.99			
4241.356	867.54				
4244.821		869.11			
4248.042				871.11	
4264.966	867.9				
4264.966					871.28
4265.786		869.03			
4282.284				870.99	
4283.603	867.86				
4284.022		869.07			
4298.471					871.05
4308.897				870.84	
4315.513	867.94				
4317.472		869.03			
4323.703					871.14
4331.025				870.4	
4331.025	866.95				
4331.077		869.1			
4354.858				870.67	
4359.408		869.09			
4359.408	867.71				
4377.271					871.18
4379.96				870.97	
4390.723	867.97				
4390.723		868.97			
4400.089				870.78	
4407.746		869.04			
4409.294	867.97				
4412.946					870.93
4428.119				871.09	
4447.282					870.87
4447.282	867.94				
4449.627		869			
4466.472				870.64	
4474.187	867.71				
4477.418		869.13			
4481.836					870.65
4498.026				870.78	
4506.596		868.94			
4506.596	867.05				
4512.28					870.94
4530.647	866.89				
4532.097		868.94			
4532.571					871
4535.077				870.93	
4545.845	867.85	869	870.94	870.58	
4549.682		869.31			
4549.682	867.71				
4549.682					870.69
4561.356				871.48	
4570.204					870.88
4574.441	867.54				
4575.085		869.28			
4589.747		869.09			
4590.139	868.09				
4590.935					870.41
4595.612				871.59	
4610.65					870.82
4614.198		868.85			
4619.062	868.06			871.04	

```
Cross Section / Bank Profile Locations

Name                                 Type                 Profile Station
---------------------------------------------------------------------
(Year 2) Cross Section 1 - Riffle (R2)Riffle XS             2631
(Year 2) Cross Section 2 - Pool (R2)Riffle XS              3109
(Year 2) Cross Section 3 - Pool (R2)Riffle XS              3630
(Year 2) Cross Section 4 - Riffle (R2)Riffle XS             4102
(Year 2) Cross Section 5 - Pool (R2)Riffle XS              4545


Measurements from Graph

Bankfull Slope:     0.00138

Variable       Min            Avg            Max
---------------------------------------------------------------------
S riffle       0.00201        0.00375        0.00616
S pool         0              0              0
S run          0              0              0
S glide        0              0              0
P - P          79.62          147.00         228.66
Pool length    30.62          50.27          91.87
Riffle length  20.42          28.07          34.71
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

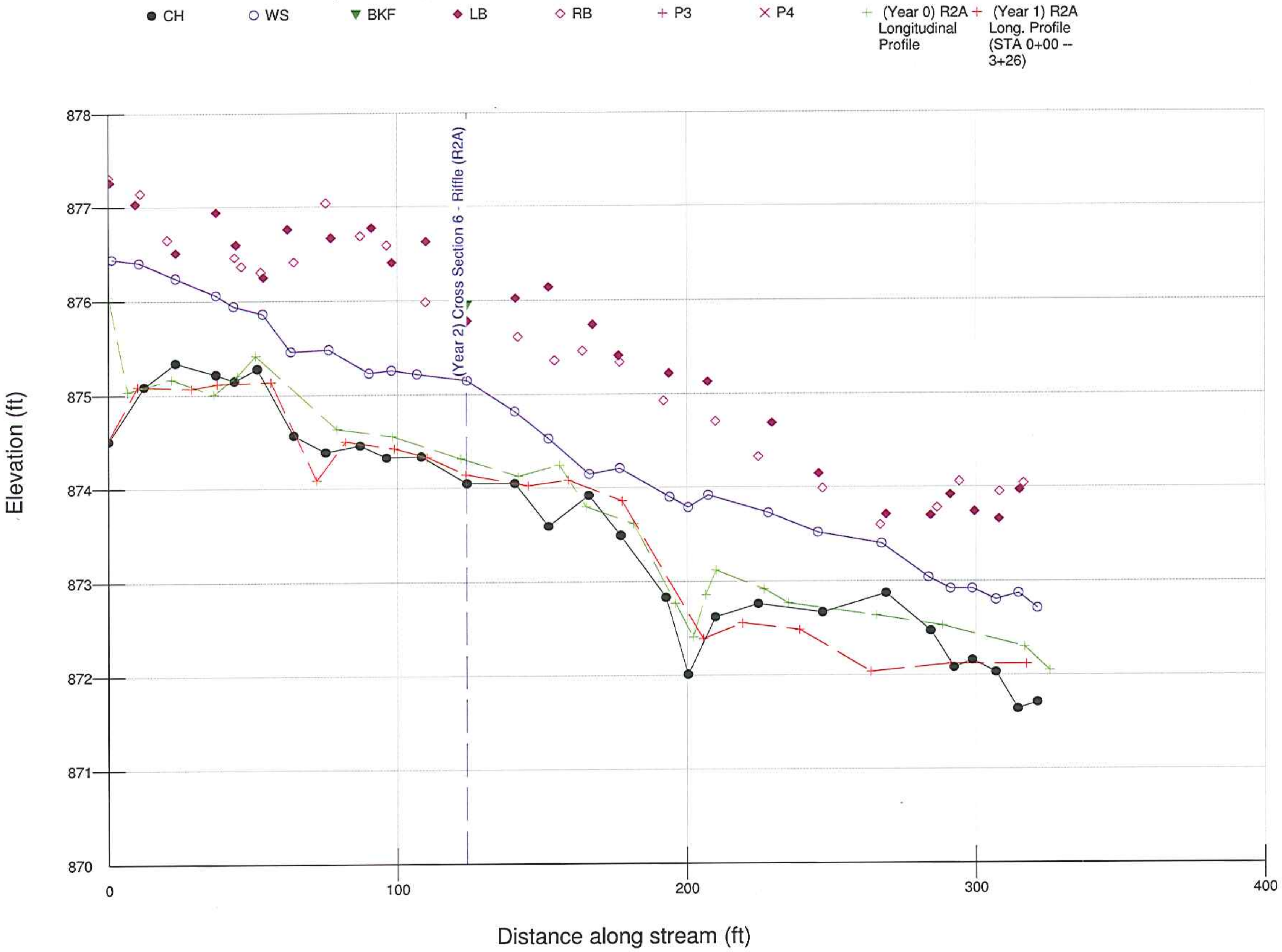
---------------------------------------------------------------------

River Name:   Little White Oak Creek (Year 2)
Reach Name:   R2
Profile Name: (Year 2) R2 Long. Profile (STA 25+13 -- 45+60)
Survey Date:  11/18/2009

DIST        Note
---------------------------------------------------------------------
2510.76     REW
2539.066    REW
2552.347    REW
2572.916    REW
2597.252    REW
2613.849    REW
2631.852    XS1 - TW Intersect @ station 2631
2653.404    REW
2670.369    REW
2699.411    REW
2720.654    REW
2740.286    REW
2761.49     REW
2789.319    REW
2816.811    REW
2839.434    REW
2866.554    REW
2895.816    REW
2918.51     REW
2945.972    REW
2968.52     REW
2991.366    REW
```

3018.547	REW
3083.613	REW
3109.508	XS2 - TW Intersect @ station 3109
3120.208	REW
3138.906	REW
3156.304	REW
3187.378	REW
3226.745	REW
3242.561	REW
3254.769	REW
3285.459	REW
3298.828	REW
3318.785	REW
3340.645	REW
3392.667	REW
3415.024	REW
3436.569	REW
3476.71	REW
3512.255	REW
3534.402	REW
3549.31	REW
3566.19	REW
3591.912	REW
3610.214	REW
3630.288	XS3 - TW Intersect @ station 3630
3654.763	REW
3677.014	REW
3698.57	REW
3716.896	REW
3748.513	REW
3815.665	REW
3845.273	REW
3884.481	REW
3917.707	REW
3944.218	REW
3967.158	REW
3984.895	REW
4014.971	REW
4049.991	REW
4079.424	REW
4094.449	REW
4102.196	XS4 - TW Intersect @ station 4102
4124.578	REW
4151.359	REW
4180.044	REW
4198.893	REW
4227.071	REW
4244.821	REW
4265.786	REW
4284.022	REW
4317.472	REW
4331.077	REW
4359.408	REW
4390.723	REW
4407.746	REW
4449.627	REW
4477.418	REW
4506.596	REW
4532.097	REW
4545.845	XS5 - TW Intersect @ station 4545
4549.682	REW
4575.085	REW
4589.747	REW
4614.198	REW

(Year 2) R2A Long. Profile (STA 0+00 -- 3+26)



RIVERMORPH PROFILE SUMMARY

River Name: Little White Oak Creek (Year 2)
Reach Name: R2A
Profile Name: (Year 2) R2A Long. Profile (STA 0+00 -- 3+26)
Survey Date: 11/18/2009

Survey Data

DIST	CH	WS	BKF	LB	RB	P3	P4
0	874.51						
0					877.31		
0.458				877.26			
1.112		876.44					
9.285				877.03			
10.552		876.4					
10.979					877.14		
12.316	875.09						
20.339					876.65		
23.198				876.51			
23.198	875.34						
23.198		876.24					
37.191				876.94			
37.191		876.06					
37.191	875.22						
43.266		875.94					
43.582	875.15						
43.582					876.46		
44.017				876.6			
45.977					876.36		
51.516	875.28						
52.726					876.3		
53.38		875.86					
53.535				876.25			
62.002				876.76			
63.119		875.46					
64.091					876.41		
64.091	874.57						
75.179					877.04		
75.179	874.39						
76.254		875.48					
76.944				876.67			
87.145	874.46						
87.145					876.69		
90.222		875.23					
91.048				876.77			
96.28	874.33						
96.28					876.59		
97.96		875.26					
98.089				876.4			
106.804		875.22					
108.313	874.34						
109.729					875.98		
109.893				876.63			
124.106	874.05	875.15	875.95	875.78			
140.635	874.05						
140.635		874.82					
140.831				876.02			
141.705					875.61		
152.325				876.14			

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152.325   873.59
152.325           874.53
154.346                                    875.36
163.954                                    875.46
166.162   873.92
166.326           874.15
167.472                            875.74
176.468                            875.41
176.793                                    875.34
176.916           874.21
177.155   873.49
192.043                                    874.93
192.819   872.83
193.862                            875.22
194.096           873.9
200.454   872.01
200.454           873.79
207.256                            875.13
207.434           873.92
209.895                                    874.71
209.895   872.62
224.751   872.76
224.751                                    874.33
228.155           873.73
229.425                            874.69
245.345           873.52
245.548                            874.15
246.945   872.67
246.97                                     873.99
266.946                                    873.6
267.362           873.4
268.888   872.87
268.937                            873.71
283.563           873.04
284.386                            873.7
284.386   872.47
286.521                                    873.78
291.151                            873.92
291.194           872.92
292.402   872.08
294.257                                    874.06
298.713   872.16
298.713           872.92
299.572                            873.74
306.857   872.03
306.906           872.8
307.979                            873.66
308.165                                    873.95
314.452   871.64
314.667           872.87
315.135                            873.97
316.516                                    874.04
321.334   871.71  872.71

Cross Section / Bank Profile Locations

Name                               Type                Profile Station
-----------------------------------------------------------------------
(Year 2) Cross Section 6 - Riffle (R2A)Riffle XS            124


Measurements from Graph

Bankfull Slope:     0.01149

Variable       Min             Avg            Max
```
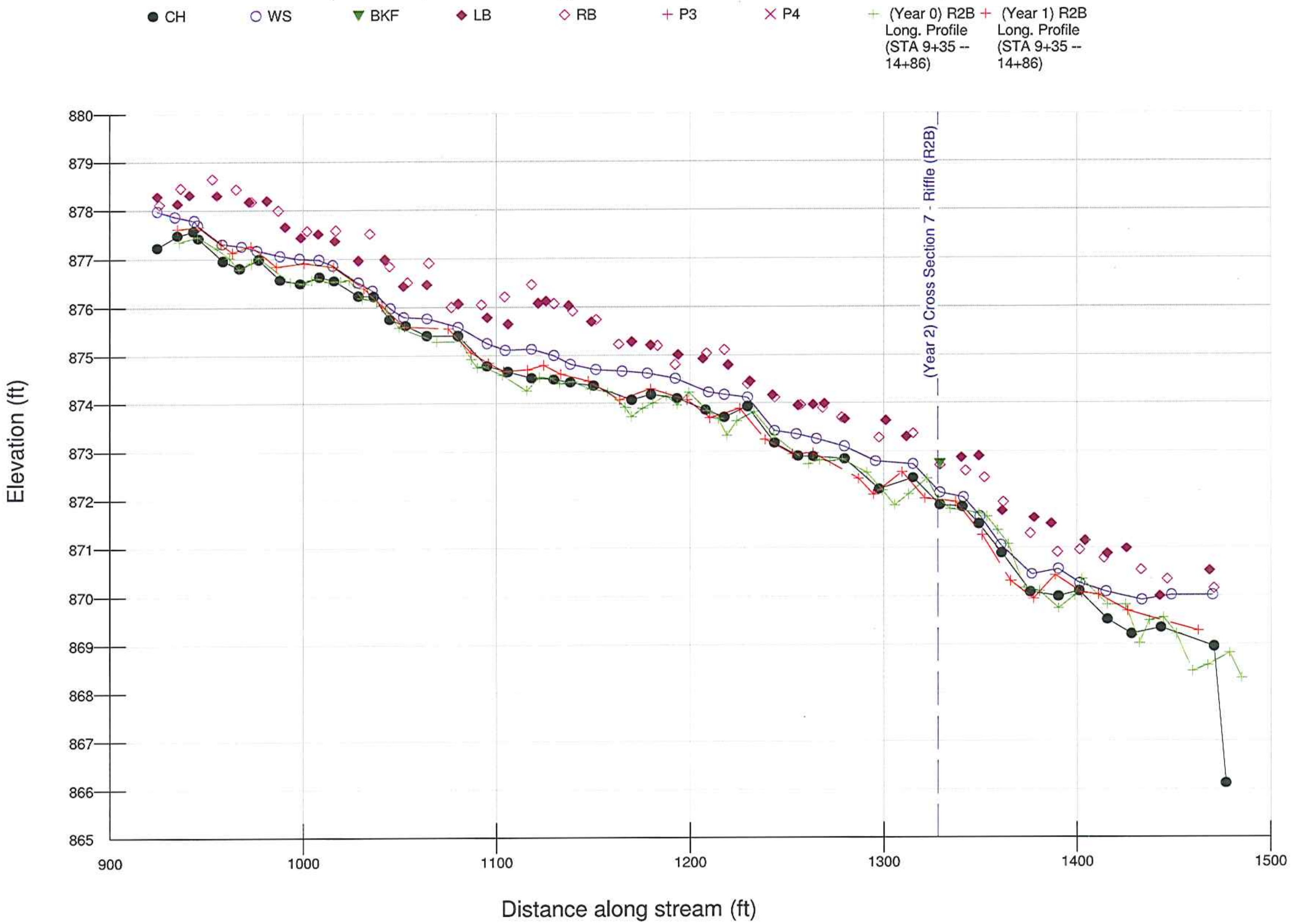

```
-------------------------------------------------------------------------
S riffle       0.00463        0.01158        0.02008
S pool         0              0              0
S run          0              0              0
S glide        0              0              0
P - P          47.66          72.72          93
Pool length    13.18          18.34          22.09
Riffle length  18.21          21.44          26.35
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 2)
Reach Name:   R2A
Profile Name: (Year 2) R2A Long. Profile (STA 0+00 -- 3+26)
Survey Date:  11/18/2009

DIST       Note
-------------------------------------------------------------------------
1.112      REW
10.552     REW
23.198     REW
37.191     REW
43.266     REW
53.38      REW
63.119     REW
76.254     REW
90.222     REW
97.96      REW
106.804    REW
124.106    XS6 - TW Intersect @ station 124.106
140.635    REW
152.325    REW
166.326    REW
176.916    REW
194.096    REW
200.454    REW
207.434    REW
228.155    REW
245.345    REW
267.362    REW
283.563    REW
291.194    REW
298.713    REW
306.906    REW
314.667    REW
```

(Year 2) R2B Long. Profile (STA 9+35 -- 14+86)



RIVERMORPH PROFILE SUMMARY

River Name: Little White Oak Creek (Year 2)
Reach Name: R2B
Profile Name: (Year 2) R2B Long. Profile (STA 9+35 -- 14+86)
Survey Date: 11/18/2009

Survey Data

DIST	CH	WS	BKF	LB	RB	P3	P4
924.61	877.23						
924.61				878.28			
924.61		877.98					
925.679					878.11		
933.761		877.87					
935.004	877.49						
935.004				878.13			
936.758					878.45		
941.173				878.31			
943.268	877.58						
943.795		877.79					
945.385		877.7					
945.857	877.43						
953.135					878.64		
955.511				878.3			
958.117		877.31					
958.58	876.96						
965.379					878.43		
967.252	876.81						
968.21		877.26					
972.1				878.17			
973.197					878.17		
976.199		877.17					
977.147	876.99						
981.288				878.19			
987.126					877.99		
988.087		877.06					
988.183	876.57						
990.685				877.66			
998.28		877					
998.579	876.49						
998.862				877.44			
1002.065					877.58		
1007.894				877.52			
1008.257		876.98					
1008.503	876.63						
1015.368		876.87					
1016.127	876.55						
1016.51				877.37			
1017.003					877.59		
1028.669		876.51					
1028.721	876.23						
1028.721				876.96			
1034.535					877.52		
1035.896		876.34					
1036.589	876.22						
1042.318				876.98			
1044.857					876.84		
1044.857	875.75						
1045.16		875.98					

1051.886			876.43	
1052.112		875.8		
1053.059	875.62			
1054.044				876.51
1064.07			876.46	
1064.07	875.41			
1064.171		875.77		
1065.01				876.91
1076.668				876
1080.245	875.41			
1080.245			876.07	
1080.245		875.59		
1092.231				876.05
1095.112	874.78			
1095.112			875.79	
1095.191		875.25		
1104.18				876.21
1104.557		875.11		
1106.005	874.66			
1106.005			875.65	
1118.173		875.13		
1118.173				876.46
1118.173	874.53			
1121.504			876.08	
1125.567			876.12	
1129.724				876.07
1129.724	874.5			
1129.724		875		
1137.277			876.03	
1138.117		874.82		
1138.117	874.44			
1139.334				875.92
1149.049			875.7	
1150.107	874.37			
1151.385		874.71		
1151.478				875.74
1163.11				875.23
1164.93		874.67		
1169.904	874.07			
1169.904			875.28	
1177.929		874.63		
1179.61			875.21	
1179.841	874.18			
1183.142				875.2
1192.223				874.81
1192.323		874.52		
1193.25	874.1			
1193.729			875.01	
1206.618			874.93	
1207.98	873.86			
1208.38				875.04
1209.471		874.23		
1217.616	873.71			
1217.616				875.11
1217.616		874.18		
1219.635			874.8	
1229.62		874.12		
1229.62				874.4
1229.62	873.93			
1230.876			874.46	
1242.49			874.17	
1243.605		873.43		
1243.605	873.17			
1243.605				874.12
1254.865		873.36		
1255.71			873.95	

1255.71	872.9				
1256.951					873.96
1263.43				873.97	
1263.43	872.89				
1265.268		873.26			
1268.413					873.9
1269.283				873.99	
1278.311					873.7
1279.697		873.1			
1279.798				873.67	
1279.798	872.84				
1295.728		872.79			
1297.505					873.28
1297.505	872.21				
1301.036				873.64	
1311.743				873.3	
1315.122					873.37
1315.122	872.44				
1315.142		872.73			
1328.975	871.88	872.14	872.73		872.71
1340.098				872.87	
1340.623	871.84				
1341.215		872.04			
1342.305					872.59
1349.141				872.9	
1349.141	871.48				
1349.81		871.64			
1352.01					872.45
1360.588		871.05			
1360.958	870.88				
1361.215				871.76	
1361.74					871.94
1375.751	870.08				
1375.751					871.29
1376.583		870.45			
1377.717				871.61	
1386.652				871.49	
1389.809					870.9
1390.288		870.56			
1390.288	869.99				
1401.083	870.1				
1401.288					870.95
1401.304		870.26			
1404.106				871.14	
1413.858					870.78
1415.061		870.09			
1415.603	869.51				
1415.603				870.87	
1425.579				870.98	
1428.077	869.21				
1433.106					870.54
1433.565		869.92			
1442.854				870	
1443.387	869.34				
1446.568					870.34
1448.881		870.02			
1468.562				870.52	
1470.06		870.02			
1470.809	868.95				870.15
1476.969	866.12				

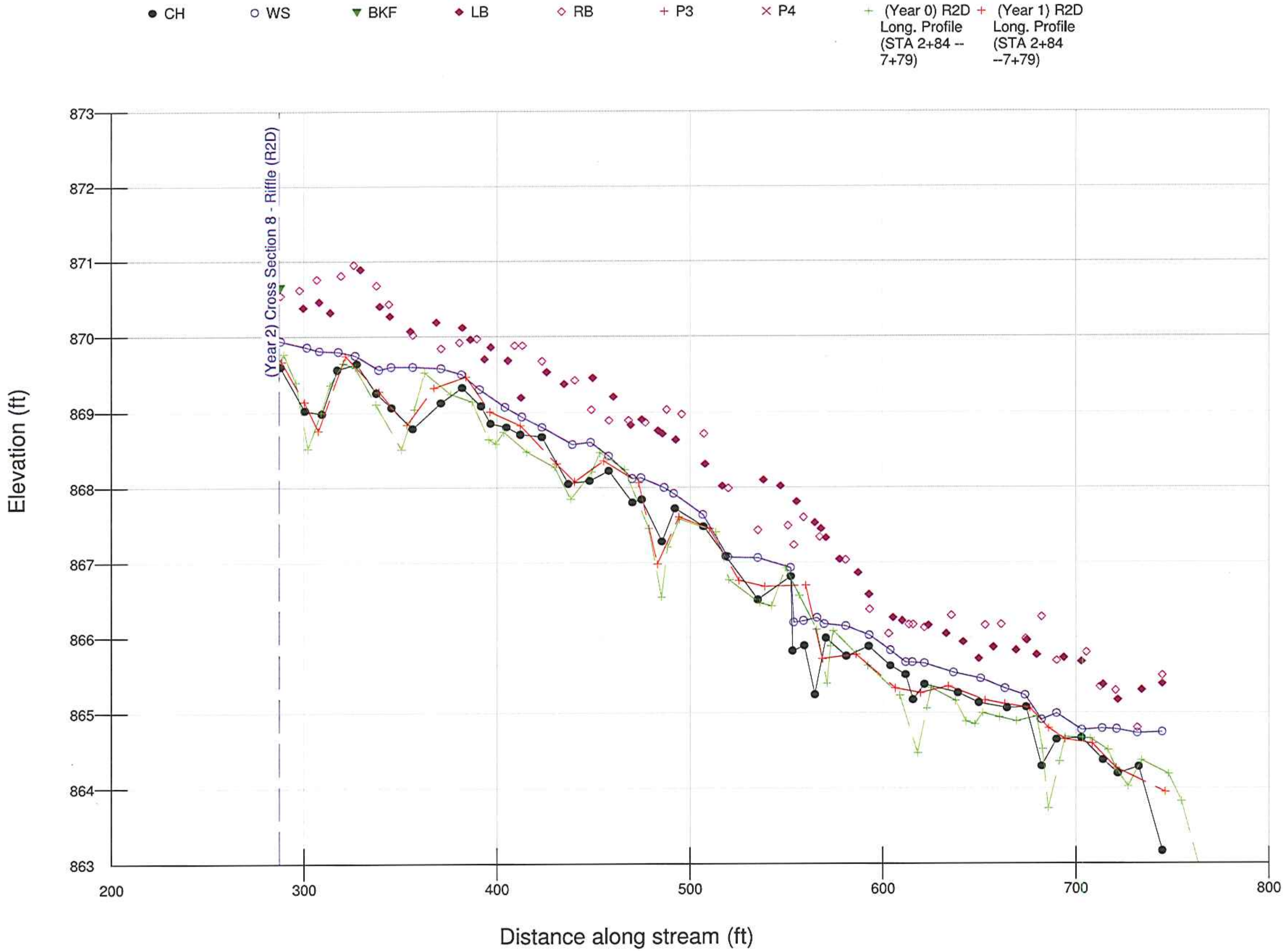
Cross Section / Bank Profile Locations

Name	Type	Profile Station
(Year 2) Cross Section 7 - Riffle (R2B)	Riffle XS	1328

```
Measurements from Graph

Bankfull Slope:     0.01641

Variable       Min            Avg            Max
----------------------------------------------------------------------
S riffle       0.01252        0.03485        0.04758
S pool         0              0              0
S run          0              0              0
S glide        0              0              0
P - P          30.37          42.24          55.12
Pool length    13.50          17.51          23.62
Riffle length  5.06           7.76           10.69
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 2)
Reach Name:    R2B
Profile Name: (Year 2) R2B Long. Profile (STA 9+35 -- 14+86)
Survey Date:   11/18/2009

DIST       Note
----------------------------------------------------------------------
924.61     REW
933.761    REW
943.795    REW
945.385    REW
958.117    REW
968.21     REW
976.199    REW
988.087    REW
998.28     REW
1008.257   REW
1015.368   REW
1028.669   REW
1035.896   REW
1045.16    REW
1052.112   REW
1064.171   REW
1080.245   REW
1095.191   REW
1104.557   REW
1118.173   REW
1129.724   REW
1138.117   REW
1151.385   REW
1164.93    REW
1177.929   REW
1192.323   REW
1209.471   REW
1217.616   REW
1229.62    REW
1243.605   REW
1254.865   REW
```

1265.268	REW
1279.697	REW
1295.728	REW
1315.142	REW
1328.975	XS7 - TW Intersect @ station 1328
1341.215	REW
1349.81	REW
1360.588	REW
1376.583	REW
1390.288	REW
1401.304	REW
1415.061	REW
1433.565	REW
1448.881	REW
1470.06	REW

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



RIVERMORPH PROFILE SUMMARY

River Name: Little White Oak Creek (Year 2)
Reach Name: R2D
Profile Name: (Year 2) R2D Long. Profile (STA 2+84 -- 7+79)
Survey Date: 11/18/2009

Survey Data

DIST	CH	WS	BKF	LB	RB	P3	P4
280.8	869.79						
280.8					870.85		
280.8		870.07					
282.343				870.75			
287.856	869.6	869.94	870.65		870.54		
297.621					870.62		
299.636				870.38			
300.449	869.02						
301.49		869.86					
306.666					870.76		
307.846				870.46			
307.925		869.81					
309.346	868.98						
313.635				870.32			
317.225	869.56						
317.818		869.8					
319.158					870.81		
325.808					870.95		
326.575		869.75					
327.452	869.64						
329.195				870.89			
337.598					870.68		
337.598	869.25						
338.785		869.56					
339.34				870.4			
344.082					870.43		
344.523				870.27			
345.201		869.6					
345.476	869.06						
355.151				870.07			
356.446					870.02		
356.446		869.6					
356.446	868.78						
368.639				870.19			
371.052	869.12						
371.052		869.58					
371.052					869.84		
380.559					869.92		
381.75		869.5					
382.123	869.32						
382.123				870.12			
386.289				869.96			
389.642					869.97		
391.017		869.3					
391.915	869.08						
393.544				869.7			
396.788	868.85						
396.788				869.86			
404.218		869.07					
404.977	868.8						

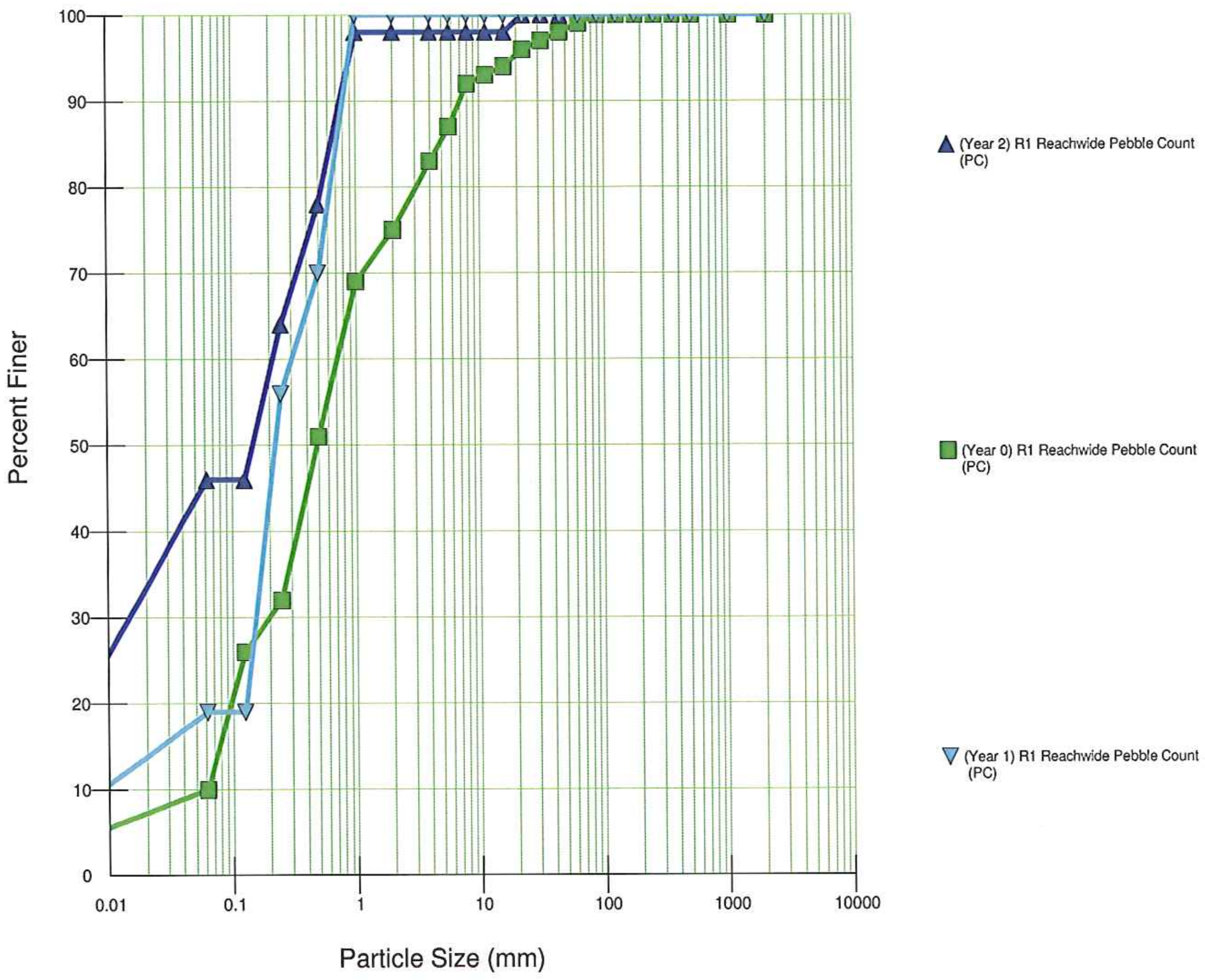
405.731			869.68	
409.146				869.88
412.307	868.7			
412.519			869.19	
413.024		868.94		
413.207				869.88
423.335		868.8		
423.335	868.67			
423.335				869.67
425.754			869.53	
434.791			869.37	
437.068	868.05			
439.08		868.57		
440.345				869.42
448.064	868.09			
448.544		868.6		
448.9				869.03
449.649			869.45	
457.876		868.42		
458.018	868.22			
458.018				868.89
460.276			869.2	
468.196				868.89
469.338			868.83	
470.088		868.12		
470.191	867.8			
474.634		868.13		
475.048	867.84			
475.048			868.9	
476.854				868.86
483.522			868.75	
485.551	867.28			
485.775			868.71	
486.667		868		
487.915				869.03
491.611		867.92		
492.313	867.72			
492.625			868.63	
495.704				868.97
506.709		867.64		
507.043	867.48			
507.255				868.71
507.79			868.31	
516.711			868.02	
518.557	867.08			
519.67		867.07		
519.855				867.99
535.129				867.43
535.168		867.06		
535.168	866.5			
538.034			868.1	
546.951			868.02	
550.76				867.49
552.109		866.93		
552.22	866.81			
553.209	865.82			
553.791		866.2		
553.814				867.23
555.223			867.81	
558.774				867.6
558.841		866.22		
559.196	865.89			
564.723			867.53	
564.723	865.24			
565.81		866.26		
567.212				867.34

567.84			867.45	
569.495		866.18		
570.385			867.33	
570.385	865.99			
577.462			867.04	
580.58				867.03
580.788		866.15		
581.02	865.75			
587.057			866.86	
592.648	865.88			
592.808			866.57	
592.849		866.03		
593.126				866.37
602.972				866.05
603.81	865.62			
603.81		865.83		
605.193			866.26	
610.042			866.22	
611.692	865.5			
611.848		865.67		
613.444				866.17
615.235		865.67		
615.54				866.17
615.54	865.17			
621.533	865.37			
621.533				866.13
621.533		865.66		
623.561			866.16	
632.769			866.05	
635.484				866.29
636.588		865.53		
638.823	865.26			
641.53			865.94	
649.693			865.72	
649.693	865.13			
650.701		865.45		
652.948				866.16
657.191			865.87	
661.327				866.17
663.25		865.32		
664.337	865.06			
668.993			865.83	
673.625		865.23		
673.968				865.98
674.19	865.07			
674.513			865.96	
679.739			865.77	
682.292		864.91		
682.292	864.29			
682.292				866.27
690.025				865.69
690.025	864.64			
690.025		864.99		
693.797			865.73	
702.955			865.68	
702.955	864.66			
703.094		864.77		
705.455				865.8
712.668				865.34
713.713		864.79		
714.102	864.37			
714.102			865.37	
720.674				865.29
721.193		864.78		
721.829			865.17	
721.829	864.19			

```
731.937           864.73
731.987                                   864.8
732.676   864.28
734.273                           865.3
744.845   863.16  864.74          865.38  865.49

Cross Section / Bank Profile Locations

Name                              Type                Profile Station
----------------------------------------------------------------------
(Year 2) Cross Section 8 - Riffle (R2D)Riffle XS          287


Measurements from Graph

Bankfull Slope:     0.01252

Variable       Min            Avg            Max
----------------------------------------------------------------------
S riffle       0.01092        0.02507        0.04369
S pool         0              0              0
S run          0              0              0
S glide        0              0              0
P - P          27.9           49.41          66.27
Pool length    8.14           16.77          24.41
Riffle length  5.81           8.06           12.21
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 2)
Reach Name:   R2D
Profile Name: (Year 2) R2D Long. Profile (STA 2+84 -- 7+79)
Survey Date:  11/18/2009

DIST       Note
----------------------------------------------------------------------
280.8      REW
287.856    XS8 - TW Intersect @ station 287
301.49     REW
307.925    REW
317.818    REW
326.575    REW
338.785    REW
345.201    REW
356.446    REW
371.052    REW
381.75     REW
391.017    REW
404.218    REW
413.024    REW
423.335    REW
439.08     REW
448.544    REW
457.876    REW
470.088    REW
474.634    REW
```

486.667	REW
491.611	REW
506.709	REW
519.67	REW
535.168	REW
552.109	REW
553.791	REW
558.841	REW
565.81	REW
569.495	REW
580.788	REW
592.849	REW
603.81	REW
611.848	REW
615.235	REW
621.533	REW
636.588	REW
650.701	REW
663.25	REW
673.625	REW
682.292	REW
690.025	REW
703.094	REW
713.713	REW
721.193	REW
731.937	REW

(Year 2) R1 Reachwide Pebble Count



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                    RIVERMORPH PARTICLE SUMMARY

----------------------------------------------------------------------

River Name:           Little White Oak Creek (Year 2)
Reach Name:           R1
Sample Name:          (Year 2) R1 Reachwide Pebble Count
Survey Date:          11/23/2009

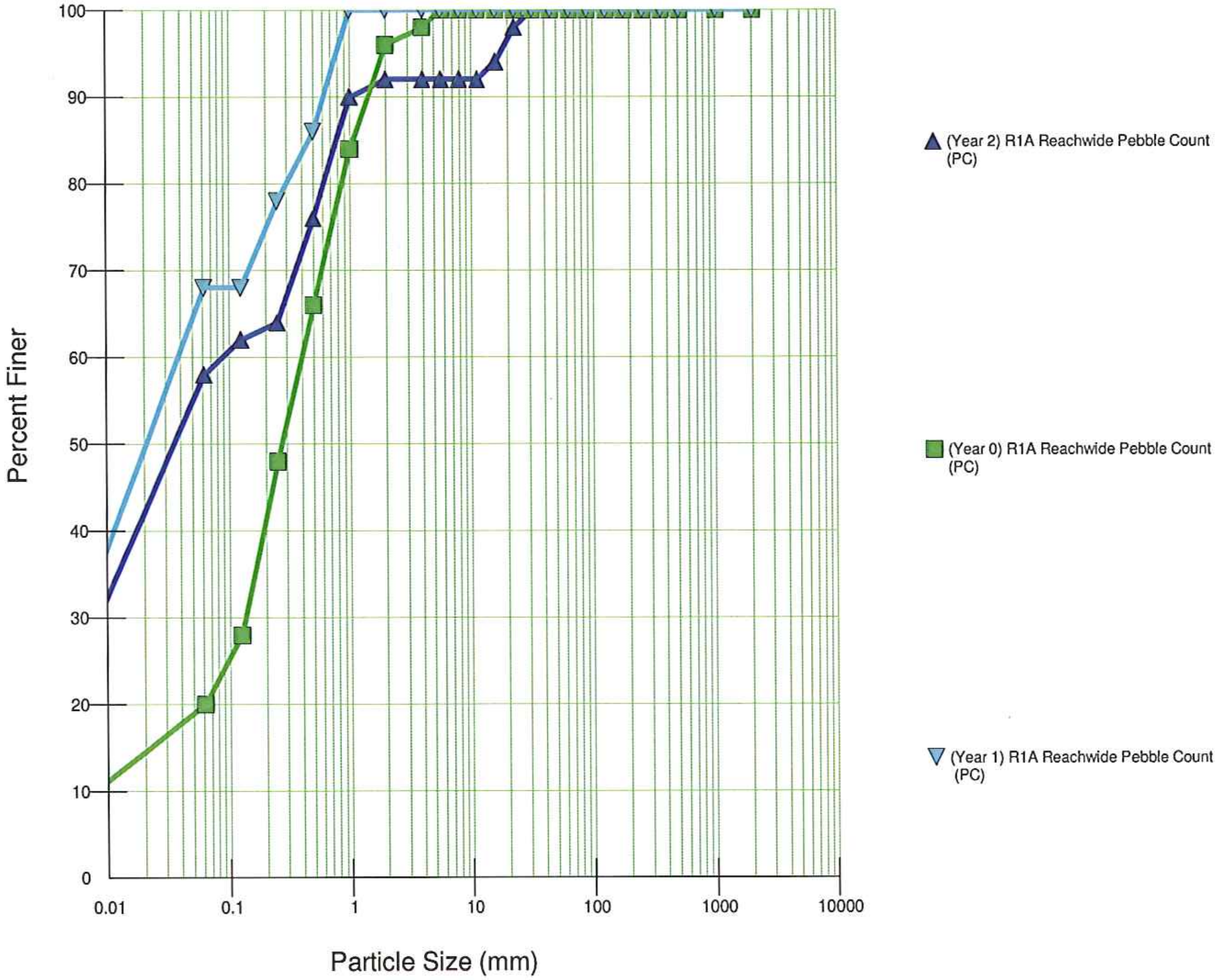
----------------------------------------------------------------------

Size (mm)                 TOT #      ITEM %     CUM %
----------------------------------------------------------------------
0 - 0.062                 46         46.00      46.00
0.062 - 0.125             0          0.00       46.00
0.125 - 0.25              18         18.00      64.00
0.25 - 0.50               14         14.00      78.00
0.50 - 1.0                20         20.00      98.00
1.0 - 2.0                 0          0.00       98.00
2.0 - 4.0                 0          0.00       98.00
4.0 - 5.7                 0          0.00       98.00
5.7 - 8.0                 0          0.00       98.00
8.0 - 11.3                0          0.00       98.00
11.3 - 16.0               0          0.00       98.00
16.0 - 22.6               2          2.00       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)                  0.15
D84 (mm)                  0.65
D95 (mm)                  0.93
D100 (mm)                 22.6
Silt/Clay (%)             46
Sand (%)                  52
Gravel (%)                2
Cobble (%)                0
Boulder (%)               0
Bedrock (%)               0

Total Particles = 100.
```

(Year 2) R1A Reachwide Pebble Count



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                    RIVERMORPH PARTICLE SUMMARY

--------------------------------------------------------------------

River Name:          Little White Oak Creek (Year 2)
Reach Name:          R1A
Sample Name:         (Year 2) R1A Reachwide Pebble Count
Survey Date:         11/23/2009

--------------------------------------------------------------------

Size (mm)                 TOT #     ITEM %    CUM %
--------------------------------------------------------------------
0 - 0.062                 29        58.00     58.00
0.062 - 0.125             2         4.00      62.00
0.125 - 0.25              1         2.00      64.00
0.25 - 0.50               6         12.00     76.00
0.50 - 1.0                7         14.00     90.00
1.0 - 2.0                 1         2.00      92.00
2.0 - 4.0                 0         0.00      92.00
4.0 - 5.7                 0         0.00      92.00
5.7 - 8.0                 0         0.00      92.00
8.0 - 11.3                0         0.00      92.00
11.3 - 16.0               1         2.00      94.00
16.0 - 22.6               2         4.00      98.00
22.6 - 32.0               1         2.00      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)                  0.04
D50 (mm)                  0.05
D84 (mm)                  0.79
D95 (mm)                  17.65
D100 (mm)                 32
Silt/Clay (%)             58
Sand (%)                  34
Gravel (%)                8
Cobble (%)                0
Boulder (%)               0
Bedrock (%)               0

Total Particles = 50 (need at least 60).
```
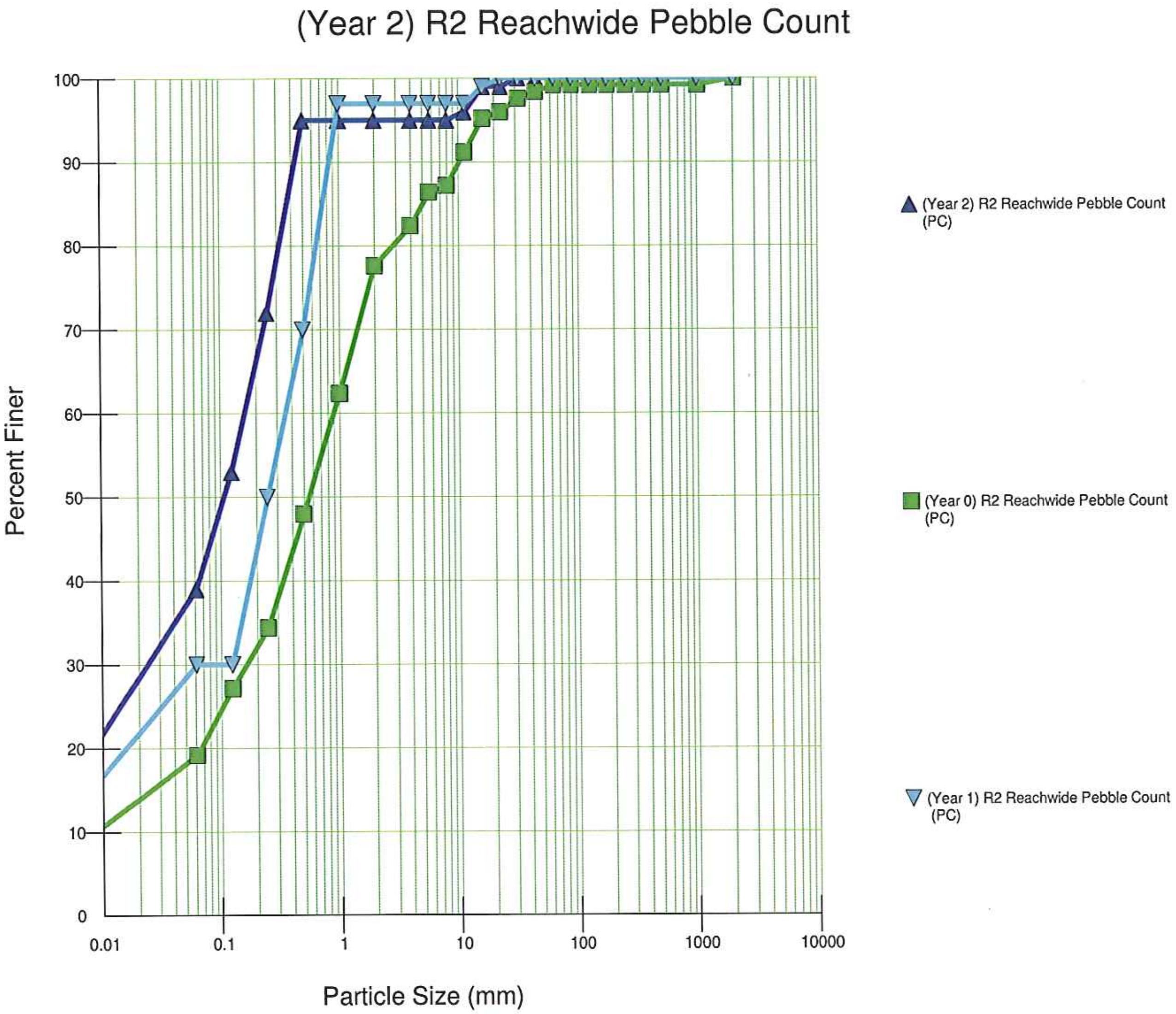
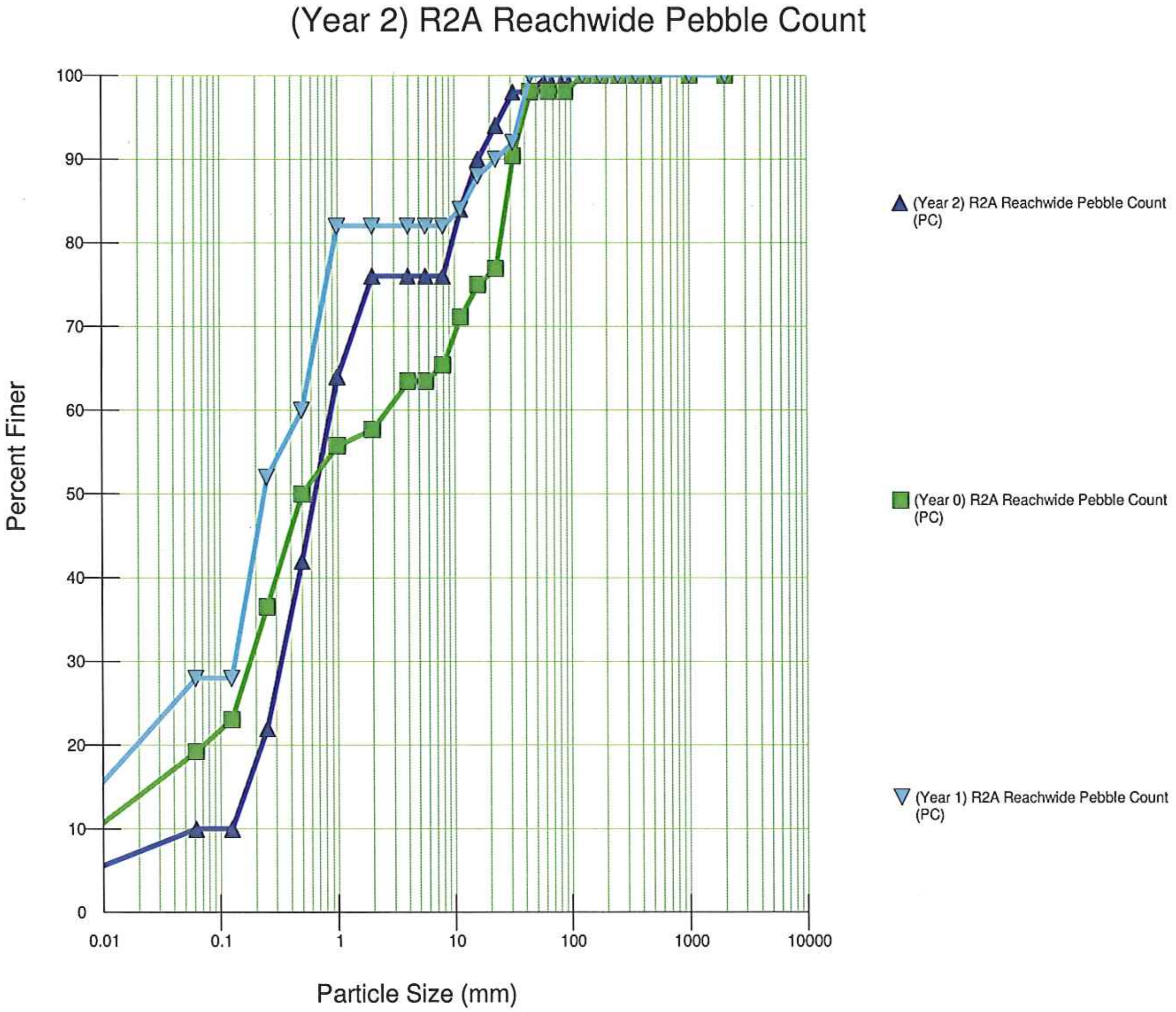



(Year 2) R2 Reachwide Pebble Count
Percent Finer
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)
▲ (Year 2) R2 Reachwide Pebble Count (PC)
🟩 (Year 0) R2 Reachwide Pebble Count (PC)
▽ (Year 1) R2 Reachwide Pebble Count (PC)

```
                    RIVERMORPH PARTICLE SUMMARY

--------------------------------------------------------------------

River Name:        Little White Oak Creek (Year 2)
Reach Name:        R2
Sample Name:       (Year 2) R2 Reachwide Pebble Count
Survey Date:       11/23/2009

--------------------------------------------------------------------

Size (mm)               TOT #     ITEM %     CUM %
--------------------------------------------------------------------
0 - 0.062               39        39.00      39.00
0.062 - 0.125           14        14.00      53.00
0.125 - 0.25            19        19.00      72.00
0.25 - 0.50             23        23.00      95.00
0.50 - 1.0              0         0.00       95.00
1.0 - 2.0               0         0.00       95.00
2.0 - 4.0               0         0.00       95.00
4.0 - 5.7               0         0.00       95.00
5.7 - 8.0               0         0.00       95.00
8.0 - 11.3              1         1.00       96.00
11.3 - 16.0             3         3.00       99.00
16.0 - 22.6             0         0.00       99.00
22.6 - 32.0             1         1.00       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)                0.06
D50 (mm)                0.11
D84 (mm)                0.38
D95 (mm)                0.5
D100 (mm)               32
Silt/Clay (%)           39
Sand (%)                56
Gravel (%)              5
Cobble (%)              0
Boulder (%)             0
Bedrock (%)             0

Total Particles = 100.
```


(Year 2) 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 2) R2A Reachwide Pebble Count (PC)
🟩 (Year 0) R2A Reachwide Pebble Count (PC)
▽ (Year 1) R2A Reachwide Pebble Count (PC)

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                       RIVERMORPH PARTICLE SUMMARY

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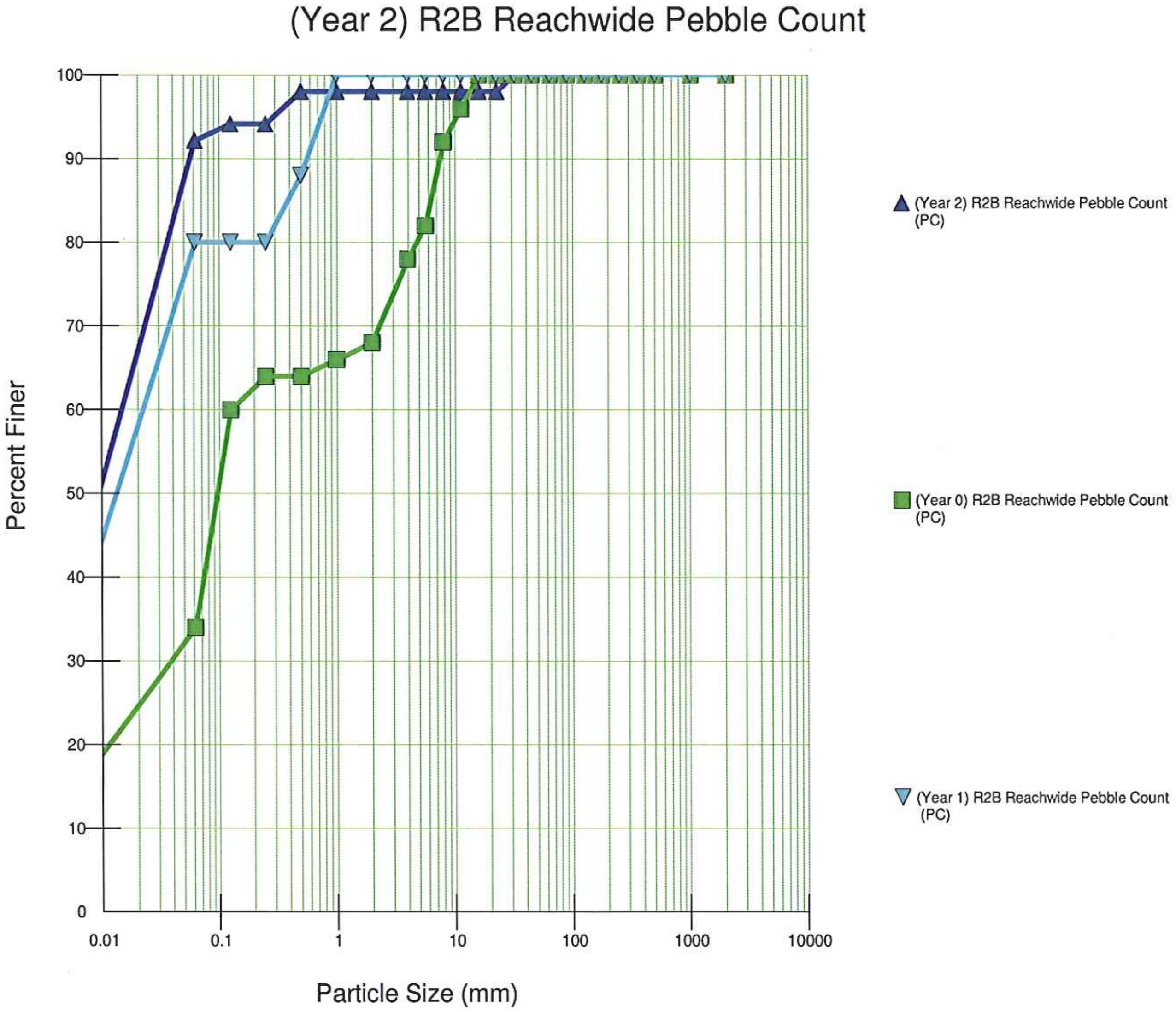
River Name:         Little White Oak Creek (Year 2)
Reach Name:         R2A
Sample Name:        (Year 2) R2A Reachwide Pebble Count
Survey Date:        11/23/2009

----------------------------------------------------------------------

Size (mm)                TOT #     ITEM %    CUM %
----------------------------------------------------------------------
0 - 0.062                5         10.00     10.00
0.062 - 0.125            0         0.00      10.00
0.125 - 0.25             6         12.00     22.00
0.25 - 0.50              10        20.00     42.00
0.50 - 1.0               11        22.00     64.00
1.0 - 2.0                6         12.00     76.00
2.0 - 4.0                0         0.00      76.00
4.0 - 5.7                0         0.00      76.00
5.7 - 8.0                0         0.00      76.00
8.0 - 11.3               4         8.00      84.00
11.3 - 16.0              3         6.00      90.00
16.0 - 22.6              2         4.00      94.00
22.6 - 32.0              2         4.00      98.00
32 - 45                  0         0.00      98.00
45 - 64                  1         2.00      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)                 0.19
D35 (mm)                 0.41
D50 (mm)                 0.68
D84 (mm)                 11.3
D95 (mm)                 24.95
D100 (mm)                64
Silt/Clay (%)            10
Sand (%)                 66
Gravel (%)               24
Cobble (%)               0
Boulder (%)              0
Bedrock (%)              0

Total Particles = 50 (need at least 60).
```



(Year 2) R2B Reachwide Pebble Count

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                    RIVERMORPH PARTICLE SUMMARY

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River Name:          Little White Oak Creek (Year 2)
Reach Name:          R2B
Sample Name:         (Year 2) R2B Reachwide Pebble Count
Survey Date:         11/23/2009

---------------------------------------------------------------------

Size (mm)                 TOT #     ITEM %    CUM %
---------------------------------------------------------------------
0 - 0.062                 47        92.16     92.16
0.062 - 0.125             1         1.96      94.12
0.125 - 0.25              0         0.00      94.12
0.25 - 0.50               2         3.92      98.04
0.50 - 1.0                0         0.00      98.04
1.0 - 2.0                 0         0.00      98.04
2.0 - 4.0                 0         0.00      98.04
4.0 - 5.7                 0         0.00      98.04
5.7 - 8.0                 0         0.00      98.04
8.0 - 11.3                0         0.00      98.04
11.3 - 16.0               0         0.00      98.04
16.0 - 22.6               0         0.00      98.04
22.6 - 32.0               1         1.96      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)                  0.02
D50 (mm)                  0.03
D84 (mm)                  0.06
D95 (mm)                  0.31
D100 (mm)                 32
Silt/Clay (%)             92.16
Sand (%)                  5.88
Gravel (%)                1.96
Cobble (%)                0
Boulder (%)               0
Bedrock (%)               0

Total Particles = 51 (need at least 60).
```

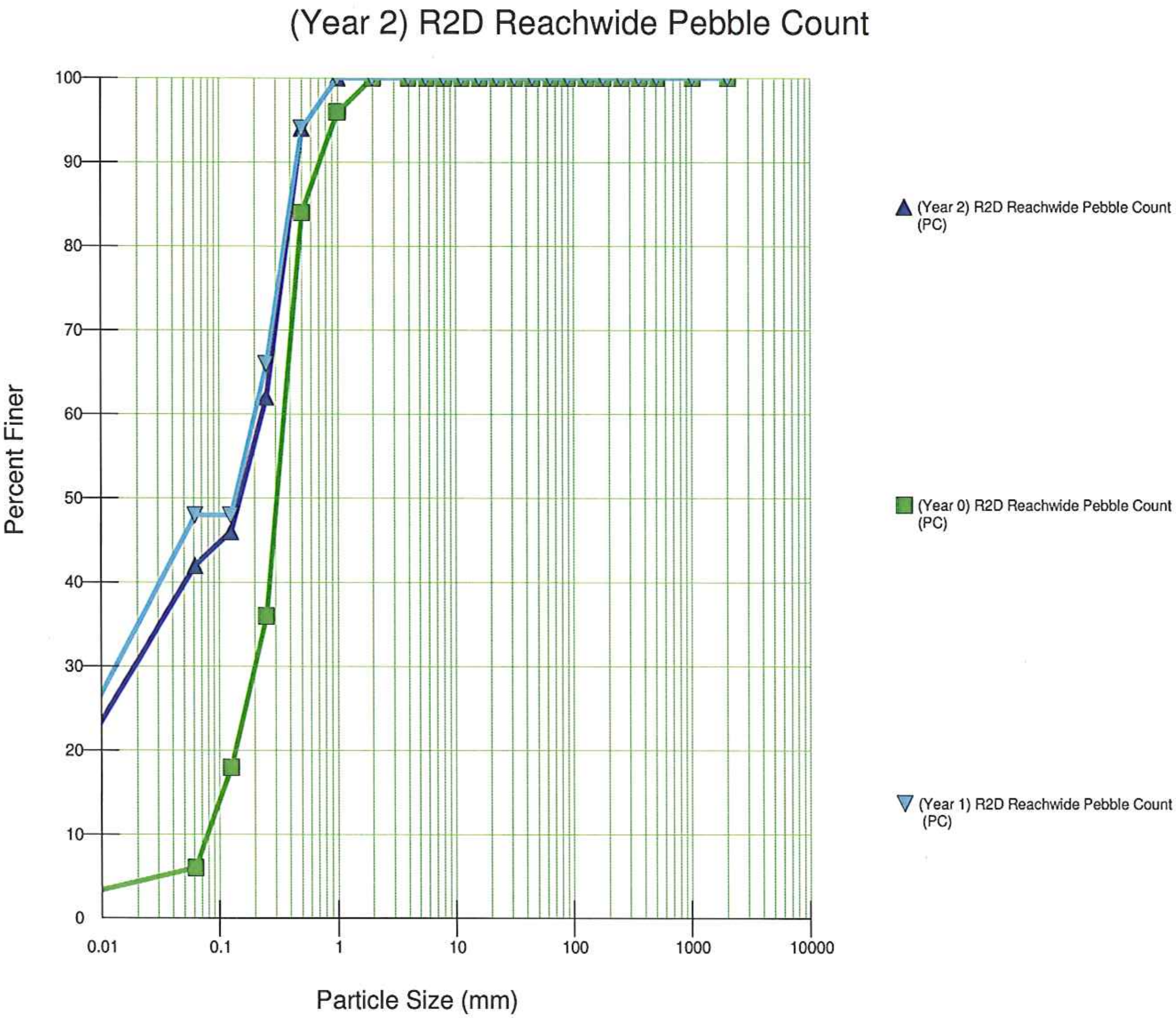
(Year 2) R2D Reachwide Pebble Count
Percent Finer
0
10
20
30
40
50
60
70
80
90
100
Particle Size (mm)
0.01
0.1
1
10
100
1000
10000
▲ (Year 2) R2D Reachwide Pebble Count (PC)
🟩 (Year 0) R2D Reachwide Pebble Count (PC)
▽ (Year 1) R2D Reachwide Pebble Count (PC)

```
                    RIVERMORPH PARTICLE SUMMARY

--------------------------------------------------------------------

River Name:          Little White Oak Creek (Year 2)
Reach Name:          R2D
Sample Name:         (Year 2) R2D Reachwide Pebble Count
Survey Date:         11/23/2009

--------------------------------------------------------------------

Size (mm)                TOT #     ITEM %    CUM %
--------------------------------------------------------------------
0 - 0.062                21        42.00     42.00
0.062 - 0.125            2         4.00      46.00
0.125 - 0.25             8         16.00     62.00
0.25 - 0.50              16        32.00     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)                 0.16
D84 (mm)                 0.42
D95 (mm)                 0.58
D100 (mm)                1
Silt/Clay (%)            42
Sand (%)                 58
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

Year of Sampling

Crest Gauge Information			2008	2008	2009					
Gauge ID	**Bankfull Elevation (ft)**	**Zero Elevation (ft)**	**Year 0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total Exceedance by Gauge**	**Reach**
1	886.12	885.87	N/A	1	1	0	0	0	2	R1 (U/S End)
2	882.04	882.04	N/A	1	1	0	0	0	2	R1A (D/S End)
3	875.80	875.30	N/A	1	1	0	0	0	2	R1 (U/S NC 9)
4	878.10	877.96	N/A	1	1	0	0	0	2	R2 (U/S End)
5	876.30	876.26	N/A	0	1	0	0	0	1	R2A (Middle)
6	871.70	871.51	N/A	1	1	0	0	0	2	R2B (D/S End)
7	869.90	869.14	N/A	1	1	0	0	0	2	R2 (Confluence)
8	866.93	866.67	N/A	0	0	0	0	0	0	R2D (D/S End)

(Year 1) Initial Data Entry for Crest Gage (feet)

Gage ID	BKF Elev.	1	2	3	4	5	6	7	8	9	10	Reach
1	886.12	1.18										R1 (U/S End)
2	882.04	0.25										R1A (D/S End)
3	875.80	0.95										R1 (U/S NC 9)
4	878.10	0.35										R2 (U/S End)
5	876.30	0.00										R2A (Middle)
6	871.70	0.74										R2B (D/S End)
7	869.90	0.84										R2 (Confluence)
8	866.93	0.12										R2D (D/S End)

Peak Flow Height by Crest Gage (feet)

Gage ID	BKF Elev.	1	2	3	4	5	6	7	8	9	10	Reach
1	886.12	887.05	885.87	885.87	885.87	885.87	885.87	885.87	885.87	885.87	885.87	R1 (U/S End)
2	882.04	882.29	882.04	882.04	882.04	882.04	882.04	882.04	882.04	882.04	882.04	R1A (D/S End)
3	875.80	876.25	875.30	875.30	875.30	875.30	875.30	875.30	875.30	875.30	875.30	R1 (U/S NC 9)
4	878.10	878.31	877.96	877.96	877.96	877.96	877.96	877.96	877.96	877.96	877.96	R2 (U/S End)
5	876.30	876.26	876.26	876.26	876.26	876.26	876.26	876.26	876.26	876.26	876.26	R2A (Middle)
6	871.70	872.25	871.51	871.51	871.51	871.51	871.51	871.51	871.51	871.51	871.51	R2B (D/S End)
7	869.90	869.98	869.14	869.14	869.14	869.14	869.14	869.14	869.14	869.14	869.14	R2 (Confluence)
8	866.93	866.79	866.67	866.67	866.67	866.67	866.67	866.67	866.67	866.67	866.67	R2D (D/S End)

Bankfull Exceedance by Crest Gage

Gage ID	BKF Elev.	1	2	3	4	5	6	7	8	9	10	Reach	Exceedance by Gage
1	886.12	exceeds	below	below	below	below	below	below	below	below	below	R1 (U/S End)	1
2	882.04	exceeds	below	below	below	below	below	below	below	below	below	R1A (D/S End)	1
3	875.80	exceeds	below	below	below	below	below	below	below	below	below	R1 (U/S NC 9)	1
4	878.10	exceeds	below	below	below	below	below	below	below	below	below	R2 (U/S End)	1
5	876.30	below	below	below	below	below	below	below	below	below	below	R2A (Middle)	0
6	871.70	exceeds	below	below	below	below	below	below	below	below	below	R2B (D/S End)	1
7	869.90	exceeds	below	below	below	below	below	below	below	below	below	R2 (Confluence)	1
8	866.93	below	below	below	below	below	below	below	below	below	below	R2D (D/S End)	0
No. of Exceedances by Sampling		6	0	0	0	0	0	0	0	0	0		

(Year 2) Initial Data Entry for Crest Gage (feet)

Gage ID	BKF Elev.	1	2	3	4	5	6	7	8	9	10	Reach
1	886.12	0.26										R1 (U/S End)
2	882.04	0.08										R1A (D/S End)
3	875.80	0.81										R1 (U/S NC 9)
4	878.10	0.50										R2 (U/S End)
5	876.30	0.46										R2A (Middle)
6	871.70	1.53										R2B (D/S End)
7	869.90	1.08										R2 (Confluence)
8	866.93	0.16										R2D (D/S End)

Peak Flow Height by Crest Gage (feet)

Gage ID	BKF Elev.	1	2	3	4	5	6	7	8	9	10	Reach
1	886.12	886.13	885.87	885.87	885.87	885.87	885.87	885.87	885.87	885.87	885.87	R1 (U/S End)
2	882.04	882.12	882.04	882.04	882.04	882.04	882.04	882.04	882.04	882.04	882.04	R1A (D/S End)
3	875.80	876.11	875.30	875.30	875.30	875.30	875.30	875.30	875.30	875.30	875.30	R1 (U/S NC 9)
4	878.10	878.46	877.96	877.96	877.96	877.96	877.96	877.96	877.96	877.96	877.96	R2 (U/S End)
5	876.30	876.72	876.26	876.26	876.26	876.26	876.26	876.26	876.26	876.26	876.26	R2A (Middle)
6	871.70	873.04	871.51	871.51	871.51	871.51	871.51	871.51	871.51	871.51	871.51	R2B (D/S End)
7	869.90	870.22	869.14	869.14	869.14	869.14	869.14	869.14	869.14	869.14	869.14	R2 (Confluence)
8	866.93	866.83	866.67	866.67	866.67	866.67	866.67	866.67	866.67	866.67	866.67	R2D (D/S End)

Bankfull Exceedance by Crest Gage

Gage ID	BKF Elev.	1	2	3	4	5	6	7	8	9	10	Reach	Exceedance by Gage
1	886.12	exceeds	below	below	below	below	below	below	below	below	below	R1 (U/S End)	1
2	882.04	exceeds	below	below	below	below	below	below	below	below	below	R1A (D/S End)	1
3	875.80	exceeds	below	below	below	below	below	below	below	below	below	R1 (U/S NC 9)	1
4	878.10	exceeds	below	below	below	below	below	below	below	below	below	R2 (U/S End)	1
5	876.30	exceeds	below	below	below	below	below	below	below	below	below	R2A (Middle)	1
6	871.70	exceeds	below	below	below	below	below	below	below	below	below	R2B (D/S End)	1
7	869.90	exceeds	below	below	below	below	below	below	below	below	below	R2 (Confluence)	1
8	866.93	below	below	below	below	below	below	below	below	below	below	R2D (D/S End)	0
No. of Exceedances by Sampling		7	0	0	0	0	0	0	0	0	0		