TRIBUTARY TO REEDY FORK CREEK STREAM RESTORATION

NORTH CAROLINA PROFESSIONAL SEAL 036254 1/21/11 ENGINEER EMMETT PERDUE

GUILFORD COUNTY, NORTH CAROLINA

CONTRACT # D06028-A


Year 0 - Photo Point 4

Year 3 - Photo Point 4

Prepared For:

Ecosystem Enhancement

Ecosystem Enhancement Program
Department of Environment and Natural Resources
1652 Mail Service Center
Raleigh, NC 27699-1652

ANNUAL MONITORING REPORT (YEAR 3 OF 5)

DECEMBER 2010

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Owner

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1.0 Executive Summary

This annual monitoring report details the monitoring activities through the third year and the results for the Tributary to Reedy Fork Creek Stream Restoration Site (RFC). 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 RFC. The content and format of this report were developed in accordance with the contract requirements for the Full Delivery RFP 16-D06028 (NCEEP, 2005). Accordingly, this report includes project background information, project monitoring results, and description of the project monitoring methodology.

Mulkey Engineers & Consultants (Mulkey) submitted RFC for the Full Delivery RFP 16-D06028 to provide 7,000 Stream Mitigation Units (SMUs). Mulkey was awarded the stream restoration contract by the Ecosystem Enhancement Program Department of Environment and Natural Resources (NCEEP) and began work on the project on November 26, 2007. The primary goals of RFC 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 approximately 7,511 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.

RFC located in Guilford County, North Carolina near the Town of Gibsonville and is situated in the Cape Fear River Basin. Past land use practices, including extensive cattle farming and clearing of the riparian buffers resulted in substantial degradation of the stream systems at RFC. RFC is comprised of seven stream reaches totaling approximately 7,511 feet of restored stream channel. All of the analyses, design, and restoration at RFC 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 RFC were also replanted with native species vegetation.

The survivability of the planted vegetation at RFC will be monitored at representative vegetation plots as well as project-wide. Stem counts, photo documentation and comparison, and visual assessment will be utilized. Bare root stock were planted at a density of 680 stems per acre (eight foot by eight foot spacing) and live stakes were planted on the stream banks at a density of 1,742 stems per acre (five foot by five foot spacing). A total of 16 representative vegetation plots were installed at RFC based on the recommendations set forth by NCEEP regarding the acreage contained in the conservation easement. The survivability of the planted woody vegetation at RFC will be monitored using annual stem counts at each of the plots. In addition to the stem counts, annual photos will be taken at each of the plots and also from eight other permanent photo reference points. The vegetation plot photos will be used for photo documentation and comparison of the vegetation growth at each plot. The photo documentation at the reference points will be employed to assist in a project-wide visual assessment of the vegetation at RFC. Survivability will be based on achieving a minimum of 320 stems per acre, the rate required to be present during the third year of monitoring, across the project site. The stem counts will be conducted during the latter part of the growing season months (August, September, and October) to ensure survival throughout a complete growing season while still allowing for relative ease in identification.

In late September 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 for the 16 vegetation plots ranged from 121 to 972 stems per acre, with an average survivability of 478 stems per acre. These results indicated that the survivability of the planted woody vegetation at RFC may not meet the success criteria of achieving at least 320 stems per acre after three years and 260 stems per acre after five years at RFC. Based on the results of the stem counts, supplemental plantings of bare root seedlings were recommended to be conducted by Mulkey during the 2008-2009 planting season to ameliorate any deficiencies. The comparisons of the baseline and Monitoring Year 1 photos at both the 16 vegetation plot photo reference points and the eight permanent photo reference points did not reveal any concerns, problems, or negative trends. No vegetation problem areas were observed or documented during the project-wide visual assessment. Beyond the described supplemental plantings, Mulkey did not make any additional recommendations or take any other action other than to proceed with the annual vegetation monitoring.

Mulkey conducted the recommended supplemental plantings of bare root seedlings in late winter 2008. These supplemental plantings were conducted only at the areas of the site where the most mortality was observed. Subsequent to the described replanting, the results of the Monitoring Year 2 stem counts, conducted in September of 2009, showed that the counts for the 16 vegetation plots ranged from 504 to 972 stems per acre, with an average survivability of 697 stems per acre. These results indicated that the survivability of the planted woody vegetation at RFC should meet the success criteria of achieving at least 320 stems per acre after three years and 260 stems per acre after five years at RFC. The comparisons of the baseline, Monitoring Year 1, and Monitoring Year 2 photos at both the 16 vegetation plot photo reference points and the eight permanent photo reference points did not reveal any concerns, problems, or negative trends. No vegetation problem areas were observed or documented during the project-wide visual assessment. Based on the positive results from the vegetative monitoring for Monitoring Year 2 at RFC, Mulkey does not propose any additional recommendations or actions other than to proceed with the annual vegetation monitoring.

Between late September and early October 2010, the vegetation monitoring for Monitoring Year 3 was conducted. Monitoring Year 3 stem counts were documented and the survivability calculated from the Monitoring Year 2 totals following replanting. Monitoring Year 3 showed that the counts for the 16 vegetation plots ranged from 377 to 769 stems per acre, with an average survivability of 596 stems per acre. These results indicate that the survivability of the planted woody vegetation at RFC have met the success criteria of achieving at least 320 stems per acre after three years and will likely meet the 260 stems per acre after five years at RFC. However, Mulkey is aware, through pedestrian surveys and visual observations, that at first glance some areas appear to be lacking woody species; however upon strict search, the planted trees are in fact present. The conditions at RFC have improved each year, with vegetation being one of the main contributors. Mulkey is confident that the vegetation will continue to improve as it slowly outcompetes some of the grasses, briers, and weeds in the coming years.

Stream dimension, pattern, profile, stream bed material, bank stability, and bankfull hydrology will be monitored to evaluate the success of stream restoration at RFC. The limits of the project stream reaches to be monitored at RFC were determined using the sampling rates outlined by the USACE *et al*. (2003). The monitoring involves 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 seven permanent cross sections were surveyed and photo documented across RFC. A total of three crest gages across RFC 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 eight permanent reference photo points. Annual project wide visual assessment was conducted using field observation and pedestrian surveys to identify any specific problem areas. This being the third year of monitoring, the BEHI information was collected as required during Monitoring Year 3 and Monitoring Year 5. Stream restoration success at RFC 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 was deemed achieved when all such comparisons reveal positive trends toward overall stream stability.

In late September 2008, the stream monitoring for Monitoring Year 1 was conducted using the methodologies described above. The results of the stream dimension, pattern, and profile monitoring demonstrated that all of the reaches were experiencing the expected minor adjustments indicative of movement toward increased stream stability and are attributed to vegetation establishment and natural channel adjustments. Fluctuations in bed materials were expected to occur during the early years following construction. Fining of the bed materials was documented by the stream bed material monitoring. Mulkey believes that this fluctuation was attributed to the deposition of finer bed materials (sands and silts) mobilized during construction and during subsequent storm events. Mulkey believes that the stream bed materials will coarsen as stream bank stability increases. These monitoring results suggested that on-site sediment supply from RFC is being greatly reduced as a result of the restoration. Fluctuations in bed materials will likely continue to occur and several years may be needed to observe a consistent bed material. Two of the three crest gages recorded flood stages in excess of the bankfull stage. The evidence recorded by the crest gages indicates that a storm event producing a stage in excess of the bankfull storm occurred at RFC 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 RFC. No stream problems were documented through the photo documentation comparison process or through the conduction of the project-wide visual assessment along each of the project stream reaches. RFC experienced no stream problem areas and was deemed a success for Year 1 Monitoring.

Between early and mid-September 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 are attributed to vegetation establishment and natural channel adjustments. Fluctuations in bed materials were again documented. The Monitoring Year 2 results also suggest that on-site sediment supply from RFC is being greatly reduced as a result of the restoration. Both of the crest gages recorded flood stages in excess of the bankfull stage. The evidence recorded by the crest gages indicates that a storm event producing a stage in excess of the bankfull storm occurred again at RFC 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 RFC. No stream problems were documented through the photo documentation comparison process or through the conduction of the project-wide visual assessment along each of the project stream reaches. RFC experienced no stream problem areas and was again deemed a success for Year 2 Monitoring.

Between late September and early October 2010, the stream monitoring for Monitoring Year 3 was conducted. Overall, the Monitoring Year 3 data illustrates a stream system reaching equilibrium in terms of projected adjustments in pattern, dimension, profile, substrate development, and bank stability. It can still be expected to see slight variations within the data set over the next two years of monitoring, but these will be most likely be attributed to inherent error in data collection and measurement and/or the natural tendencies of an active, dynamic system. The compilation of three years of monitoring data strongly suggest the RFC project has been successfully restored to a stable stream system in all stream related monitoring aspects.

Therefore, based on the positive results of both the vegetative and the stream monitoring for all monitoring to date at RFC, Mulkey does not propose any actions other than to proceed with the annual stream monitoring.

2.0 Project Background

2.1 Project Location and Setting

RFC located in Guilford County, North Carolina approximately five miles north of the Town of Gibsonville, approximately one half mile east of the intersection of NC Highway 61 and Sockwell Road (SR 2735) and immediately south of SR 2735 (Figure 1). RFC is situated in the Cape Fear River Basin 8-digit cataloging unit 03030002 and the 14-digit cataloging unit 03030002020070. Mulkey proposed to provide 7,000 Stream Mitigation Units (SMUs) with RFC under the Full Delivery RFP 16-D06028 issued by NCEEP. Mulkey acquired and installed permanent fencing along an easement covering 19.64 acres, which encompasses the streams and associated buffers at RFC.

2.2 Project Goals and Objectives

The primary goals of RFC 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 will be met through the following objectives:

- By using natural channel design to restore stable pattern, dimension, and profile for approximately 7,511 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

RFC is comprised of three main reaches (R2-1, R2-2, R2-3) and four tributaries (R1, R2-4a, R2-4b, and R2-4c). 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 7,093 linear feet. A total of approximately 7,511 linear feet of stream channel was restored at RFC within the 19.64-acre conservation easement.

Analyses, design, and restoration of the stream channels at RFC was accomplished using Natural Stream Channel design methods developed by Rosgen (Rosgen, D. L., 1994, 1996, 1998). The proposed Rosgen channel type for each the stream reaches was a C4 channel. A combination of Priority Level I and II methods were used to construct these reaches.

The most significant stream restoration component at RFC involved 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 ensure such floodplain access. The first approach involved relocating and raising the stream bed such that the historic floodplain is accessed by stream flows greater than bankfull (the sections of the project stream reaches that were restored using Priority Level I methodologies). A second approach was used where site constraints prevented such relocation and raising of the stream bed. The second approach involved building a floodplain at a level lower than the historic floodplain through the construction of bankfull benches (the sections of the project stream reaches that were restored using Priority Level II methodologies). In-stream structures were installed along each of the stream reached to provide grade control and stream bank protection, and to increase in-stream habitat diversity. The in-stream structures that were installed included rock cross vanes, j-hook rock vanes, rock vanes, constructed riffles, and root wads. Stream banks were further stabilized through the installation of coir fiber erosion control matting, temporary and permanent seeding, and the installation of native species vegetation in the form of transplants, live stakes, and bare root seedlings. All areas of the site that were disturbed during construction activities were stabilized using temporary and permanent seeding. The riparian and upland buffer communities along RFC 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 RFC 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 150 dairy cattle utilizing the pastures and directly accessing the stream channels. 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 RFC, as well as reduced water quality due to large quantities of fecal matter into the stream system. As a result of these land and water quality issues, Mulkey submitted RFC for the Full Delivery RFP 16-D06028 to provide 7,000 Stream Mitigation Units (SMUs). Mulkey was awarded the stream restoration contract by the NCEEP and began work on the project on November 26, 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 RFC. Table IV provides a complete listing of project background information.

2.5 Project Monitoring Plan View

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

- Title sheet
- Legend sheet
- As-built planimetric drawings and profiles developed from the baseline monitoring field surveys

The 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 RFC, 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 in mid-April 2008. 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 March and April 2008, with all such planting being completed by mid-April 2008. 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 RFC 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 (eight foot by eight foot spacing) and the live stakes were planted on the stream banks at a density of 1,742 stems per acre (five foot by five foot spacing).

As-built surveys were initiated immediately following the installation of plant materials. In the period between March and May 2008, during the as-built surveys and after the completion of planting, a total of 16 representative vegetation plots (vegetation plots 1 through 16) were installed randomly across RFC. 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 April and May 2008, after the establishment of the plots, the species of each planted stem in each plot was identified. Each of these stems was then tallied, by species, and marked with loosely tied survey flagging (on lateral branches) to facilitate future identification. The survivability of the planted woody vegetation at RFC was monitored using annual stem counts at each of the plots. During 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 the 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 eight additional permanent photo reference points were installed across RFC. These photo reference points were monumented using steel rebar and PVC pipe and were used for additional photo documentation of vegetation growth across RFC. Photos were taken from each of the eight permanent photo reference points with the same orientation each year and used for photo documentation and annual comparison of the vegetation growth across RFC. This exercise helped to further validate and document vegetation success at RFC. Between April and May 2008, after installation of the described eight photo reference points, photos were taken from each of the photo reference points to document the baseline conditions at RFC with regards to planted vegetation. Project-wide visual assessment was also used for vegetation monitoring at RFC. A visual assessment was conducted using annual field observation and pedestrian surveys to identify any specific vegetation problem areas at RFC during the monitoring period. Any problem areas where vegetation was lacking or exotic vegetation occurred, was identified and categorized as bare bank, bare bench, bare floodplain, or invasive population. Such areas were documented using representative photos and their locations mapped on the plan view in Appendix A.

3.1.2 Vegetation Monitoring Success Criteria

Vegetation success at RFC will be measured by stem survivability. Survivability was based on achieving at least 320 stems per acre, the rate required to be present during Year 3 Monitoring. 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 RFC. If during any given year, the planted species are not anticipated to meet final criteria established for vegetation, supplemental plantings are to be considered. In the event that this occurs, a remedial planting plan will be developed that achieves the survivability goals established for Years 3 and 5.

3.1.3 Vegetative Monitoring Results for Year 1 of 5

In late September 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 RFC for Monitoring Year 1. Stem counts were conducted at each of the 16 vegetation plots. Table V presents the results of these stem counts for each of the plots. Photos were taken from the photo reference points at each of the 16 vegetation plots. Appendix B compares these photos with the initial baseline photos taken from the photo reference points at each of the 16 vegetation plots. Photos were also taken from each of the eight permanent photo reference points. Appendix C compares these photos with the initial baseline photos taken from the original eight permanent photo reference points. 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 counts for the 16 vegetation plots ranged from 121 to 972 stems per acre, with an average survivability of 478 stems per acre. These results indicated that the survivability of the planted woody vegetation at RFC may not meet the success criteria of achieving at least 320 stems per acre after three years and 260 stems per acre after five years at RFC. Based on the results of the stem counts, supplemental plantings of bare root seedlings were recommended to be conducted by Mulkey during the 2008 – 2009 planting season to ameliorate any deficiencies. The comparisons of the baseline and Monitoring Year 1 photos at both the 16 vegetation plot photo reference points and the eight permanent photo reference points did not reveal any concerns, problems, or negative trends. No vegetation problem areas were observed or documented during the project-wide visual assessment. No significant volunteer woody species were observed at any of the 16 vegetation plots. Beyond the supplemental plantings, Mulkey did not propose any additional recommendations or actions other than to proceed with the annual vegetation monitoring.

3.1.4 Vegetative Monitoring Results for Year 2 of 5

Mulkey conducted the recommended supplemental plantings of bare root seedlings in late winter 2008. These supplemental plantings were conducted only at the areas of the site where the most mortality was observed. Between early and mid-September 2009, the vegetation monitoring for Monitoring Year 2 was conducted. The methodologies described in the Vegetation Monitoring Methodology Section above were used for the vegetation monitoring at RFC for Monitoring Year 2. Stem counts were conducted at each of the 16 vegetation plots. Table V presents the results of these stem counts for each of the plots. Photos were taken from the photo reference points at each of the 16 vegetation plots. Appendix B compares these photos with the initial baseline photos taken from the photo reference points at each of the 16 vegetation plots. Photos were also taken from each of the eight permanent photo reference points. Appendix C compares these photos with the initial baseline photos taken from the original eight permanent photo reference points. 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.

Subsequent to the described replanting, the results of the Monitoring Year 2 stem counts showed that the counts for the 16 vegetation plots ranged from 504 to 972 stems per acre, with an average survivability of 697 stems per acre. These results indicated that the survivability of the planted woody vegetation at RFC should meet the success criteria of achieving at least 320 stems per acre after three years and 260 stems per acre after five years at RFC. The comparisons of the baseline, Monitoring Year 1, and Monitoring Year 2 photos at both the 16 vegetation plot photo reference points and the eight permanent photo reference points did not reveal any concerns, problems, or negative trends. No vegetation problem areas were observed or documented during the project-wide visual assessment. No significant volunteer woody species were observed at any of the 16 vegetation plots. Native species herbaceous vegetation was clearly observed to be flourishing at RFC in conjunction with the woody species vegetation. Both the woody and herbaceous vegetation are establishing well along the stream banks, with root mats for both clearly visible along the edges of water for the project stream reaches. Based on the positive results from the vegetative monitoring for Monitoring Year 2 at RFC, Mulkey does not propose any additional recommendations or actions other than to proceed with the annual vegetation monitoring.

3.1.5 Vegetative Monitoring Results for Year 3 of 5

Between late September and early October 2010, the vegetation monitoring for Monitoring Year 3 was conducted. The methodologies described in the Vegetation Monitoring Methodology Section above were used for the vegetation monitoring at RFC for Monitoring Year 3. Stem counts were conducted at each of the 16 vegetation plots. Table V presents the results of these stem counts for each of the plots. This table includes initial stem counts through Monitoring Year 3 stem counts and the resulting survivability percentages. Photos were taken from the photo reference points at each of the 16 vegetation plots. Appendix B compares the photos from the initial baseline photos through the Monitoring Year 3 taken from the photo reference points at each of the 16 vegetation plots. Photos were also taken from each of the eight permanent photo reference points. Appendix C compares the photos from the initial baseline photos through the Monitoring Year 3 taken from the original eight permanent photo reference points. 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.

Monitoring Year 3 stem counts were documented and the survivability calculated from the Monitoring Year 2 totals following replanting. Monitoring Year 3 showed that the counts for the 16 vegetation plots ranged from 377 to 769 stems per acre, with an average survivability of 596 stems per acre. These results indicate that the survivability of the planted woody vegetation at RFC have met the success criteria of achieving at least 320 stems per acre after three years and will likely meet the 260 stems per acre after five years at RFC. The photo comparison of the baseline data through Monitoring Year 3 at the 16 vegetation plots, photo reference points, and the eight permanent photo reference points depict an established herbaceous vegetative layer dominating the landscape. Mulkey believes that by comparing the Year 2 and Year 3 photos, the herbaceous vegetation has reached its growth limit. This should allow the planted woody trees to become well established above the herbaceous vegetation and to continue their increased growth pattern. Mulkey is aware, through pedestrian surveys and visual observations, that at first glance some areas appear to be lacking woody species; however upon a strict search, the planted trees are in fact present. At this time, Mulkey does not propose any additional recommendations or actions other than to proceed with the annual vegetation monitoring.

3.2 Project Stream Monitoring

3.2.1 Stream Monitoring Methodology

Stream dimension, pattern, profile, stream bed material, bank stability, and bankfull hydrology will be monitored to evaluate the success of the stream restoration activities at RFC. The monitoring of stream dimension, pattern, and profile, or morphometric monitoring, along with the monitoring of stream bed material, was conducted using annual field surveys along with visual assessment. The morphometric, stream bed material, and stream bank stability monitoring was 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 in mid-April 2008. Immediately following the completion of the major grading and channel construction activities, all remaining plant material was installed during the months of March and April 2008. The as-built surveys of all of the stream reaches at RFC were initiated immediately following the installation of plant materials and were conducted utilizing 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 RFC for comparison to the proposed design, the results of the as-built surveys were also used to establish baseline morphology for the proposed monitoring. This information is presented in Table VII. A summary of the restored stream channel lengths 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 surveys, the limits and corresponding lengths of the project stream reaches to be monitored at RFC were determined using the sampling rates outlined by the USACE *et al*. (2003). A total of 3,060 linear feet of all restored stream channels are surveyed annually during the monitoring period. This amount satisfies the 3,000 linear feet required minimum. Based on these the sampling rates, the limits of the project stream reaches to be surveyed annually for monitoring are as follows:

Reach R1 – 600 Linear Feet Total (Stations 0+00-R1- through 6+00-R1-)
Reach R2-2 – 453 Linear Feet Total (Stations 18+43-R2- through 22+96-R2-)
Reach R2-3 – 1,633 Linear Feet Total (Stations 2+10-R2- through 18+43-R2-)
Reach R2-4a – 174 Linear Feet Total (Stations 0+36-R2- through 2+10-R2-)
Reach R2-4b – 100 Linear Feet Total (Stations 0+31-R2-4b- through 1+31-R2-4b-)
Reach R2-4c – 100 Linear Feet Total (Stations 0+00-R2-4c- through 1+00-R2-4c-)

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

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

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

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

During the as-built surveys, Modified Wolman pebble counts were conducted at each of the project stream reaches to classify the stream bed materials. The pebble counts for the larger project stream reaches (R2-2 and R2-3) 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. These larger reaches were sampled at a minimum rate of 25 counts per cross section such that a minimum of 100 counts were made for each of the larger reaches. Reach-wide pebble counts were conducted along the smaller project stream reaches (R1, R2-4a, R2-4b, and R2-4c). A minimum of 100 counts were made for each of these smaller reaches. The stream bed materials are monitored at RFC by repeating these 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 RFC. Stream bank stability monitoring using these parameters was required in Monitoring Year 3 and will be again in Year 5. Data collected during these years were 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 RFC are expected as a result of restoration and will be documented as described to demonstrate success.

During the as-built surveys, a total of three crest gages were installed across RFC, with two along Reach R2 and one at Reach R1. At the base of each crest gage a permanent vertical datum was installed. The locations of each crest gage along with the elevation of the permanent vertical datum were surveyed during the as-built surveys. The crest gages were used for the hydrologic monitoring at RFC 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 were used for stream monitoring at RFC to complement the other stream monitoring practices. A total of eight permanent reference photo points were installed across RFC during the as-built surveys. 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 eight permanent photo reference points with the same orientation each year and were used for photo documentation and annual comparison of the stream conditions across RFC. This exercise helped to further validate and document stream restoration success at RFC. The visual assessment was conducted using annual field observation and pedestrian surveys to identify any specific problem areas along the streams at RFC 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 mapped on the plan and profile sheets located in Appendix A. The suspected cause and appropriate remedial action for each problem was determined. If during any given year, the streams are not anticipated to meet the final established monitoring criteria, corrective actions are to be considered. Such modifications are to be documented and discussed with NCEEP.

3.2.2 Stream Monitoring Success Criteria

Stream dimension, pattern, profile, stream bed material, bank stability, and bankfull hydrology was monitored annually for the project stream reaches as described in detail above. Stream restoration success at RFC was evaluated by comparison of those annual results against those same parameters as predicted, specified, and required in proposed design. Success was achieved when all such comparisons reveal positive trends toward overall stream stability. The stream monitoring results should show that the stream channels at RFC 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 are expected to remain consistent from year to year and should fall within the ranges established by the original proposed design parameters. It is expected and acceptable that minor adjustments in dimension will occur such as the development of point bars and the subsequent deepening of pools. As vegetation becomes established and the stream banks are stabilized, the anticipation is that the width depth ratios will decrease and the entrenchment ratios will increase slightly, both within the normal ranges for C and E stream channel types (Rosgen, 1994).

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

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

Stream bed material 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 RFC.

Stream bank stability was monitored using BEHI and sediment transport estimates during Monitoring Years 3 and again in Year 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 RFC 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 RFC. 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 were used to complement the other stream monitoring practices as part of the stream monitoring protocol at RFC. If during any given year, the streams are not anticipated to meet the final established monitoring criteria, corrective actions will be considered. Such modifications will be documented and discussed with NCEEP.

3.2.3 Stream Monitoring Results for Year 1 of 5

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

All of the seven 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. 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, radius 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 radius of curvature in various locations, 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, including deepening of pools. The comparison of the baseline and Monitoring Year 1 longitudinal profiles did not show excessive aggrading or degrading.

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. 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. Mulkey believes that this fluctuation is attributed to the deposition of finer bed materials (sands and silts) mobilized during construction that have been subsequently deposited during storm events. At this time, Mulkey still believes that the stream bed materials will coarsen as stream bank stability increases with additional vegetation establishment and as the finer bed materials are concurrently flushed through the stream systems at RFC. The monitoring results suggested that on-site sediment supply from RFC is being greatly reduced as a result of the restoration. As noted earlier, the success criteria for the bed material will be determined at the end of the five-year monitoring period when data can be reviewed and compared to the proposed channel material types. Fluctuations in bed materials will likely continue to occur and several years may be needed to observe a consistent bed material.

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

Each of the three crest gages were checked during the Monitoring Year 1 surveys to monitor hydrology at RFC. Wrack lines were observed well above the bankfull stage across RFC during the Monitoring Year 1 surveys, suggesting that a flood event in excess of the bankfull event. One of the crest gages along Reach R2 was apparently washed away during this flood event. The two remaining crest gages (one each at Reach R1 and Reach R2) recorded flood stages in excess of the bankfull stage. Both of the remaining crest gages were reset after checking stage measurements to record future events. Table X lists the information related to the verification of bankfull events at RFC 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 RFC during Monitoring Year 1. This was further validated through conversations with the land owner, Mr. George Teague, as he noted he had not seen a flood event of that magnitude in decades. This documentation of the first bankfull event at RFC during the monitoring period suggests success with regards to hydrologic monitoring at RFC.

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 eight permanent photo reference points. Appendix C includes all of the described photos and provides comparison of the photos with the initial baseline photos taken from the eight 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. The project-wide visual assessment did not reveal any specific stream problem areas. Table XI presents the results of the project-wide visual assessment. Table XII presents the findings of no stream problem areas. Based on the results of the stream monitoring for Monitoring Year 1 at RFC, 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

Between early and mid-September 2009, the stream monitoring for Monitoring Year 2 was conducted. The methodologies described in the Stream Monitoring Methodology Section above were used for the stream monitoring at RFC for Monitoring Year 2. Detailed surveys were conducted along the project stream reaches specified to be surveyed for annual monitoring as described in detail above. The results of these surveys were used as the basis for the morphometric monitoring, including stream dimension, pattern and profile.

All of the seven 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. The comparison of the baseline condition along with the Monitoring Years 1 and 2 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 to the width to depth ratios, entrenchment ratios, and 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 baseline condition, Monitoring Year 1, and Monitoring Year 2 cross section photos strongly complemented these conclusions, 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, radius of curvature, meander wavelength, and meander width ratio. The results of the pattern surveys are presented in Table VIII. The comparison of the baseline condition, Monitoring Year 1, and Monitoring Year 2 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 minor changes to the radius of curvature in various locations, 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 condition, Monitoring Year 1, and Monitoring Year 2 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. The comparison of the baseline condition, Monitoring Year 1, and Monitoring Year 2 longitudinal profiles did not show excessive aggrading or degrading.

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. The comparison of the results of the pebble counts for Monitoring Year 1 and Monitoring Year 2 showed varied fluctuation of the bed material d50 and d84 along the sampled project stream reaches. Most of these fluctuations were slight. The bed material d50 fined or decreased slightly for project stream reaches R2-4a, R2-4b, R2-2, and R2-3; coarsened or increased slightly for project stream reach R2-4c; and remained the same for project stream reach R1. The bed material d84 fined or decreased for project stream reaches R1, R2-2, R2-3, R2-4a, and R2-4c; and coarsened or increased for project stream reach R2-4b. During the pebble counts, Mulkey noted that herbaceous vegetation is thriving in the subject stream reaches. This vegetation appears to be catching finer bed materials such that the actual stream bed is overlain with a thin layer of vegetation, root mass, and trapped finer materials. Upon further observation, coarser bed materials not reflected in the described pebble counts could be found directly under the layer of organics and trapped finer bed materials. Mulkey believes that this is the reason for the fining of the bed material reflected by the pebble counts for some reaches. The monitoring results continue to suggest that on-site sediment supply from RFC is being greatly reduced as a result of the restoration. As noted earlier, the success criteria for the bed material will be determined at the end of the five-year monitoring period when data can be reviewed and compared to the proposed channel material types. Fluctuations in bed materials will likely continue to occur and several years may be needed to observe a consistent bed material.

Stream bank stability monitoring was not conducted, as these monitoring practices are 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 RFC and is presented in Table IX. The raw data for this table can be viewed in Appendix E.

Both of the crest gages (one each at Reach R1 and Reach R2) were checked during the Monitoring Year 2 surveys to monitor hydrology at RFC. Deposition was observed above the bankfull stage across RFC during the Monitoring Year 2 surveys, suggesting that a flood event in excess of the bankfull event. Both of the crest gages recorded flood stages in excess of the bankfull stage. Both of the crest gages were reset after checking stage measurements to record future events. Table X lists the information related to the verification of bankfull events at RFC 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 RFC during Monitoring Year 2. Documentation of the second bankfull event at RFC during the monitoring period suggests success with regards to hydrologic monitoring at RFC and also satisfies the requirement that a minimum of two bankfull events, each occurring in two separate monitoring years, be documented within the five-year monitoring period.

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 eight 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. The project-wide visual assessment did not reveal any specific stream problem areas. Table XI presents the results of the project-wide visual assessment. Table XII presents the findings of no stream problem areas. As noted in the vegetation monitoring section above, root mats for both the woody and herbaceous vegetation are clearly visible along the edges of water for the project stream reaches. Such vegetation growth is contributing greatly to the restoration of stream stability at RFC. The smaller reaches (R1, R2-4 a, b, and c) have shown tremendous success with their reconnection to the floodplain. As a result, vigorous establishment of herbaceous wetland vegetation is occurring within the riparian buffers along these reaches. Given the relative small capacity of these streams, the described vegetation has begun to encroach into the stream channel, creating the elevation difference noticeable in reaches R1 and R2-4c. Additionally, the increased roughness created by the vegetation in the channel allows for some of the upstream sediment to accumulate within the vegetation mats. Reach R2-4a is an example of where this activity has occurred. The denuded upstream channel (off-site) offers a sediment source and the establishing vegetation is trapping the finer materials creating a bed for the next layer of vegetation. Reach R2-4b was influenced similarly by the encroaching vegetation, but not to the same degree as the other reaches. Given that there are no areas of scour, bare banks, or sparse vegetation, Mulkey believes this aggradation does not imply future stability problems. Actually, the vegetation responsible for the aggradation is contributing to increased grade control, channel stability, and providing exceptional in-stream habitat. It is Mulkey's belief that over time, woody vegetation will out compete the current herbaceous vegetation, and the channel will begin to show a trend back towards the originally restored conditions. Other field observations made during the Monitoring Year 2 include the presence of large minnows and/or small fish in the deeper restored pools. Fish of this size and number had not been previously observed at RFC by Mulkey pre or post construction. Based on the positive results of the stream monitoring for Monitoring Year 2 at RFC, Mulkey does not propose any additional recommendations or actions other than to proceed with the annual stream monitoring.

3.2.5 Stream Monitoring Results for Year 3 of 5

Between late September and early October 2010, the stream monitoring for Monitoring Year 3 was conducted. The methodologies described in the Stream Monitoring Methodology Section above were used for the stream monitoring at RFC for Monitoring Year 3. Detailed surveys were conducted along the project stream reaches specified to be surveyed for annual monitoring as described in detail above. The results of these surveys were used as the basis for the morphometric monitoring, including stream dimension, pattern and profile.

All of the seven 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 3 with all previous photos at each of the seven cross sections.

Appendix E provides an overlay of the Monitoring Years 1, 2 and 3 as well as baseline conditions, along with the raw data for each cross section.

The comparison of the stream dimension data between the baseline conditions and Monitoring Years 1, 2, and 3 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 to the width to depth ratios, entrenchment ratios, and depth. Each of these trends was indicative of movement toward increased stream stability with the primary contributors being well established vegetation (root mass) and natural channel adjustments. The cross section photo comparisons of the baseline conditions with Monitoring Years 1, 2, and 3 further support these conclusions, 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, radius of curvature, meander wavelength, and to determine meander width ratio. The results of the pattern surveys are presented in Table VIII. The comparison of the baseline condition with the stream pattern data for Monitoring Years 1, 2, 3 for each of the project stream reaches showed positive results, all of which were comparable to the originally proposed design parameters. The results showed that all of the reaches have experienced minor adjustments attributed to vegetation establishment and natural channel adjustments. Some of the fluctuations in the data can also be attributed to the standard deviation associated with human error in data collection and measurement. Overall the data suggest the reaches are beginning to reach equilibrium in the pattern measurements which would be attributed to the streams reaching stability. Noteworthy outliers in the data can be found in low belt widths, however these specific measurements occur where the valley takes a significant turn thus compromising the measurement methodology. In the field, each of these areas are showing stability in the visual assessment and other pattern measurements.

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. Comparisons of the longitudinal profiles for the baseline conditions and Monitoring Years 1, 2, and 3 for each of the monitored project stream reaches fell within the ranges for each parameter as set forth by the design. Comparisons of the baseline data and results up to Monitoring Year 3 did not show excessive aggrading or degrading. Overlays for the longitudinal profiles can be found in Appendix E along with the raw data for Monitoring Year 3.

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 overlays of the percent accumulation graphs for the baseline conditions through Monitoring Year 3 are shown in Appendix E. Raw data for Monitoring Year 3 can be found behind each respective graph.

The comparison of the results of the pebble counts for Monitoring Year 2 and Monitoring Year 3 showed varied fluctuation of the d50 and d84 bed material along the sampled project stream reaches. Most of these fluctuations were significant in that they moved toward the original designed substrate size. The d50 bed material coarsened significantly for project stream reaches R1, R2-3, R2-2, and R2-4b, which now closely resembles the designed (proposed) substrate. The d50 bed material slightly coarsened for the project stream reach R2-4a and actually decreased or fined for R2-4b. The d84 bed material coarsened for project stream reaches R1, R2-2, R2-3, and R2-4a. The d84 bed material decreased or fined for R2-4b and R2-4c. As mentioned in Monitoring Year 2, Mulkey noted that herbaceous vegetation was thriving in the areas containing R2-4a, b, and c. This vegetation coupled with the degraded channel upstream of R2-4b could attribute to the fining of this reach. R2-4c is spring fed and at this time appears the silt bed may become the stable bed material as large, purging storm flows are not experienced in this reach. As for the remaining streams, the coarsening of the bed was anticipated in the design parameters and the presence of the coarser substrate indicates stability is being reached and the finer materials left after construction are no longer present. The monitoring results continue to suggest that on-site sediment supply from RFC is being greatly reduced as a result of the restoration. As noted earlier, the success criteria for the bed material will be determined at the end of the five-year monitoring period when data can be reviewed and compared to the proposed channel material types. Fluctuations in bed materials will likely continue to occur and the complete monitoring period may be needed to observe a consistent bed material in all project reaches.

Stream bank stability monitoring was conducted as required for Monitoring Year 3 using BEHI and sediment transport estimates. The current steam bank stability results showed a significant reduction in sediment exports when compared with 2006 pre-construction estimates. The 2006 pre-construction sediment export values for RFC were originally estimated to be 445 tons per year. Monitoring Year 3 sediment export values for RFC currently show that 26.6 tons per year are currently leaving the site, which equates to 418.4 tons per year reduction in sediment export as depicted in Table IX. As outlined in the success criteria, monitoring of the stream bank stability will occur once again in Year 5 and the ultimate success of the project will then be determined.

Both of the crest gages (one each at Reach R1 and Reach R2) were checked during the Monitoring Year 3 surveys to monitor hydrology at RFC. Deposition was observed above the bankfull stage across RFC during the Monitoring Year 3 surveys, suggesting a flood event in excess of the bankfull stage. Accordingly, both of the crest gages recorded flood stages in excess of the bankfull stage. Both of the crest gages were reset after checking stage measurements to record future events. Table X lists the information related to the verification of bankfull events at RFC for Monitoring Year 3 while the raw data can be found in Appendix E. Documentation of the third bankfull event at RFC during the monitoring period suggests success with regards to hydrologic monitoring at RFC. This third bankfull event, in as many monitoring years, also exceeds the required minimum of two bankfull events to have occurred and be documented within the five-year monitoring period.

Photo documentation and project-wide visual assessment were used to complement the other Monitoring Year 3 stream monitoring practices. Photos were taken from each of the eight permanent photo reference points. Appendix C includes all of the described photos and provides comparison of the photos between the baseline conditions through Monitoring Year 3. 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. The project-wide visual assessment did not reveal any specific stream problem areas. Table XI presents the results of the project-wide visual assessment. Table XII presents the findings of no stream problem areas.

Overall, the Monitoring Year 3 data illustrates a stream system reaching equilibrium in terms of projected adjustments in pattern, dimension, profile, substrate development, and bank stability. It can still be expected to see slight variations within the data set over the next two years of monitoring, but these will be most likely be attributed to inherent error in data collection and measurement and/or the natural tendencies of an active, dynamic system. The compilation of three years of monitoring data strongly suggest the RFC project has been successfully restored to a stable stream system in all stream related monitoring aspects including the established vegetation success criteria. Since the project is progressing in a positive direction, Mulkey does not propose any additional recommendations or actions other than to proceed with the annual stream monitoring.

4.0 Project Monitoring Methodology

Success criteria for stream mitigation sites are based on guidelines established by the USACE, US Environmental Protection Agency (USEPA), NC Wildlife Resources Commission (NCWRC) and the NCDWQ (USACE *et. al,* 2003). These guidelines establish criteria for monitoring both hydrologic conditions and vegetation survival. These same guidelines were used to develop the monitoring methods, frequencies, and success criteria discussed herein for RFC and further described in detail in the approved mitigation report (Mulkey Engineers and Consultants, 2008). RFC 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-D06028. 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 RFC 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

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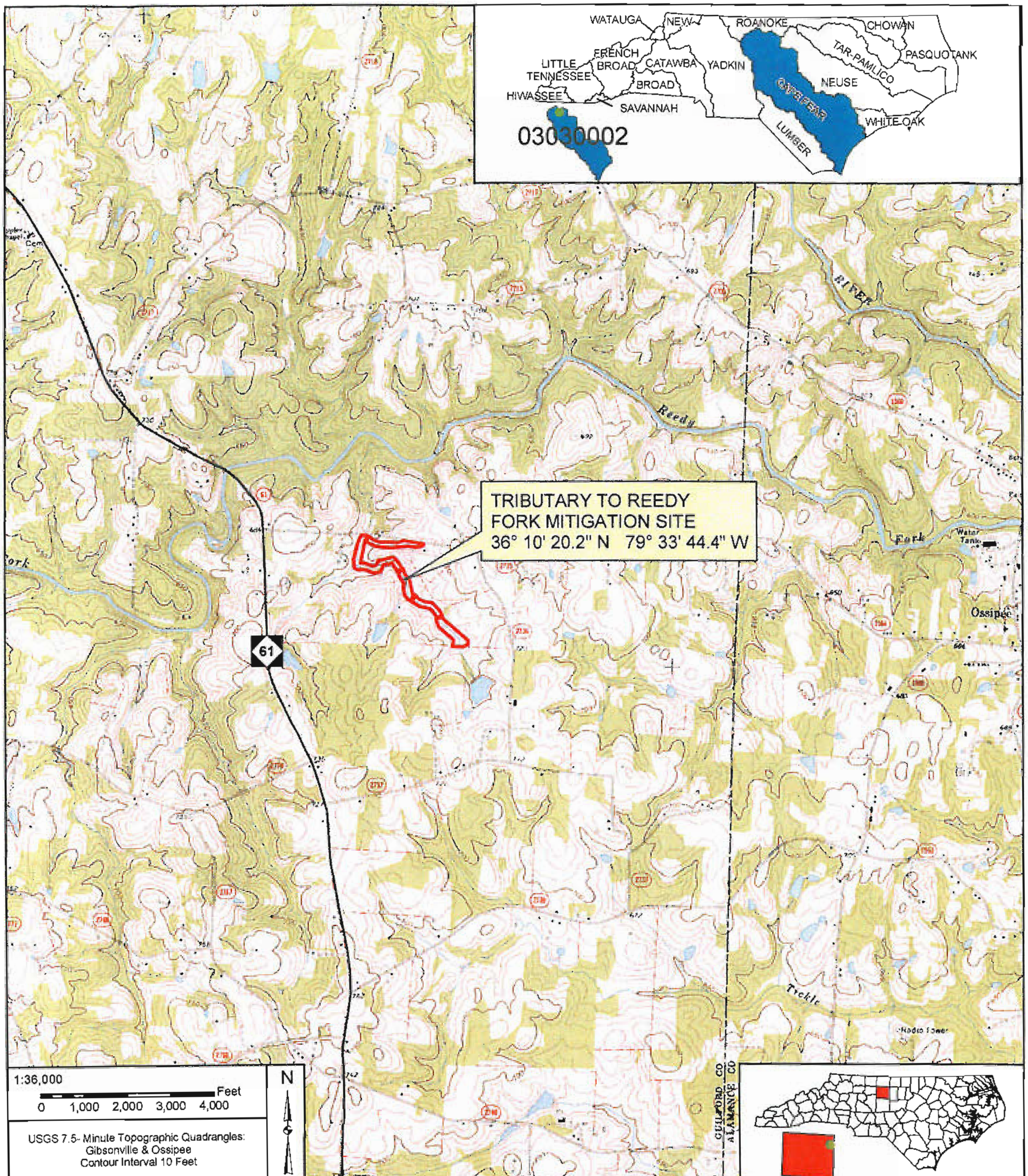


LOCATION MAP

TRIBUTARY TO REEDY FORK

GUILFORD COUNTY, NORTH CAROLINA

May 30, 2008

Figure

1

PROJECT NO. D06028-A

Exhibit Table I. Project Restoration Approach and Mitigation Type Table Tributary to Reedy Fork Creek Stream Restoration / D06028-A						
Stream Reach ID	**Restoration Approach**	**Mitigation Type**	**Original Channel Length (lf)**	**Restored Channel Length (lf)**	**Stream Mitigation Units (SMU)***	**Comments**
R1	P1/P2	R	1,409	1,632	1,600	Includes both P1 (connection to historic floodplain) and P2 (channel relocation with floodplain excavation)
R2-1	P2	R	906	819	819	P2 (channel relocation with floodplain excavation)
R2-2	P1/P2	R	2,522	853	853	Includes both P1 (connection to historic floodplain) and P2 (channel relocation with floodplain excavation)
	P2	EII		418	167	Includes both P2 (channel relocation with floodplain excavation) and EII
	P1/P2	R		1,273	1,213	Includes both P1 (connection to historic floodplain) and P2 (channel relocation with floodplain excavation)
R2-3	P2	R	1,584	1,771	1,741	P2 (channel relocation with floodplain excavation)
R2-4a	P2	R	289	231	195	P2 (channel relocation with floodplain excavation)
R2-4b	P2	R	226	307	276	P2 (channel relocation with floodplain excavation)
R2-4c	P2	R	157	208	208	P2 (channel relocation with floodplain excavation)
		Totals	7,093	7,512	7,072	

*** Stream Mitigation Units do not include restored channel outside of easement and within crossings.**

R = Restoration   P1 = Priority I
EII = Enhancement II   P2 = Priority II

Exhibit Table II. Project Activity and Reporting History Tributary to Reedy Fork Creek Stream Restoration / D06028-A			
Activity or Report	**Scheduled Completion**	**Data Collection Completion**	**Actual Completion or Delivery**
Restoration Plan Prepared	Dec-06	Oct-06	10-Jul-07
Restoration Plan Approved	Jan-07	N/A	30-Jul-07
Final Design - 90%	Feb-07	N/A	10-Aug-07
Construction	Aug-07	N/A	14-Apr-08
Temporary S&E mix applied to entire project area	Aug-07	N/A	14-Apr-08
Permanent seed mix applied to entire project area	Aug-07	N/A	14-Apr-08
Planting live stakes	Dec-07	N/A	14-Apr-08
Planting bare roots	Dec-07	N/A	14-Apr-08
End of Construction	Dec-07	N/A	14-Apr-08
Survey of As-built conditions (Year 0 Monitoring - Baseline)	Jan-08	May-08	28-May-08
Monitoring			
Year 1 - 2008	Dec-08	Sep-08	Dec-08
Year 2 - 2009	Dec-09	Sep-09	Nov-09
Year 3 - 2010	Dec-10	Oct-10	Dec-10
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.

Exhibit Table III. Project Contacts Tributary to Reedy Fork Creek Stream Restoration / D06028-A		
Designer		
	Mulkey Engineers and Consultants	6750 Tryon Road Cary, NC 27518 Contact: Emmett Perdue, PE Tel. 919.858.1874
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		
	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: Emmett Perdue Tel. 919.858.1874

Exhibit Table IV. Project Background Tributary to Reedy Fork Creek Stream Restoration / D06028-A	
Project County	Guilford County, North Carolina
Drainage Area [sq. mi(acres)]	
R1	0.028 (17.71)
R2-1	0.92 (591.5)
R2-2	0.51 (326.1)
R2-3	0.33 (210.9)
R2-4a	0.09 (55.7)
R2-4b	0.09 (55.7)
R2-4c	0.09 (55.7)
Drainage Impervious cover estimate (%)	
R1	2
R2-1	2
R2-2	2
R2-3	2
R2-4a	2
R2-4b	2
R2-4c	2
Stream Order	
R1	1
R2-1	2
R2-2	2
R2-3	2
R2-4a	1
R2-4b	1
R2-4c	1
Physiographic Region	Piedmont
Ecoregion	Southern Outer Piedmont
Rosgen Classification (As-built)	
R1, R2-1, R2-2, R2-3, R2-4a, R2-4b, R2-4c	C4
Cowardin Classification	R3UB3*
Dominat Soil Types	Enon-Mecklenburg
Reference Site ID	UT to Wells Creek
USGS HUC for Project and Reference	
Project	03030002
Reference	03030002
NCDWQ Sub-basin for Project and Reference	
Project	03-06-02 (Cape Fear)
Reference	03-06-04 (Cape Fear)
NCDWQ Classification for Project and Reference	
Project	C NSW
Reference	C NSW
Any portion of any project segement 303d?	Yes
Any portion of any project segement upstream of a 303d listed segment?	Yes
Reasons for 303d listing or stressor	Imparied Biological Integrity
Percent of project easement fenced	100

*(R) Riverine (3) Upper Perennial (UB) Unconsolidated Bottom (3) Cobble-Gravel

Exhibit Table V. Stem Counts Monitoring Year 3 for Each Species Arranged by Plot
Triburary to Reedy Fork Creek Stream Restoration / D06028-A

Species	Plots 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Initial Totals	Initial Totals Adjusted [A]	Year 1 Totals	Year 2 Totals [B]	Year 3 Totals	Survival % [C]
Shrubs																						
Cornus amomum																	1	1	1	1	0	0%
Trees																						
Betula nigra		7	4			1	1	4	3	2	1			3	1	1	24	23	17	29	28	97%
Diospyros virginiana		2		1			2				3	1	5		3		25	26	17	21	17	81%
Juglans nigra	6				3		1	1			2	4	3	1			0	0	0	28	21	75%
Pinus echinata		1		1									2				19	15	6	5	4	80%
Pinus strobus				2								2		1			14	14	4	8	5	63%
Pinus virginiana				1									1	1			11	15	8	4	3	75%
Prunus serotina																	4	4	0	0	0	**NLE**
Plantanus occidentalis				1	3		3			3	4			3	7	7	0	0	0	32	31	97%
Quercus alba	2	2		2					1		6	4			3	1	20	23	17	23	21	91%
Quercus falcata														1		1	32	45	25	2	2	100%
Quercus michauxii			3	3	1	1	1	2	5	4			3	3	3	4	28	32	28	38	33	87%
Quercus nigra		1		1	1	9		9	5	4		1					52	37	24	38	31	82%
Quercus phellos	11	1	5	2	4	5	1	3		4	1				1		62	57	40	45	38	84%
Salix nigra									2								2	2	2	2	2	100%
Totals	19	14	12	14	12	16	9	19	16	17	17	12	14	13	18	14	294	294	189	276	236	86%

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Stems Per Acre Summary: Min	Ave	Max
Plot Acreage	0.025	0.025	0.025	0.025	0.025	0.025	0.024	0.025	0.025	0.025	0.025	0.025	0.024	0.026	0.025	0.025	Min	Ave	Max
Stems/Acre	763.1	569.1	489.8	557.8	481.9	645.2	376.6	769.2	653.1	693.9	677.3	483.9	573.8	503.9	725.8	564.5	377	596	769

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

[B] "Year 2 Totals" represents the current species totals (100% survival) following replanting in Year 1 (2008).

[C] "Survival %" represents the Year 3 Totals compared to the Year 2 Totals.

NLE - This species no longer exists within the permanent monitoring vegetation plots.

Exhibit Table VI. Vegetative Problem Areas Triburary to Reedy Fork Creek Stream Restoration / D06028-A			
Feature/Issue	**Station / Range**	**Probable Cause**	**Photo No. (If Available)**
No problem areas observed in Year 3 (2010)	All project reaches	N/A	N/A
No problem areas observed in Year 2 (2009)	All project reaches	N/A	N/A
Site replanted late winter 2009 following Year 1 (2008) due to mortality from drought	All project reaches	N/A	N/A
Scattered bare root planting mortality in Year 1 (2008)	All project reaches	Drought	N/A

Exhibit Table VII. Baseline Morphology and Hydraulic Summary
Tributary to Reedy Fork Creek Stream Restoration / D06028-A
Reach R1 (1,632 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)	--	--	--	--	--	--	3.0	8.1	5.6	6.2	8.6	7.2	--	--	6.9	7.0	9.1	8.0
Floodprone Width (ft)	--	--	--	--	--	--	3.5	26.7	15.1	15.3	25.0	20.5	13.4	28.0	20.5	34.3	52.3	43.3
BKF Cross Sectional Area (sq. ft.)	--	--	--	--	--	--	3.2	7.8	5.5	3.9	6.3	5.4	--	--	4.0	3.8	4.4	4.1
BKF Mean Depth (ft)	--	--	--	--	--	--	0.97	1.06	1.01	0.56	1.02	0.79	--	--	0.58	0.49	0.54	0.52
BKF Max Depth (ft)	--	--	--	--	--	--	1.15	1.75	1.45	0.64	1.38	1.02	0.47	1.01	0.75	0.89	1.16	1.03
Width/Depth Ratio	--	--	--	--	--	--	2.9	8.4	5.6	6.1	12.6	9.1	--	--	12.0	12.9	18.5	15.7
Entrenchment Ratio	--	--	--	--	--	--	1.1	3.3	2.2	1.9	4.1	3.0	1.9	4.1	3.0	3.8	7.5	5.7
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	7.59	--	--	--	--	--	8.1	7.5	9.3	8.4
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	0.73	--	--	--	--	--	0.49	0.47	0.50	0.49
Pattern	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	--	--	--	--	--	--	--	--	--	10.0	35.0	20.9	9.7	33.9	20.3	3.7	32.4	12.2
Radius of Curvature (ft)	--	--	--	--	--	--	--	--	--	2.3	31.8	13.5	2.2	30.8	13.1	7.1	26.0	14.7
Meander Wavelength (ft)	--	--	--	--	--	--	--	--	--	35.0	70.0	50.0	33.9	67.9	48.5	32.5	66.4	45.4
Meander Width Ratio	--	--	--	--	--	--	--	--	--	1.4	4.9	2.9	1.4	4.9	2.9	0.5	4.1	1.5
Profile	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	--	--	--	--	--	--	9.1	67.7	38.4	2.5	25.4	13.8	2.4	24.7	13.4	2.3	10.8	5.2
Riffle Slope (ft/ft)	--	--	--	--	--	--	0.014	0.075	0.029	0.016	0.085	0.040	0.016	0.083	0.039	0.011	0.102	0.040
Pool Length (ft)	--	--	--	--	--	--	35.7	96.9	66.0	7.3	27.5	14.6	7.1	26.6	14.2	7.2	20.9	13.5
Pool Spacing (ft)	--	--	--	--	--	--	134.2	253.1	180.5	16.5	62.8	36.5	16.0	60.9	35.4	19.1	52.9	35.1
Substrate																		
d50 (mm)	--			--			1.1			6.2			1.1			4.9		
d84 (mm)	--			--			16.8			72.7			16.8			25.7		
Additional Reach Parameters																		
Bankfull Slope (ft/ft)	--			--			0.0237			0.0199			0.0197			0.0198		
Channel Length(ft)	--			--			1409			496			1693			1632		
Valley Length (ft)	--			--			1311			352			1311			1311		
Sinuosity	--			--			1.07			1.41			1.29			1.24		
Rosgen Classification	--			--			Degraded E5b			C4/1			C4/1			C4/1		

Exhibit Table VII. cont. Baseline Morphology and Hydraulic Summary
Tributary to Reedy Fork Creek Stream Restoration / D06028-A
Reach R2-1 (819 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)	--	--	--	7.0	27.0	14.0	10.6	11.4	11.0	6.2	8.6	7.2	--	--	15.8	--	--	15.8
Floodprone Width (ft)	--	--	--	--	--	--	48.9	50.6	49.8	15.3	25.0	20.5	30.5	64.0	46.7	--	--	66.1
BKF Cross Sectional Area (sq. ft.)	--	--	--	9.0	40.0	21.0	17.0	21.2	19.1	3.9	6.3	5.4	--	--	20.0	--	--	18.3
BKF Mean Depth (ft)	--	--	--	0.90	2.30	1.70	1.60	1.86	1.73	0.56	1.02	0.79	--	--	1.26	--	--	1.15
BKF Max Depth (ft)	--	--	--	--	--	--	1.75	2.47	2.13	0.64	1.38	1.02	1.03	2.22	1.64	--	--	1.94
Width/Depth Ratio	--	--	--	--	--	--	6.1	6.6	6.4	6.1	12.6	9.1	--	--	12.5	--	--	13.8
Entrenchment Ratio	--	--	--	--	--	--	4.4	4.6	4.5	1.9	4.1	3.0	1.9	4.1	3.0	--	--	4.2
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	14.5	--	--	--	--	--	18.3	--	--	16.7
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	1.32	--	--	--	--	--	1.09	--	--	1.09
Pattern	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	--	--	--	--	--	--	4.3	44.6	24.3	10.0	35.0	20.9	22.1	77.5	46.3	17.9	39.7	28.3
Radius of Curvature (ft)	--	--	--	--	--	--	19.8	54.3	33.8	2.3	31.8	13.5	5.1	70.4	29.9	24.2	85.6	41.1
Meander Wavelength (ft)	--	--	--	--	--	--	53.6	114.7	79.9	35.0	70.0	50.0	77.5	154.9	110.7	94.3	143.2	115.4
Meander Width Ratio	--	--	--	--	--	--	0.4	4.1	2.2	1.4	4.9	2.9	1.4	4.9	2.9	1.1	2.5	1.8
Profile	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	--	--	--	--	--	--	9.0	104.8	38.4	2.5	25.4	13.8	5.6	56.3	30.5	6.2	11.6	9.6
Riffle Slope (ft/ft)	--	--	--	--	--	--	0.0078	0.0362	0.0169	0.016	0.085	0.040	0.005	0.028	0.013	0.003	0.031	0.017
Pool Length (ft)	--	--	--	--	--	--	14.2	75.5	36.7	7.3	27.5	14.6	16.2	60.8	32.4	20.2	36.4	26.7
Pool Spacing (ft)	--	--	--	--	--	--	44.34	165.18	97.35	16.5	62.8	36.5	36.6	139.0	80.8	38.0	82.9	64.6
Substrate																		
d50 (mm)	--			--			17.5			6.2			17.5			3.0		
d84 (mm)	--			--			81.3			72.7			81.3			19.3		
Additional Reach Parameters																		
Bankfull Slope (ft/ft)	--			--			0.0067			0.0199			0.0074			0.0075		
Channel Length(ft)	--			--			906			496			802			819		
Valley Length (ft)	--			--			745			352			745			745		
Sinuosity	--			--			1.22			1.41			1.08			1.10		
Rosgen Classification	--			--			Degraded E4/1			C4/1			C4/1			C4/1		

Exhibit Table VII. cont. Baseline Morphology and Hydraulic Summary
Tributary to Reedy Fork Creek Stream Restoration / D06028-A
Reach R2-2 (2,544 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	20.0	11.0	14.1	15.5	14.8	6.2	8.6	7.2	--	--	15.8	13.5	14.8	14.3
Floodprone Width (ft)	--	--	--	--	--	--	46.1	82.5	64.3	15.3	25.0	20.5	30.5	64.0	46.7	61.1	85.0	73.6
BKF Cross Sectional Area (sq. ft.)	--	--	--	6.0	28.0	15.5	19.6	21.6	20.6	3.9	6.3	5.4	--	--	20.0	14.5	17.6	15.7
BKF Mean Depth (ft)	--	--	--	0.75	2.00	1.40	1.27	1.53	1.40	0.56	1.02	0.79	--	--	1.26	0.99	1.31	1.03
BKF Max Depth (ft)	--	--	--	--	--	--	1.59	2.11	1.79	0.64	1.38	1.02	1.03	2.22	1.64	1.53	2.23	1.79
Width/Depth Ratio	--	--	--	--	--	--	9.2	12.2	10.7	6.1	12.6	9.1	--	--	12.5	10.3	14.8	13.3
Entrenchment Ratio	--	--	--	--	--	--	3.0	5.8	4.4	1.9	4.1	3.0	1.9	4.1	3.0	4.1	6.3	5.2
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	17.6	--	--	--	--	--	18.3	15.1	15.5	15.3
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	1.17	--	--	--	--	--	1.09	0.96	1.17	1.03
Pattern	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	--	--	--	--	--	--	10.3	94.8	39.6	10.0	35.0	20.9	22.1	77.5	46.3	14.3	65.6	33.4
Radius of Curvature (ft)	--	--	--	--	--	--	15.9	76.7	45.6	2.3	31.8	13.5	5.1	70.4	29.9	17.3	66.8	33.0
Meander Wavelength (ft)	--	--	--	--	--	--	73.2	238.2	139.3	35.0	70.0	50.0	77.5	154.9	110.7	79.1	133.5	107.8
Meander Width Ratio	--	--	--	--	--	--	0.7	6.4	2.7	1.4	4.9	2.9	1.4	4.9	2.9	1.0	4.6	2.3
Profile	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	--	--	--	--	--	--	6.43	91.81	28.91	2.5	25.4	13.8	5.58	56.3	30.47	3.9	17.1	9.5
Riffle Slope (ft/ft)	--	--	--	--	--	--	0.009	0.040	0.020	0.016	0.085	0.040	0.008	0.041	0.019	0.006	0.041	0.018
Pool Length (ft)	--	--	--	--	--	--	6.8	119.7	46.0	7.3	27.5	14.6	16.2	60.8	32.4	15.3	69.9	34.7
Pool Spacing (ft)	--	--	--	--	--	--	35.3	343.6	143.8	16.5	62.8	36.5	36.6	139.0	80.8	37.2	99.6	63.5
Substrate																		
d50 (mm)	--			--			50.9			6.2			50.9			6.0		
d84 (mm)	--			--			152.5			72.7			152.5			29.1		
Additional Reach Parameters																		
Bankfull Slope (ft/ft)	--			--			0.0092			0.0199			0.0094			0.0096		
Channel Length(ft)	--			--			2522			496			2490			2544		
Valley Length (ft)	--			--			2116			352			2116			2116		
Sinuosity	--			--			1.19			1.41			1.18			1.20		
Rosgen Classification	--			--			Degraded E4/1			C4/1			C4/1			C4/1		

Exhibit Table VII. cont. Baseline Morphology and Hydraulic Summary
Tributary to Reedy Fork Creek Stream Restoration / D06028-A
Reach R2-3 (1,771 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)	--	--	--	4.5	18.0	9.0	4.2	4.4	4.3	6.2	8.6	7.2	--	--	10.0	10.6	10.6	10.6
Floodprone Width (ft)	--	--	--	--	--	--	7.8	32.7	20.3	15.3	25.0	20.5	19.3	40.5	29.5	78.5	78.7	78.6
BKF Cross Sectional Area (sq. ft.)	--	--	--	5.0	20.0	10.0	4.1	5.2	4.6	3.9	6.3	5.4	--	--	8.0	7.3	8.4	7.8
BKF Mean Depth (ft)	--	--	--	0.6	1.7	1.1	0.93	1.23	1.08	0.56	1.02	0.79	--	--	0.80	0.69	0.79	0.74
BKF Max Depth (ft)	--	--	--	--	--	--	1.11	1.76	1.35	0.64	1.38	1.02	0.65	1.40	1.04	1.19	1.34	1.27
Width/Depth Ratio	--	--	--	--	--	--	3.4	4.7	4.1	6.1	12.6	9.1	--	--	12.5	13.4	15.3	14.4
Entrenchment Ratio	--	--	--	--	--	--	1.8	7.8	4.8	1.9	4.1	3.0	1.9	4.1	3.0	7.4	7.4	7.4
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	6.5	--	--	--	--	--	11.6	10.9	11.1	11.0
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	0.71	--	--	--	--	--	0.69	0.67	0.76	0.72
Pattern	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	--	--	--	--	--	--	3.0	67.0	26.9	10.0	35.0	20.9	14.0	49.0	29.3	5.9	61.6	26.8
Radius of Curvature (ft)	--	--	--	--	--	--	12.2	76.6	30.7	2.3	31.8	13.5	3.2	44.5	18.9	14.9	64.7	24.8
Meander Wavelength (ft)	--	--	--	--	--	--	46.8	149.4	83.2	35.0	70.0	50.0	49.0	98.0	70.0	55.8	147.2	83.6
Meander Width Ratio	--	--	--	--	--	--	0.7	15.6	6.3	1.4	4.9	2.9	1.4	4.9	2.9	0.6	5.8	2.5
Profile	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	--	--	--	--	--	--	4.3	42.3	18.7	2.5	25.4	13.8	3.5	35.6	19.3	5.5	15.2	8.9
Riffle Slope (ft/ft)	--	--	--	--	--	--	0.008	0.082	0.026	0.016	0.085	0.040	0.006	0.031	0.014	0.005	0.023	0.012
Pool Length (ft)	--	--	--	--	--	--	4.8	85.2	31.8	7.3	27.5	14.6	10.2	38.4	20.5	15.9	27.7	20.9
Pool Spacing (ft)	--	--	--	--	--	--	71.1	296.3	149.8	16.5	62.8	36.5	23.1	87.9	51.1	27.6	83.2	41.9
Substrate																		
d50 (mm)	--			--			0.2			6.2			0.2			6.5		
d84 (mm)	--			--			6.1			72.7			6.1			18.4		
Additional Reach Parameters																		
Bankfull Slope (ft/ft)	--			--			0.0080			0.0199			0.0075			0.0073		
Channel Length(ft)	--			--			1584			496			1734			1771		
Valley Length (ft)	--			--			1291			352			1305			1305		
Sinuosity	--			--			1.23			1.41			1.33			1.36		
Rosgen Classification	--			--			Degraded E5			C4/1			C4/1			C4/1		

Exhibit Table VII. cont. Baseline Morphology and Hydraulic Summary
Tributary to Reedy Fork Creek Stream Restoration / D06028-A
Reach R2-4a (231 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)	--	--	--	--	--	--	--	--	--	6.2	8.6	7.2	--	--	7.1	--	--	--
Floodprone Width (ft)	--	--	--	--	--	--	--	--	--	15.3	25.0	20.5	13.6	28.6	20.9	--	--	--
BKF Cross Sectional Area (sq. ft.)	--	--	--	--	--	--	--	--	--	3.9	6.3	5.4	--	--	4.0	--	--	--
BKF Mean Depth (ft)	--	--	--	--	--	--	--	--	--	0.56	1.02	0.79	--	--	0.57	--	--	--
BKF Max Depth (ft)	--	--	--	--	--	--	--	--	--	0.64	1.38	1.02	0.46	0.99	0.73	--	--	--
Width/Depth Ratio	--	--	--	--	--	--	--	--	--	6.1	12.6	9.1	--	--	12.5	--	--	--
Entrenchment Ratio	--	--	--	--	--	--	--	--	--	1.9	4.1	3.0	1.9	4.1	3.0	--	--	--
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pattern	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	--	--	--	--	--	--	--	--	--	10.0	35.0	20.9	9.9	34.6	20.7	12.5	25.4	18.1
Radius of Curvature (ft)	--	--	--	--	--	--	--	--	--	2.3	31.8	13.5	2.3	31.5	13.4	12.1	28.2	18.3
Meander Wavelength (ft)	--	--	--	--	--	--	--	--	--	35.0	70.0	50.0	34.6	69.3	49.5	59.4	75.2	65.4
Meander Width Ratio	--	--	--	--	--	--	--	--	--	1.4	4.9	2.9	1.4	4.9	2.9	--	--	--
Profile	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	--	--	--	--	--	--	--	--	--	2.5	25.4	13.8	2.5	25.2	13.6	4.1	13.4	7.5
Riffle Slope (ft/ft)	--	--	--	--	--	--	--	--	--	0.016	0.085	0.040	0.006	0.031	0.014	0.005	0.026	0.015
Pool Length (ft)	--	--	--	--	--	--	--	--	--	7.3	27.5	14.6	7.2	27.2	14.5	5.8	29.5	17.2
Pool Spacing (ft)	--	--	--	--	--	--	--	--	--	16.5	62.8	36.5	16.4	62.2	26.1	32.9	53.8	44.3
Substrate																		
d50 (mm)	--			--			0.2			6.2			0.2			0.4		
d84 (mm)	--			--			6.1			72.7			6.1			7.3		
Additional Reach Parameters																		
Bankfull Slope (ft/ft)	--			--			0.0069			0.0199			0.0035			0.0080		
Channel Length(ft)	--			--			289			496			226			231		
Valley Length (ft)	--			--			215			352			178			178		
Sinuosity	--			--			1.35			1.41			1.27			1.30		
Rosgen Classification	--			--			n/a			C4/1			C4/1			C4/1		

Exhibit Table VII. cont. Baseline Morphology and Hydraulic Summary
Tributary to Reedy Fork Creek Stream Restoration / D06028-A
Reach R2-4b (307 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)	--	--	--	--	--	--	--	--	--	6.2	8.6	7.2	--	--	7.1	--	--	10.4
Floodprone Width (ft)	--	--	--	--	--	--	--	--	--	15.3	25.0	20.5	13.6	28.6	20.9	--	--	44.4
BKF Cross Sectional Area (sq. ft.)	--	--	--	--	--	--	--	--	--	3.9	6.3	5.4	--	--	4.0	--	--	7.7
BKF Mean Depth (ft)	--	--	--	--	--	--	--	--	--	0.56	1.02	0.79	--	--	0.57	--	--	0.74
BKF Max Depth (ft)	--	--	--	--	--	--	--	--	--	0.64	1.38	1.02	0.46	0.99	0.73	--	--	1.45
Width/Depth Ratio	--	--	--	--	--	--	--	--	--	6.1	12.6	9.1	--	--	12.5	--	--	14.0
Entrenchment Ratio	--	--	--	--	--	--	--	--	--	1.9	4.1	3.0	1.9	4.1	3.0	--	--	4.3
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	11.1
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.70
Pattern	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	--	--	--	--	--	--	--	--	--	10.0	35.0	20.9	9.9	34.6	20.7	3.3	29.8	12.6
Radius of Curvature (ft)	--	--	--	--	--	--	--	--	--	2.3	31.8	13.5	2.3	31.5	13.4	11.9	29.5	16.4
Meander Wavelength (ft)	--	--	--	--	--	--	--	--	--	35.0	70.0	50.0	34.6	69.3	49.5	40.5	55.6	47.7
Meander Width Ratio	--	--	--	--	--	--	--	--	--	1.4	4.9	2.9	1.4	4.9	2.9	0.3	2.9	1.2
Profile	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	--	--	--	--	--	--	--	--	--	2.5	25.4	13.8	2.5	25.2	13.6	4.4	5.2	4.8
Riffle Slope (ft/ft)	--	--	--	--	--	--	--	--	--	0.016	0.085	0.040	0.006	0.031	0.014	0.009	0.046	0.032
Pool Length (ft)	--	--	--	--	--	--	--	--	--	7.3	27.5	14.6	7.2	27.2	14.5	9.6	18.3	12.6
Pool Spacing (ft)	--	--	--	--	--	--	--	--	--	16.5	62.8	36.5	16.4	62.2	26.1	24.4	41.6	31.2
Substrate																		
d50 (mm)	--			--			0.2			6.2			0.2			5.7		
d84 (mm)	--			--			6.1			72.7			6.1			15.4		
Additional Reach Parameters																		
Bankfull Slope (ft/ft)	--			--			0.0155			0.0199			0.0155			0.0178		
Channel Length(ft)	--			--			226			496			334			307		
Valley Length (ft)	--			--			213			352			267			267		
Sinuosity	--			--			1.06			1.41			1.25			1.15		
Rosgen Classification	--			--			n/a			C4/1			C4/1			C4/1		

Exhibit Table VII. cont. Baseline Morphology and Hydraulic Summary
Tributary to Reedy Fork Creek Stream Restoration / D06028-A
Reach R2-4c (208 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)	--	--	--	--	--	--	--	--	--	6.2	8.6	7.2	--	--	7.1	--	--	8.7
Floodprone Width (ft)	--	--	--	--	--	--	--	--	--	15.3	25.0	20.5	13.6	28.6	20.9	--	--	42.6
BKF Cross Sectional Area (sq. ft.)	--	--	--	--	--	--	--	--	--	3.9	6.3	5.4	--	--	4.0	--	--	6.0
BKF Mean Depth (ft)	--	--	--	--	--	--	--	--	--	0.56	1.02	0.79	--	--	0.57	--	--	0.68
BKF Max Depth (ft)	--	--	--	--	--	--	--	--	--	0.64	1.38	1.02	0.46	0.99	0.73	--	--	1.23
Width/Depth Ratio	--	--	--	--	--	--	--	--	--	6.1	12.6	9.1	--	--	12.5	--	--	12.9
Entrenchment Ratio	--	--	--	--	--	--	--	--	--	1.9	4.1	3.0	1.9	4.1	3.0	--	--	4.9
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	9.3
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.65
Pattern	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	--	--	--	--	--	--	--	--	--	10.0	35.0	20.9	9.9	34.6	20.7	5.7	18.2	11.6
Radius of Curvature (ft)	--	--	--	--	--	--	--	--	--	2.3	31.8	13.5	2.3	31.5	13.4	14.0	21.8	16.6
Meander Wavelength (ft)	--	--	--	--	--	--	--	--	--	35.0	70.0	50.0	34.6	69.3	49.5	46.0	57.4	50.8
Meander Width Ratio	--	--	--	--	--	--	--	--	--	1.4	4.9	2.9	1.4	4.9	2.9	0.7	2.1	1.3
Profile	Min	Max	Med	LL	UL	Eq	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	--	--	--	--	--	--	--	--	--	2.5	25.4	13.8	2.5	25.2	13.6	4.7	5.5	5.2
Riffle Slope (ft/ft)	--	--	--	--	--	--	--	--	--	0.016	0.085	0.040	0.006	0.031	0.014	0.008	0.040	0.028
Pool Length (ft)	--	--	--	--	--	--	--	--	--	7.3	27.5	14.6	7.2	27.2	14.5	6.5	14.7	9.9
Pool Spacing (ft)	--	--	--	--	--	--	--	--	--	16.5	62.8	36.5	16.4	62.2	26.1	26.9	38.9	34.7
Substrate																		
d50 (mm)	--			--			0.2			6.2			0.2			4.0		
d84 (mm)	--			--			6.1			72.7			6.1			9.7		
Additional Reach Parameters																		
Bankfull Slope (ft/ft)	--			--			0.0144			0.0199			0.0048			0.0075		
Channel Length(ft)	--			--			157			496			232			208		
Valley Length (ft)	--			--			148			352			187			187		
Sinuosity	--			--			1.07			1.41			1.24			1.11		
Rosgen Classification	--			--			n/a			C4/1			C4/1			C4/1		

Exhibit Table VIII. Morphology and Hydraulic Monitoring Summary
Tributary to Reedy Fork Creek Stream Restoration / D06028-A
Reach R1 (1,632 ft)

PARAMETERS	Cross Section 7 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)	7.8	8.7	8.8																											
Floodprone Width (ft)	78.0	76.7	77.5																											
BKF Cross Sectional Area (sq. ft.)	5.3	5.0	5.2																											
BKF Mean Depth (ft)	0.69	0.58	0.58																											
BKF Max Depth (ft)	1.57	1.52	1.55																											
Width/Depth Ratio	11.2	14.9	15.2																											
Entrenchment Ratio	10.1	8.9	8.8																											
Wetted Perimeter (ft)	8.6	9.4	9.5																											
Hydraulic Radius (ft)	0.62	0.53	0.54																											

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)	6.1	24.8	11.5	3.3	24.2	9.9	5.0	24.4	10.4						
Radius of Curvature (ft)	7.2	20.8	11.8	6.8	19.8	12.7	8.0	19.0	13.1						
Meander Wavelength (ft)	28.4	50.1	38.8	31.4	49.7	39.1	26.0	51.4	38.9						
Meander Width Ratio	--	--	--	--	--	--	--	--	--						
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	1.4	6.0	4.1	6.9	16.5	10.4	4.7	11.7	8.8						
Riffle Slope (ft/ft)	0.019	0.177	0.063	0.030	0.070	0.054	0.011	0.106	0.040						
Pool Length (ft)	7.0	13.9	10.7	6.8	8.9	8.0	6.3	15.3	11.4						
Pool Spacing (ft)	23.2	68.8	37.1	21.7	41.5	31.5	16.8	50.9	32.4						
Substrate															
d50 (mm)	0.04			0.04			3.83								
d84 (mm)	4			0.06			9.41								
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0196			0.0196			0.0192								
Monitored Channel Length (ft)	627			602			611								
Monitored Valley Length (ft)	499			493			499								
Sinuosity	1.26			1.22			1.22								
Total Channel Length (ft)	1632			1632			1632								
Rosgen Classification	C6			C6			C4								

Exhibit Table VIII. Morphology and Hydraulic Monitoring Summary
Tributary to Reedy Fork Creek Stream Restoration / D06028-A
Reach R2-2 (2,544 ft)

PARAMETERS	No Cross Section																													
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)	--	--	--																											
Floodprone Width (ft)	--	--	--																											
BKF Cross Sectional Area (sq. ft.)	--	--	--																											
BKF Mean Depth (ft)	--	--	--																											
BKF Max Depth (ft)	--	--	--																											
Width/Depth Ratio	--	--	--																											
Entrenchment Ratio	--	--	--																											
Wetted Perimeter (ft)	--	--	--																											
Hydraulic Radius (ft)	--	--	--																											

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)	6.6	64.4	36.4	3.8	67.8	40.5	4.6	72.6	42.0						
Radius of Curvature (ft)	23.6	42.6	30.1	24.1	55.9	36.0	25.8	36.0	32.4						
Meander Wavelength (ft)	81.3	102.4	90.8	80.2	152.5	110.0	84.8	157.8	111.3						
Meander Width Ratio	--	--	--	--	--	--	--	--	--						
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	5.4	14.6	9.6	10.8	22.9	17.8	9.9	22.3	16.7						
Riffle Slope (ft/ft)	0.009	0.066	0.029	0.018	0.046	0.028	0.009	0.025	0.016						
Pool Length (ft)	16.5	60.3	29.7	13.6	60.9	29.2	17.4	55.6	32.3						
Pool Spacing (ft)	21.4	99.2	55.7	89.1	117.2	101.0	59.5	105.3	81.1						
Substrate															
d50 (mm)	0.06			0.04			4.65								
d84 (mm)	6.47			1.00			12.58								
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0108			0.0112			0.0111								
Monitored Channel Length (ft)	476			442			466								
Monitored Valley Length (ft)	356			329			356								
Sinuosity	1.34			1.35			1.31								
Total Channel Length (ft)	2544			2544			2544								
Rosgen Classification	C6			C6			C4								

Exhibit Table VIII. Morphology and Hydraulic Monitoring Summary
Tributary to Reedy Fork Creek Stream Restoration / D06028-A
Reach R2-3 (1,771 ft)

PARAMETERS	Cross Section 3 Pool					Cross Section 4 Riffle					Cross Section 5 Riffle					Cross Section 6 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)	10.1	11.75	11.57			10.8	10.77	11.0			9.95	10.41	10.9			10.87	12.0	10.89												
Floodprone Width (ft)	71.78	64.05	65.0			60.27	62.5	75.98			76.64	75.66	79.7			92.77	100.0	100.0												
BKF Cross Sectional Area (sq. ft.)	10.0	8.6	8.08			6.2	5.1	6.65			6.3	5.4	6.0			10.05	10.35	10.84												
BKF Mean Depth (ft)	0.99	0.73	0.7			0.57	0.47	0.6			0.63	0.52	0.55			0.92	0.86	1.0												
BKF Max Depth (ft)	1.82	1.62	1.67			1.07	1.18	1.24			1.10	0.99	1.3			1.89	2.29	2.26												
Width/Depth Ratio	10.2	16.1	16.53			19.0	22.9	18.33			15.79	20.0	19.82			11.82	13.93	10.89												
Entrenchment Ratio	7.1	5.5	5.62			5.6	5.8	6.91			7.7	7.3	7.31			8.5	8.4	9.19												
Wetted Perimeter (ft)	11.1	12.6	12.19			11.2	11.49	11.47			10.38	10.7	11.39			11.7	13.46	11.97												
Hydraulic Radius (ft)	0.90	0.68	0.66			0.55	0.45	0.58			0.61	0.50	0.53			0.86	0.77	0.91												

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)	3.4	43.2	25.2	1.8	40.6	23.4	2.2	38.6	22.2						
Radius of Curvature (ft)	14.3	37.2	22.7	14.0	41.5	24.3	14.5	40.5	24.8						
Meander Wavelength (ft)	57.7	98.0	79.8	55.1	98.6	79.7	56.2	99.4	79.8						
Meander Width Ratio	0.3	4.2	2.4	0.2	3.8	2.2	0.2	3.5	2.0						
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	3.5	16.5	10.0	7.9	21.3	13.3	9.0	22.1	15.4						
Riffle Slope (ft/ft)	0.009	0.056	0.021	0.011	0.041	0.023	0.004	0.022	0.011						
Pool Length (ft)	11.2	30.4	19.7	9.2	35.2	18.7	8.7	25.8	19.8						
Pool Spacing (ft)	24.3	95.9	56.6	17.1	82.3	50.9	36.2	94.0	63.4						
Substrate															
d50 (mm)	0.06			0.04			4.65								
d84 (mm)	6.47			1.00			12.58								
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0076			0.0077			0.0080								
Monitored Channel Length (ft)	1608			1629			1583								
Monitored Valley Length (ft)	1305			1301			1305								
Sinuosity	1.23			1.25			1.21								
Total Channel Length (ft)	1771			1771			1771								
Rosgen Classification	C6			C6			C4								

Exhibit Table VIII. Morphology and Hydraulic Monitoring Summary
Tributary to Reedy Fork Creek Stream Restoration / D06028-A
Reach R2-4a (231 ft)

PARAMETERS	No Cross Section																													
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)	--	--	--																											
Floodprone Width (ft)	--	--	--																											
BKF Cross Sectional Area (sq. ft.)	--	--	--																											
BKF Mean Depth (ft)	--	--	--																											
BKF Max Depth (ft)	--	--	--																											
Width/Depth Ratio	--	--	--																											
Entrenchment Ratio	--	--	--																											
Wetted Perimeter (ft)	--	--	--																											
Hydraulic Radius (ft)	--	--	--																											

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)	10.1	21.6	14.8	9.3	22.1	15.3	8.3	21.4	14.5						
Radius of Curvature (ft)	15.1	35.4	21.6	14.5	27.4	19.8	13.7	28.0	20.7						
Meander Wavelength (ft)	58.9	66.4	62.2	59.3	67.0	63.8	60.9	65.7	63.9						
Meander Width Ratio	--	--	--	--	--	--	--	--	--						
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	6.1	8.8	7.4	7.4	11.9	9.3	6.4	7.8	7.2						
Riffle Slope (ft/ft)	0.004	0.033	0.016		No water		0.007	0.016	0.011						
Pool Length (ft)	14.2	18.0	16.1	9.1	19.3	14.2	8.76	17.09	13.8						
Pool Spacing (ft)	25.1	54.8	78.3	24.7	42.5	34.4	30.0	44.8	37.4						
Substrate															
d50 (mm)	0.04			0.03			0.09								
d84 (mm)	0.25			0.06			3.43								
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0074			0.00779 (No Water)			0.0085								
Monitored Channel Length (ft)	169			205			173								
Monitored Valley Length (ft)	147			174			147								
Sinuosity	1.15			1.18			1.18								
Total Channel Length (ft)	231			231			231								
Rosgen Classification	C6			C6			C6								

Exhibit Table VIII. Morphology and Hydraulic Monitoring Summary
Tributary to Reedy Fork Creek Stream Restoration / D06028-A
Reach R2-4b (307 ft)

PARAMETERS	Cross Section 1 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)	9.38	9.31	9.33																											
Floodprone Width (ft)	37.18	38.0	40.09																											
BKF Cross Sectional Area (sq. ft.)	4.5	4.2	3.81																											
BKF Mean Depth (ft)	0.48	0.45	0.41																											
BKF Max Depth (ft)	0.84	0.89	0.82																											
Width/Depth Ratio	19.54	20.69	22.76																											
Entrenchment Ratio	3.97	4.1	4.3																											
Wetted Perimeter (ft)	9.7	9.8	9.53																											
Hydraulic Radius (ft)	0.47	0.43	0.4																											

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)	8.4	17.1	13.2	6.3	12.1	8.4	1.6	13.0	8.8						
Radius of Curvature (ft)	13.2	39.3	20.4	16.0	21.6	18.1	13.2	17.4	15.4						
Meander Wavelength (ft)	46.1	56.5	51.3	43.1	55.8	49.5	45.0	54.2	50.1						
Meander Width Ratio	0.9	1.8	1.4	0.7	1.3	0.9	0.2	1.4	0.9						
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	4.0	12.0	6.6	3.06	10.44	7.6	7.18	8.17	7.68						
Riffle Slope (ft/ft)	0.004	0.048	0.025	0.011	0.027	0.017	0.022	0.027	0.025						
Pool Length (ft)	5.03	13.29	9.16	7.77	12.99	9.76	6.2	14.6	9.5						
Pool Spacing (ft)	23.92	40.72	33.48	24.71	44.75	61.9	38.1	38.9	38.5						
Substrate															
d50 (mm)	0.7			0.5			2.41								
d84 (mm)	7.11			10.66			9.1								
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0212			0.0145			0.0154								
Monitored Channel Length (ft)	119			152			116								
Monitored Valley Length (ft)	104			134			103								
Sinuosity	1.15			1.13			1.13								
Total Channel Length (ft)	307			307			307								
Rosgen Classification	C5			C5			C4								

Exhibit Table VIII. Morphology and Hydraulic Monitoring Summary
Tributary to Reedy Fork Creek Stream Restoration / D06028-A
Reach R2-4c (208 ft)

PARAMETERS	Cross Section 2 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)	8.06	8.82	8.65																											
Floodprone Width (ft)	42.63	39.55	32.2																											
BKF Cross Sectional Area (sq. ft.)	6.0	5.5	2.7																											
BKF Mean Depth (ft)	0.74	0.62	0.31																											
BKF Max Depth (ft)	1.26	1.06	0.62																											
Width/Depth Ratio	10.89	14.23	27.9																											
Entrenchment Ratio	5.3	4.5	3.72																											
Wetted Perimeter (ft)	8.6	9.2	8.86																											
Hydraulic Radius (ft)	0.69	0.60	0.3																											

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)	5.3	17.3	13.1	3.7	16.0	11.5	15.7	15.9	15.8						
Radius of Curvature (ft)	14.9	24.5	18.3	10.8	25.0	17.3	13.8	17.4	15.5						
Meander Wavelength (ft)	48.7	58.1	53.4	47.2	56.0	51.6	56.3	56.3	56.3						
Meander Width Ratio	0.7	2.1	1.6	0.4	1.8	1.3	1.8	1.8	1.8						
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle Length (ft)	5.9	8.1	7.3	7.4	11.7	9.5	4.5	8.1	6.3						
Riffle Slope (ft/ft)	0.004	0.009	0.006	0.001	0.022	0.012	0.008	0.013	0.018						
Pool Length (ft)	11.7	13.0	12.4	11.8	14.9	13.4	11.7	11.7	11.7						
Pool Spacing (ft)	30.8	40.6	36.6	47.2	47.8	47.5	30.8	45.6	38.2						
Substrate															
d50 (mm)	0.04			0.05			0.03								
d84 (mm)	1.00			0.06			0.05								
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0047			0.0050			0.006								
Monitored Channel Length (ft)	117			107			100								
Monitored Valley Length (ft)	101			93			80								
Sinuosity	1.15			1.15			1.25								
Total Channel Length (ft)	208			208			208								
Rosgen Classification	C6			C6			C6								

Exhibit Table IX. BEHI and Sediment Export Estimates
Tributary to Reedy Fork Creek Stream Restoration / D06028-A

Time Point	Segment / Reach[1]	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	1409	1409	100											126.8
	R2-1	906	906	100											81.5
	R2-2	2522	2522	100											126.1
	R2-3	1584	1584	100											110.9
	R2-4a	289													n/a
	R2-4b	226													n/a
	R2-4c	157													n/a
	TOTAL	7092	6420	91	0	0	0	0	0	0	0	0	0	0	445
Monitoring Y3 2010	R1	1632									1632	100			2.4
	R2-1	819									819	100			3.0
	R2-2	2544									2544	100			9.2
	R2-3	1771									1771	100			7.7
	R2-4a	231									231	100			0.4
	R2-4b	307									307	100			1.6
	R2-4c	208									208	100			2.3
	TOTAL	7512	0	0	0	0	0	0	0	0	7512	100	0	0	26.6
Monitoring Y5 2012 (**NOT APPLICABLE**)	R1	1632													
	R2-1	819													
	R2-2	2544													
	R2-3	1771													
	R2-4a	231													
	R2-4b	307													
	R2-4c	208													
	TOTAL	7512	0	0	0	0	0	0	0	0	0	0	0	0	0

[1] BEHI and Sediment Export estimates were not conducted for reaches R2-4a, R2-4b, and R2-4c before Construction as they did not exist.

Exhibit Table X. Verification of Bankfull Events Tributary to Reedy Fork Creek Stream Restoration / D06028-A			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo No. (If Available)**
9/22/08-9/24/08	Unknown	Crest Guages	N/A
9/9/2009	Unknown	Crest Guages	N/A
9/28/2010	Unknown	Crest Guages	N/A

Exhibit Table XI. Categorical Stream Feature Visual Stability Assessment Tributary to Reedy Fork Creek Stream Restoration / D06028-A						
Reach R1 (1,632 ft)						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
Riffles	100%	100%	100%	100%		
Pools	100%	100%	100%	100%		
Thalwegs	100%	100%	100%	100%		
Meanders	100%	100%	100%	100%		
Bed General	100%	100%	100%	100%		
Structures	100%	100%	100%	100%		
Rootwads	100%	100%	100%	100%		
Reach R2-1 (819 ft)						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
Riffles	100%	100%	100%	100%		
Pools	100%	100%	100%	100%		
Thalwegs	100%	100%	100%	100%		
Meanders	100%	100%	100%	100%		
Bed General	100%	100%	100%	100%		
Structures	100%	100%	100%	100%		
Rootwads	100%	100%	100%	100%		
Reach R2-2 (2,544 ft)						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
Riffles	100%	100%	100%	100%		
Pools	100%	100%	100%	100%		
Thalwegs	100%	100%	100%	100%		
Meanders	100%	100%	100%	100%		
Bed General	100%	100%	100%	100%		
Structures	100%	100%	100%	100%		
Rootwads	100%	100%	100%	100%		
Reach R2-3 (1,771 ft)						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
Riffles	100%	100%	100%	100%		
Pools	100%	100%	100%	100%		
Thalwegs	100%	100%	100%	100%		
Meanders	100%	100%	100%	100%		
Bed General	100%	100%	100%	100%		
Structures	100%	100%	100%	100%		
Rootwads	100%	100%	100%	100%		
Reach R2-4a (231 ft)						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
Riffles	100%	100%	100%	100%		
Pools	100%	100%	100%	100%		
Thalwegs	100%	100%	100%	100%		
Meanders	100%	100%	100%	100%		
Bed General	100%	100%	100%	100%		
Structures	100%	100%	100%	100%		
Rootwads	100%	100%	100%	100%		
Reach R2-4b (307 ft)						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
Riffles	100%	100%	100%	100%		
Pools	100%	100%	100%	100%		
Thalwegs	100%	100%	100%	100%		
Meanders	100%	100%	100%	100%		
Bed General	100%	100%	100%	100%		
Structures	100%	100%	100%	100%		
Rootwads	100%	100%	100%	100%		

Exhibit Table XII. Stream Problem Areas Tributary to Reedy Fork Creek Stream Restoration / D06028-A			
Feature/Issue	**Station / Range**	**Probable Cause**	**Photo No. (If Available)**
None observed Monitoring Year 3 (2010)	N/A	N/A	N/A
None observed Monitoring Year 2 (2009)	N/A	N/A	N/A
None observed Monitoring Year 1 (2008)	N/A	N/A	N/A

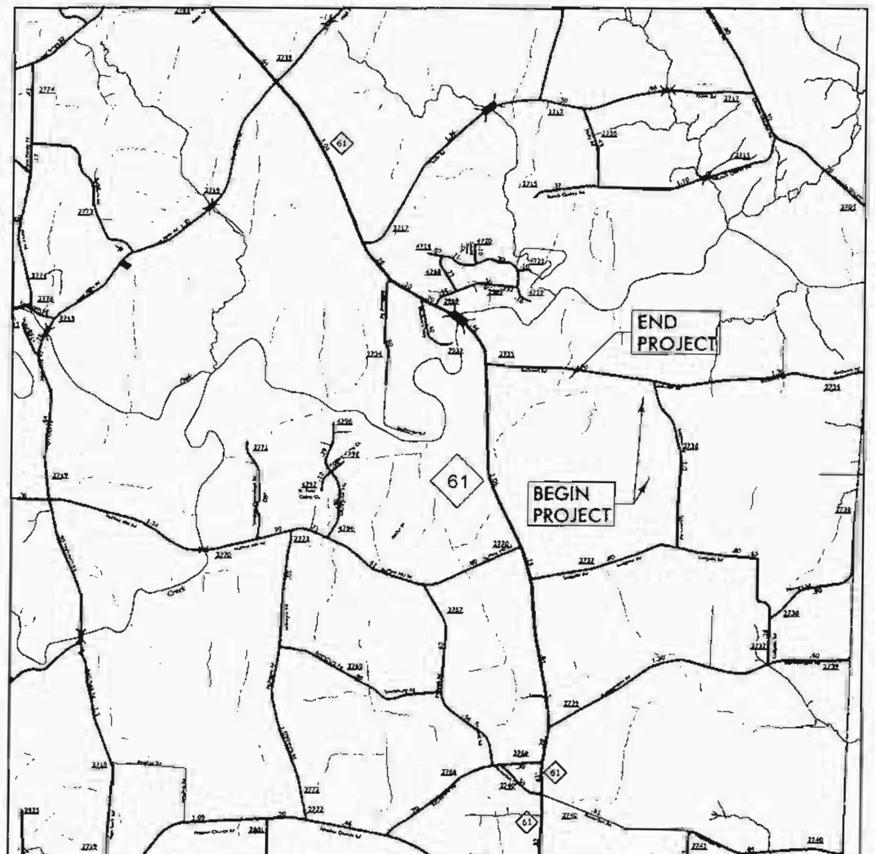
SCO ID NO. D06028-A

GUILFORD COUNTY

TRIBUTARY TO REEDY FORK STREAM RESTORATION SITE

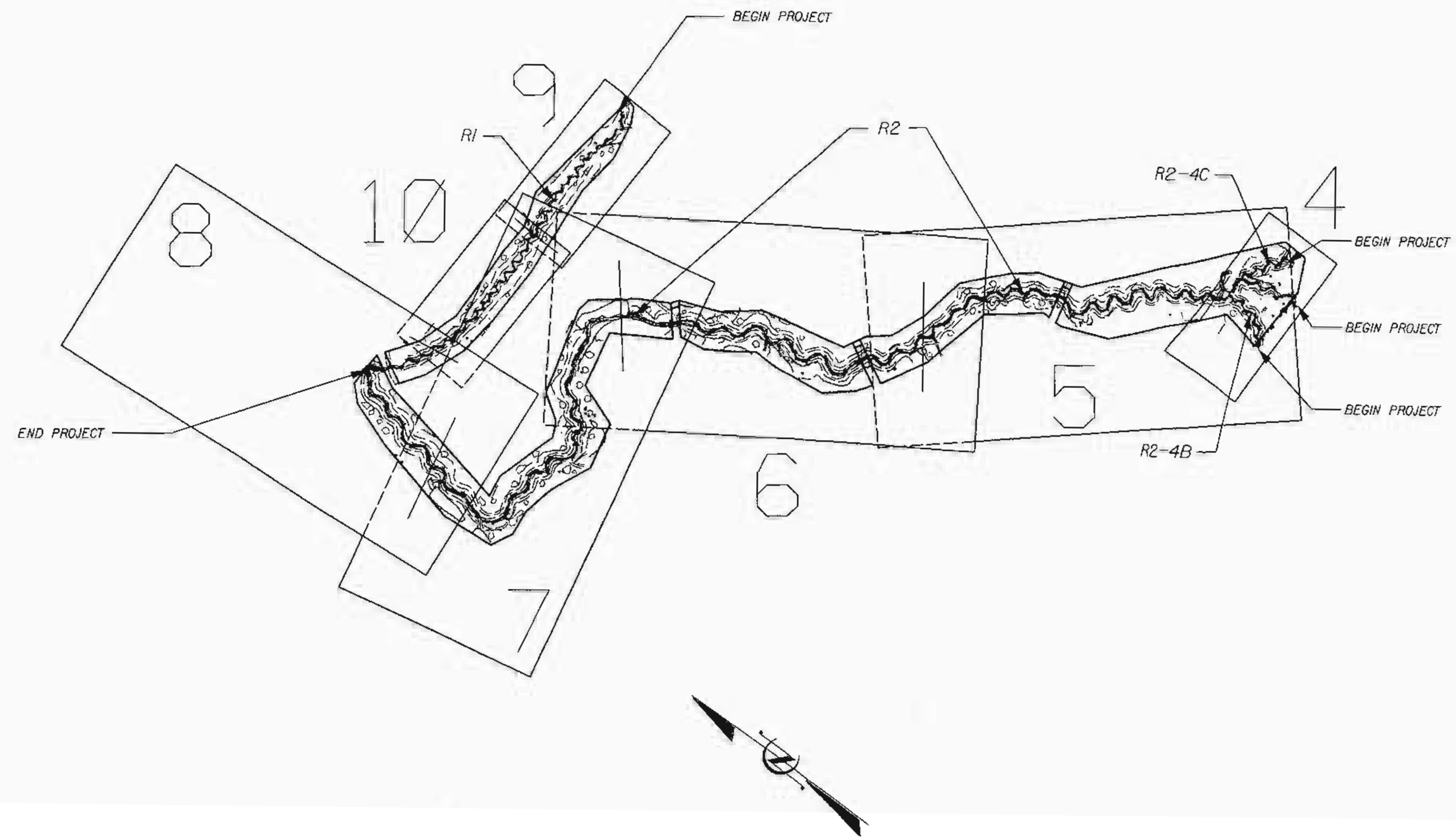
LOCATION: APPROXIMATELY 0.5 MILES EAST OF THE INTERSECTION OF NC 61 AND SR 2735 (SOCKWELL RD) AND IMMEDIATELY SOUTH OF SR 2735

YEAR 3 MONITORING



VICINITY MAP

NOT TO SCALE



NOT TO SCALE

INDEX OF SHEETS

SHEET NUMBER	SHEET
1	TITLE SHEET
2	LEGEND
4 - 12	YEAR 2 MONITORING OVERLAY

REVISIONS

DATE	BY	DESCRIPTION
1/8/09	WBA	YEAR 1 MONITORING
10/26/09	EMP	YEAR 2 MONITORING
11/23/10	MLM	YEAR 3 MONITORING

SCALE
AS SHOWN

DATE:	11/23/10
DESIGNED:	WSH
DRAWN:	MLM
CHECKED:	EMP
APPROVED:	EMP

MULKEY PROJECT NUMBER
2006240.00

PLANS PREPARED BY:

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

MULKEY PROJECT MANAGER
EMMETT PERDUE, PE

MULKEY ENGINEER
EMMETT PERDUE, PE

MULKEY SENIOR SCIENTIST
THOMAS BARRETT, RF

PROJECT ENGINEER

TITLE SHEET

SHEET 1 OF 12

NOTE: NOT TO SCALE
Not all symbols used in plans

LEGEND

REVISIONS		
DATE	BY	DESCRIPTION
1/8/09	WBA	YEAR 1 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
TRIBUTARY TO REEDY FORK	2

LEGEND

MULKEY
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WWW.MULKEYINC.COM

BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin
- Property Corner
- Property Monument
- 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
- Conservation Easement
- Construction Limits
- Limits Of Disturbance
- Proposed Gate
- Bench Mark
- Control Point

BUILDINGS AND OTHER CULTURE:

- Sign
- Foundation
- Area Outline
- Building
- School
- Church

HYDROLOGY:

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

UTILITIES:

POWER:

- Existing Power Pole
- Existing Joint Use Pole
- Power Manhole
- Power Line Tower
- Power Transformer
- U/G Power Cable Hand Hole
- H-Frame Pole
- Recorded U/G Power Line

GAS:

- Gas Meter
- Recorded U/G Gas Line
- Above Ground Gas Line — A/G Gas

TELEPHONE:

- Existing Telephone Pole
- Telephone Manhole
- Telephone Booth
- Telephone Pedestal
- Telephone Cell Tower
- U/G Telephone Cable Hand Hole
- Recorded U/G Telephone Cable
- Recorded U/G Telephone Conduit
- Recorded U/G Fiber Optics Cable

WATER:

- Water Manhole
- Water Valve
- Water Hydrant
- Recorded U/G Water Line
- Above Ground Water Line — A/G Water

TV:

- TV Satellite Dish
- TV Pedestal
- TV Tower
- U/G TV Cable Hand Hole
- Recorded U/G TV Cable
- Recorded U/G Fiber Optic Cable

MISCELLANEOUS:

- Utility Pole
- Utility Pole with Base
- Utility Located Object
- Utility Traffic Signal Box
- Utility Unknown U/G Line
- 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
- Above Ground Sanitary Sewer — A/G Sanitary Sewer
- Recorded SS Forced Main Line

PROPOSED STREAM WORK:

STREAM STRUCTURES:

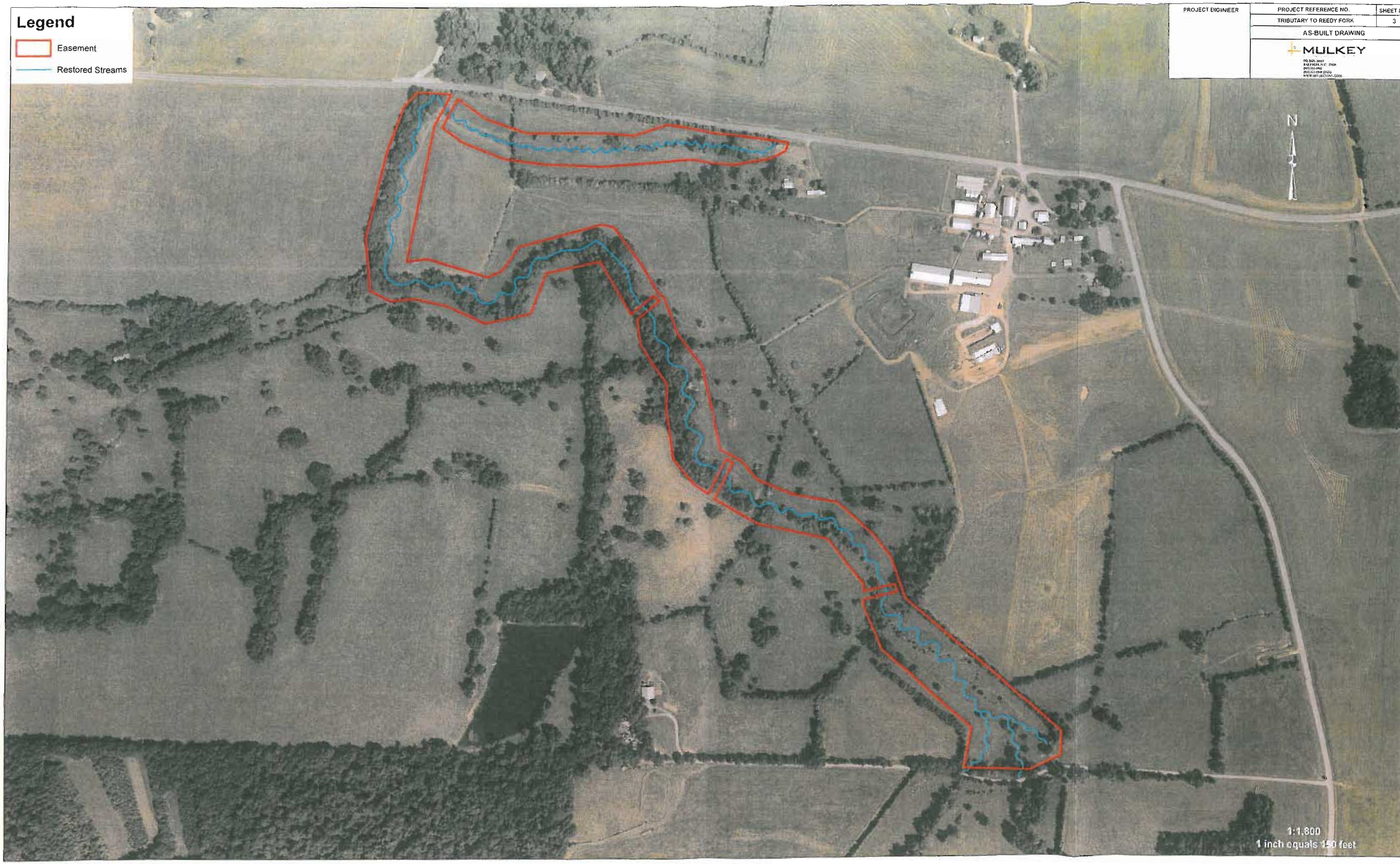
- Rock Crossvane
- Rock Vane
- J Hook Rock Vane
- Flood Plane Interceptor
- Constructed Riffle
- Root Wad
- Log Weir
- Structure Number
- Constructed Flood Plane Interceptor

STREAM FEATURES:

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

MISCELLANEOUS:

- Photo Point — PP
- Cross Section
- Crest Gauge


Legend
Easement
Restored Streams
PROJECT ENGINEER
PROJECT REFERENCE NO.
SHEET NO.
TRIBUTARY TO REEDY FORK
3
AS-BUILT DRAWING
MULKEY
N
1:1,800
1 inch equals 150 feet

REVISIONS		
DATE	BY	DESCRIPTION
1/8/09	WBA	YEAR 1 MONITORING
10/26/09	EMP	YEAR 2 MONITORING
1/23/10	M.M	YEAR 3 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.: TRIBUTARY TO REEDY FORK

SHEET NO.: 4

YEAR 3 MONITORING

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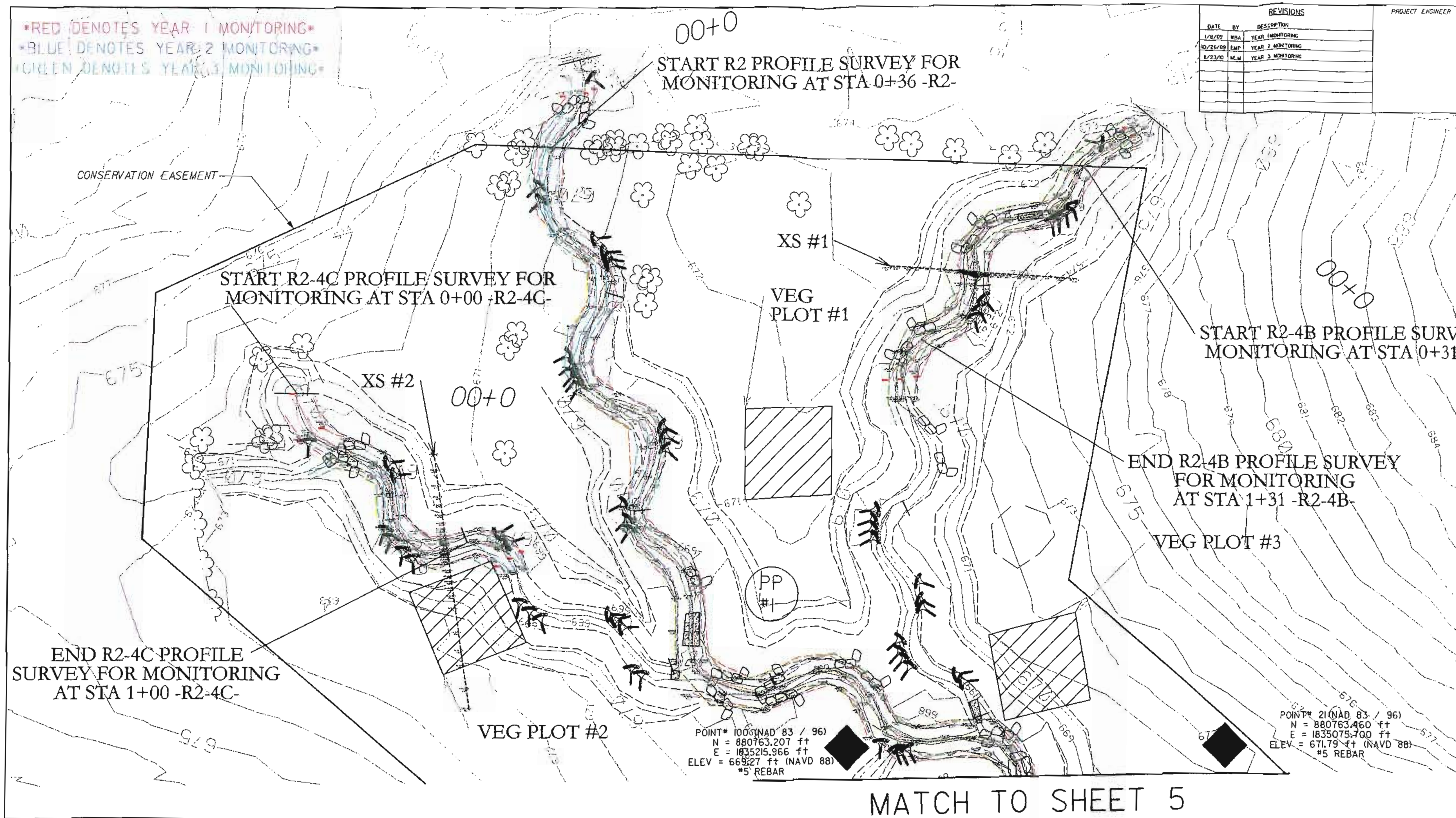
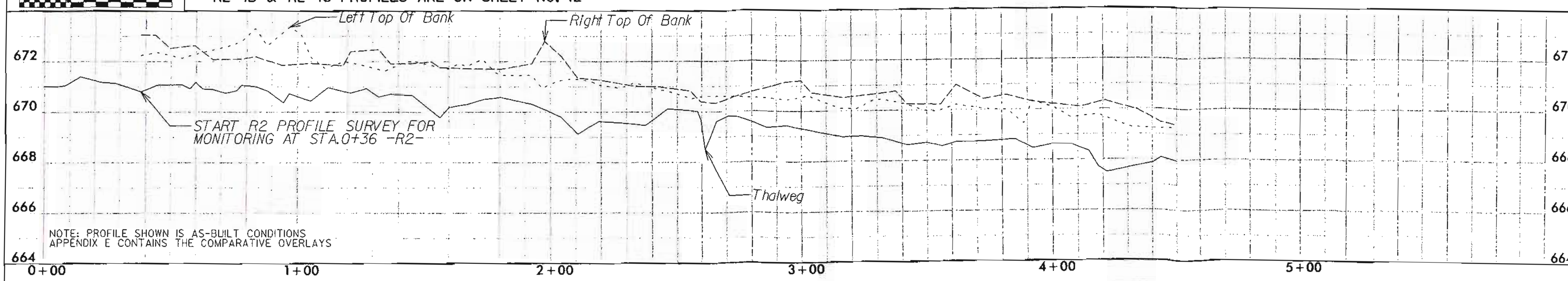


PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
1	882635.486	1836650.439	709.24
3	883045.930	1833987.836	659.34
8	883176.140	1832887.260	639.98
9	883165.690	1833166.680	635.36
10	882996.250	1833092.760	630.95
11	882724.700	1833013.410	635.78
12	882530.290	1833120.310	644.73
13	882504.040	1833345.040	647.87
14	882624.010	1833599.280	652.25
15	882618.620	1833844.520	669.88
16	882245.430	1834077.110	663.16
17	881887.050	1834217.040	659.75
18	881689.020	1834268.580	657.91
19	881317.340	1834574.690	673.03
20	881247.830	1834861.440	665.04
21	880763.460	1835075.700	671.79
100	880763.207	1835215.966	669.27
101	880886.696	1834997.543	667.87
300	882831.020	1833936.544	662.64
301	882849.487	1833633.149	654.82
600	880847.484	1835232.374	670.54

* R2-4B & R2-4C PROFILES ARE ON SHEET NO. 12 *



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

PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
1	882635.486	1836650.439	709.24
3	883045.930	1833987.836	659.34
8	883176.140	1832887.260	639.98
9	883165.690	1833166.680	635.36
10	882996.250	1833092.760	630.95
11	882724.700	1833013.410	635.78
12	882530.290	1833120.310	644.73
13	882504.040	1833345.040	647.87
14	882624.010	1833599.280	652.25
15	882618.620	1833844.520	669.88
16	882245.430	1834077.110	663.16
17	881887.050	1834217.040	659.75
18	881689.020	1834268.580	657.91
19	881317.340	1834574.690	673.03
20	881247.830	1834861.440	665.04
21	880763.460	1835075.700	671.79
100	880763.207	1835215.966	669.27
101	880886.696	1834997.543	667.87
300	882831.020	1833936.544	662.64
301	882849.487	1833633.149	654.82
600	880847.484	1835232.374	670.54

RED DENOTES YEAR 1 MONITORING

BLUE DENOTES YEAR 2 MONITORING

GREEN DENOTES YEAR 3 MONITORING

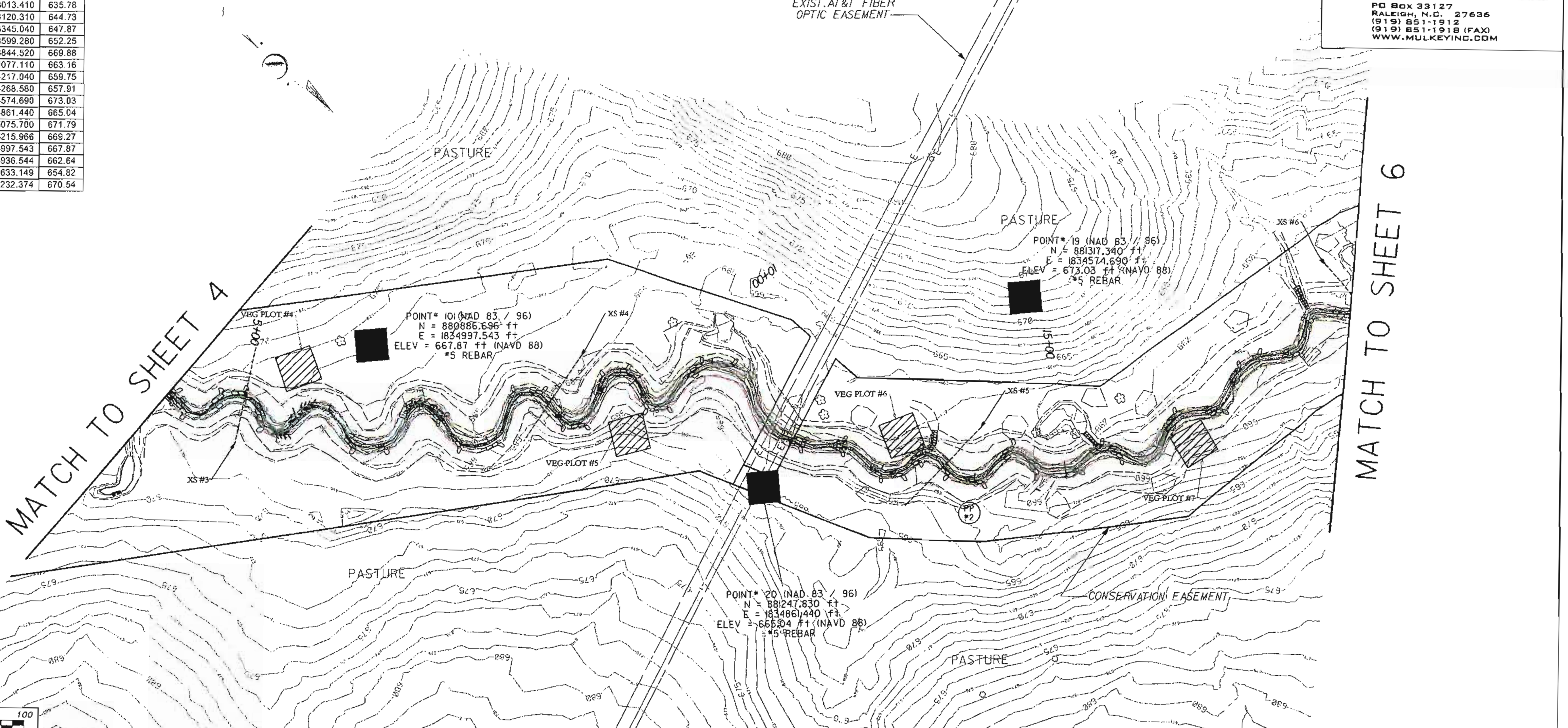
REVISIONS		
DATE	BY	DESCRIPTION
1/8/09	WBA	YEAR 1 MONITORING
10/26/09	EMP	YEAR 2 MONITORING
11/23/10	MLM	YEAR 3 MONITORING

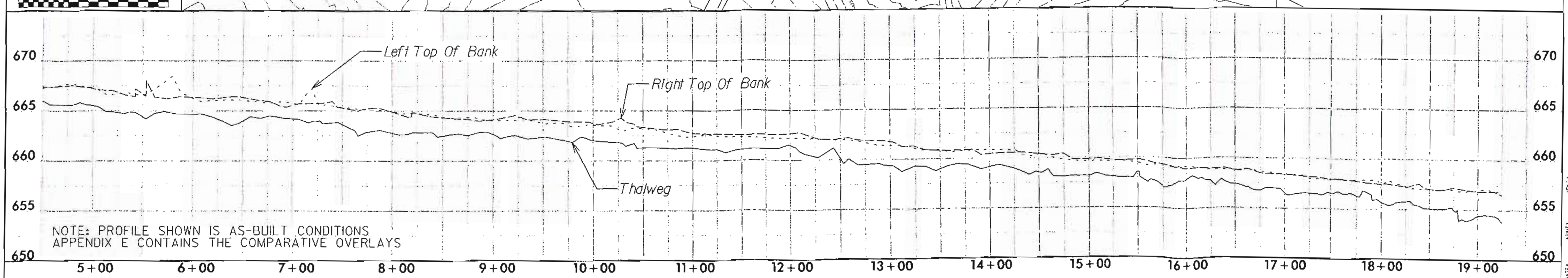
PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
TRIBUTARY TO REEDY FORK	5

YEAR 3 MONITORING

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





PROJECT REFERENCE NO.	SHEET NO.
TRIBUTARY TO REEDY FORK	6

YEAR 3 MONITORING

MULKEY ENGINEERS & CONSULTANTS
PO Box 33127
RALEIGH, N.C. 27636
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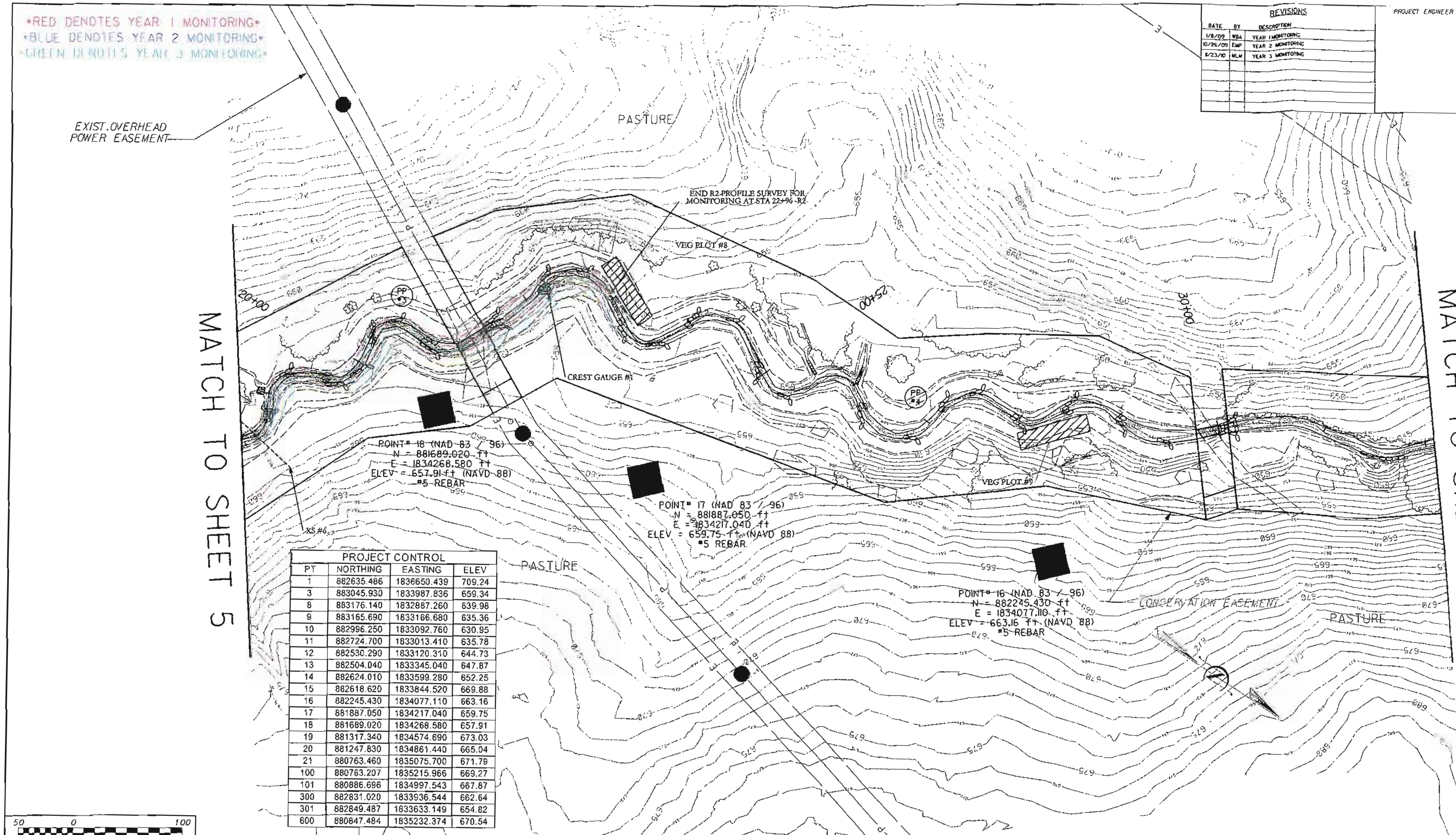
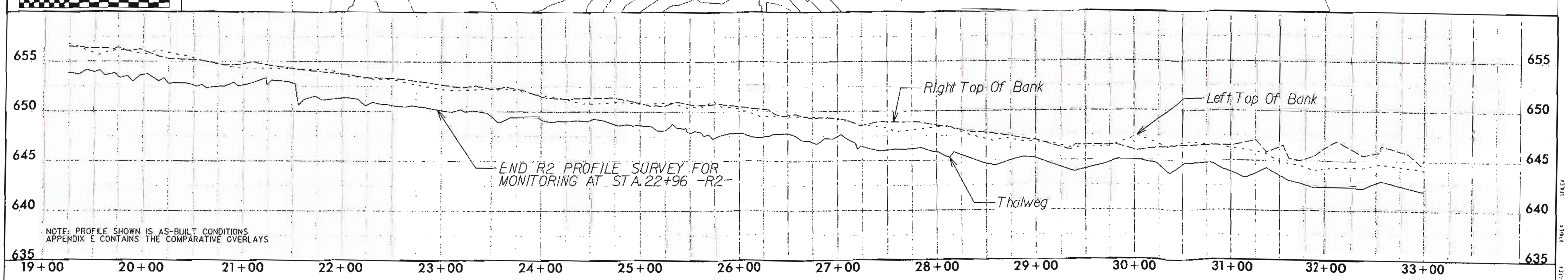
PROJECT ENGINEER

REVISIONS		
DATE	BY	DESCRIPTION
1/8/09	WBA	YEAR 1 MONITORING
10/26/09	EMP	YEAR 2 MONITORING
8/23/10	MLM	YEAR 3 MONITORING



PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
1	882635.486	1836650.439	709.24
3	883045.930	1833987.836	659.34
8	883176.140	1832887.260	639.98
9	883165.690	1833166.680	635.36
10	882996.250	1833092.760	630.95
11	882724.700	1833013.410	635.78
12	882530.290	1833120.310	644.73
13	882504.040	1833345.040	647.87
14	882624.010	1833599.280	652.25
15	882618.620	1833844.520	669.88
16	882245.430	1834077.110	663.16
17	881887.050	1834217.040	659.75
18	881689.020	1834268.580	657.91
19	881317.340	1834574.690	673.03
20	881247.830	1834861.440	665.04
21	880763.460	1835075.700	671.79
100	880763.207	1835215.966	669.27
101	880886.696	1834997.543	667.87
300	882831.020	1833936.544	662.64
301	882849.487	1833633.149	654.82
600	880847.484	1835232.374	670.54



RED DENOTES YEAR 1 MONITORING
BLUE DENOTES YEAR 2 MONITORING
GREEN DENOTES YEAR 3 MONITORING

REVISIONS		
DATE	BY	DESCRIPTION
1/8/09	WBA	YEAR 1 MONITORING
10/26/09	EMP	YEAR 2 MONITORING
11/23/10	WLM	YEAR 3 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
TRIBUTARY TO REEDY FORK	7

YEAR 3 MONITORING

MULKEY ENGINEERS & CONSULTANTS
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(919) 851-1912
(919) 851-1918 (FAX)
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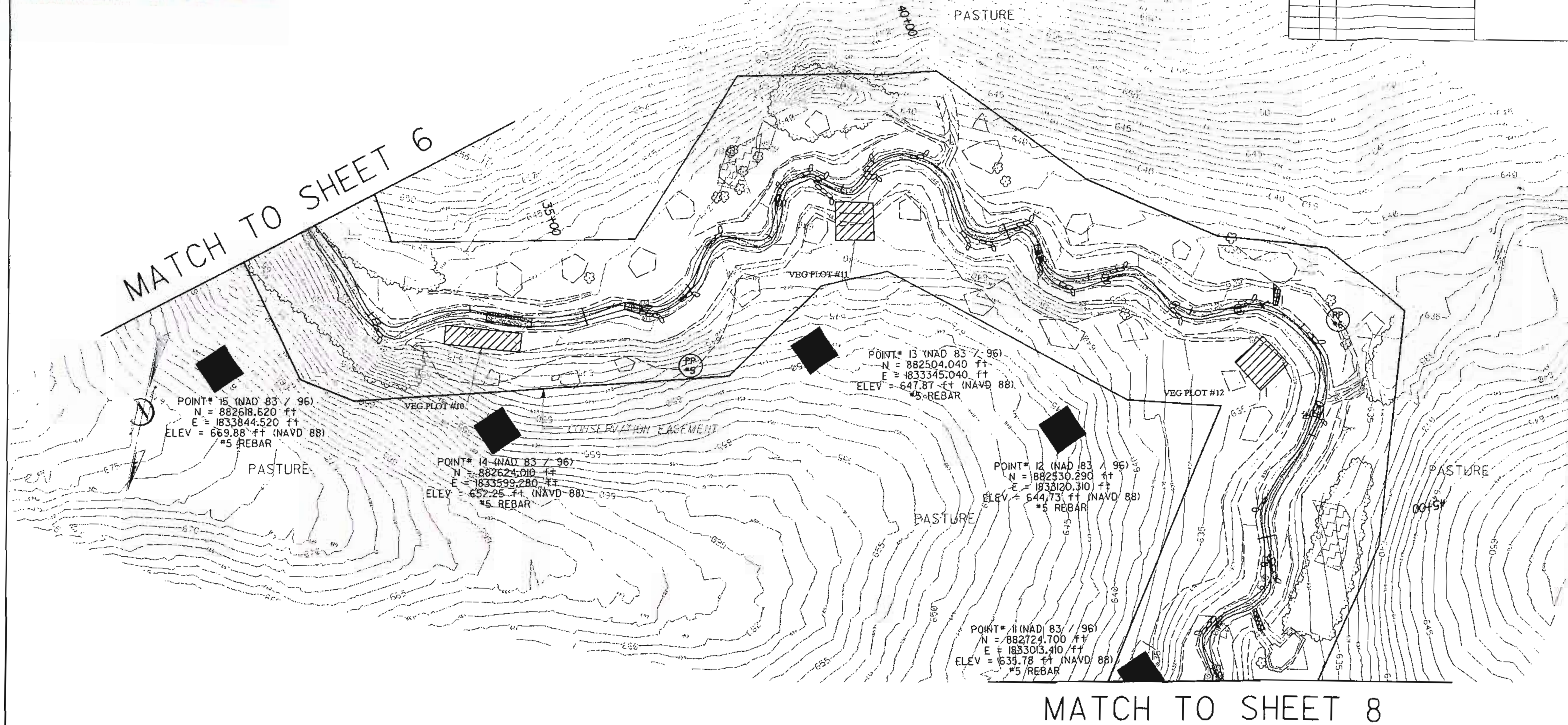
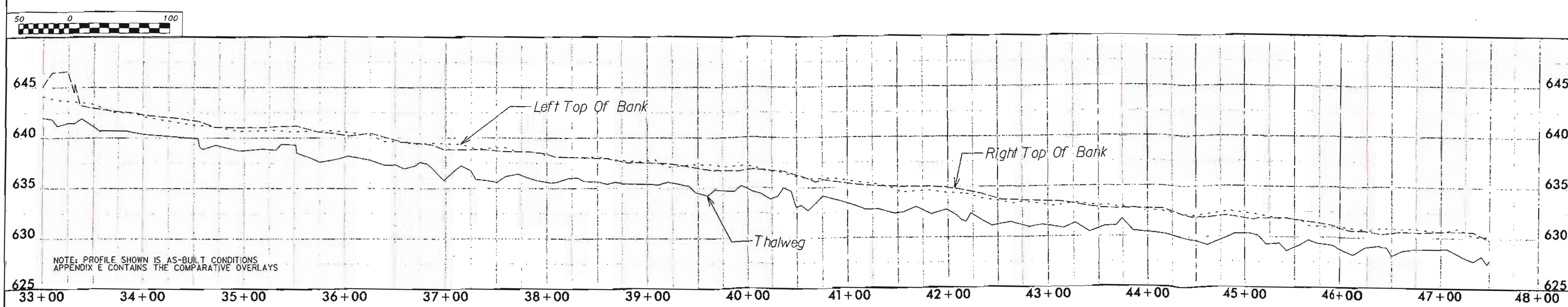
PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
1	882635.486	1836650.439	709.24
3	883045.930	1833987.836	659.34
8	883176.140	1832887.260	639.98
9	883165.690	1833166.680	635.36
10	882996.250	1833092.760	630.95
11	882724.700	1833013.410	635.78
12	882530.290	1833120.310	644.73
13	882504.040	1833345.040	647.87
14	882624.010	1833599.280	652.25
15	882618.620	1833844.520	669.88
16	882245.430	1834077.110	663.16
17	881887.050	1834217.040	659.75
18	881689.020	1834268.580	657.91
19	881317.340	1834574.690	673.03
20	881247.830	1834861.440	665.04
21	880763.460	1835075.700	671.79
100	880763.207	1835215.966	669.27
101	880886.696	1834997.543	667.87
300	882831.020	1833936.544	662.64
301	882849.487	1833633.149	654.82
600	880847.484	1835232.374	670.54





RED DENOTES YEAR 1 MONITORING
BLUE DENOTES YEAR 2 MONITORING
GREEN DENOTES YEAR 3 MONITORING

REVISIONS		
DATE	BY	DESCRIPTION
1/8/09	WBA	YEAR 1 MONITORING
10/26/09	EMP	YEAR 2 MONITORING
8/23/10	MLM	YEAR 3 MONITORING

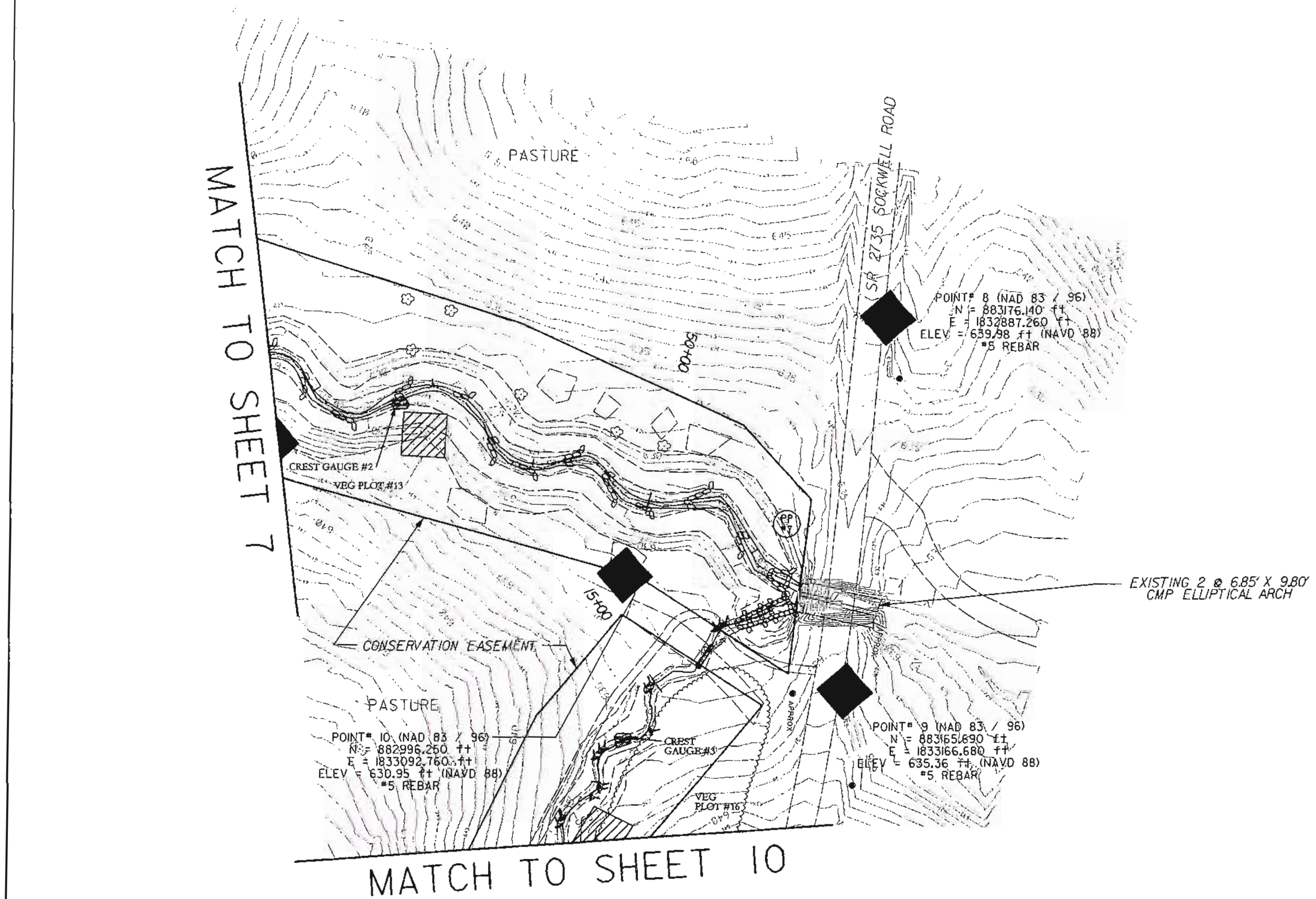
PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
TRIBUTARY TO REEDY FORK	8

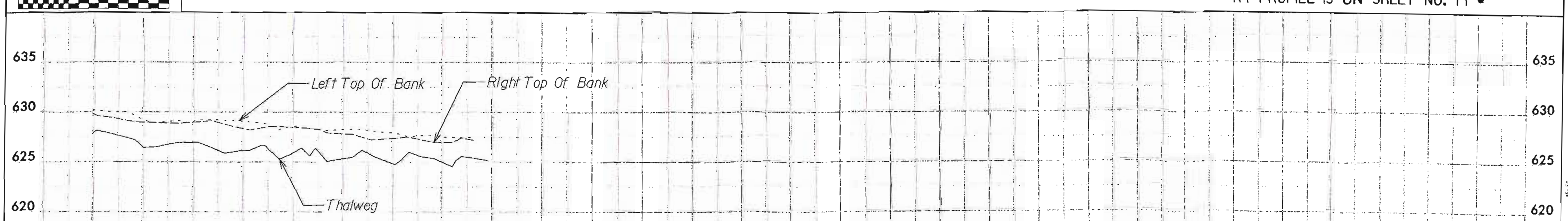
YEAR 3 MONITORING

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

PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
1	882635.486	1836650.439	709.24
3	883045.930	1833987.836	659.34
8	883176.140	1832887.260	639.98
9	883165.690	1833166.680	635.36
10	882996.250	1833092.760	630.95
11	882724.700	1833013.410	635.78
12	882530.290	1833120.310	644.73
13	882504.040	1833345.040	647.87
14	882624.010	1833599.280	652.25
15	882618.620	1833844.520	669.88
16	882245.430	1834077.110	663.16
17	881887.050	1834217.040	659.75
18	881689.020	1834268.580	657.91
19	881317.340	1834574.690	673.03
20	881247.830	1834861.440	665.04
21	880763.460	1835075.700	671.79
100	880763.207	1835215.966	669.27
101	880886.696	1834997.543	667.87
300	882831.020	1833936.544	662.64
301	882849.487	1833633.149	654.82
600	880847.484	1835232.374	670.54



* R1 PROFILE IS ON SHEET NO. 11 *



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

PROJECT REFERENCE NO.	SHEET NO.
TRIBUTARY TO REEDY FORK	9

YEAR 3 MONITORING

MULKEY
PO Box 33127
Raleigh, N.C. 27636
(919) 851-1912
(919) 851-1918 (FAX)
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PROJECT ENGINEER

REVISIONS

DATE	BY	DESCRIPTION
1/8/09	WBA	YEAR 1 MONITORING
10/26/09	EMP	YEAR 2 MONITORING
8/23/10	MLM	YEAR 3 MONITORING

PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
1	882635.486	1836650.439	709.24
3	883045.930	1833987.836	659.34
8	883176.140	1832887.260	639.98
9	883165.690	1833166.680	635.36
10	882996.250	1833092.760	630.95
11	882724.700	1833013.410	635.78
12	882530.290	1833120.310	644.73
13	882504.040	1833345.040	647.87
14	882624.010	1833599.280	652.25
15	882618.620	1833844.520	669.88
16	882245.430	1834077.110	663.16
17	881887.050	1834217.040	659.75
18	881689.020	1834268.580	657.91
19	881317.340	1834574.690	673.03
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21	880763.460	1835075.700	671.79
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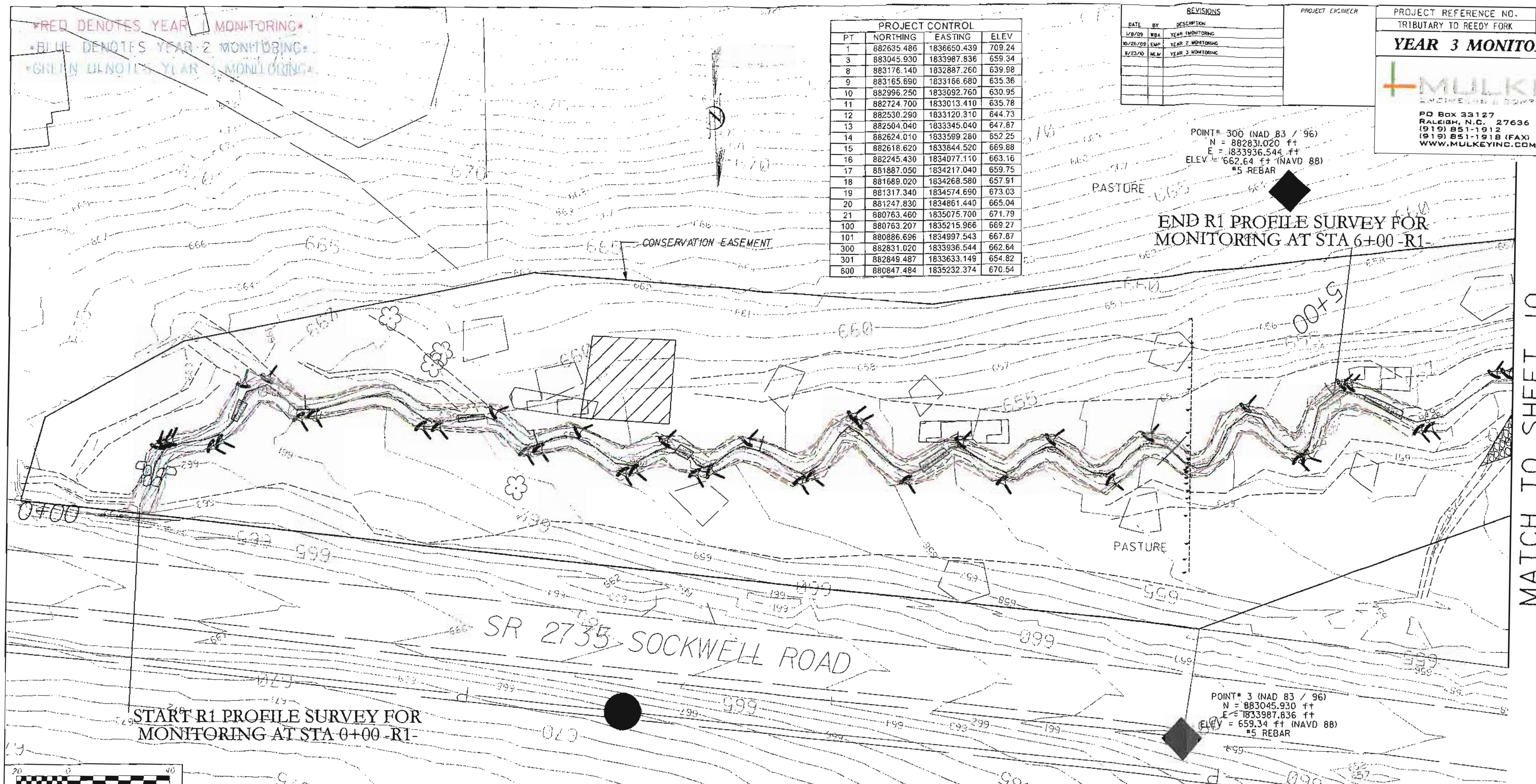
101	880886.696	1834997.543	667.87
300	882831.020	1833936.544	662.64
301	882849.487	1833633.149	654.82
600	880847.484	1835232.374	670.54



SEE SHEET NO. 11 FOR -R1- PROFILE

REVISIONS		
DATE	BY	DESCRIPTION
1/8/09	EBA	YEAR 1 MONITORING
10/26/09	EMP	YEAR 2 MONITORING
1/23/10	MLM	YEAR 3 MONITORING

PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
TRIBUTARY TO REEDY FORK	10

YEAR 3 MONITORING

MULKEY ENGINEERS & CONSULTANTS
PO Box 33127
Raleigh, N.C. 27636
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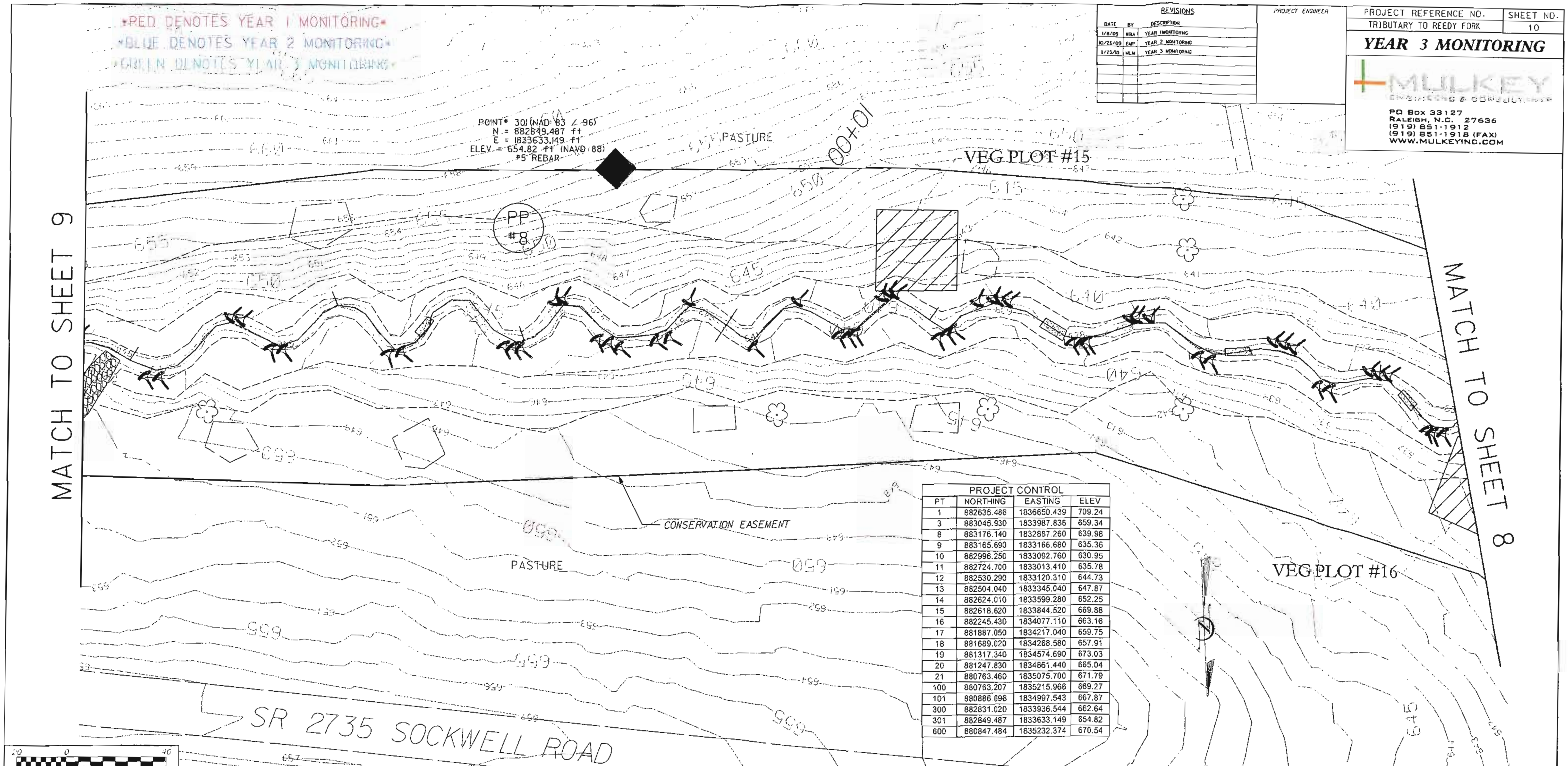


PROJECT CONTROL			
PT	NORTHING	EASTING	ELEV
1	882635.486	1836650.439	709.24
3	883045.930	1833987.836	659.34
8	883176.140	1832887.260	639.98
9	883165.690	1833166.680	635.36
10	882996.250	1833092.760	630.95
11	882724.700	1833013.410	635.78
12	882530.290	1833120.310	644.73
13	882504.040	1833345.040	647.87
14	882624.010	1833599.280	652.25
15	882618.620	1833844.520	669.88
16	882245.430	1834077.110	663.16
17	881887.050	1834217.040	659.75
18	881689.020	1834268.580	657.91
19	881317.340	1834574.690	673.03
20	881247.830	1834861.440	665.04
21	880763.460	1835075.700	671.79
100	880763.207	1835215.966	669.27
101	880886.696	1834997.543	667.87
300	882831.020	1833936.544	662.64
301	882849.487	1833633.149	654.82
600	880847.484	1835232.374	670.54

SEE SHEET NO. 11 FOR -R1- PROFILE

AS-BUILT PROFILES

REVISIONS		
DATE	BY	DESCRIPTION
1/8/09	WBA	YEAR 1 MONITORING
10/26/09	EMP	YEAR 2 MONITORING
8/23/10	MLM	YEAR 3 MONITORING

PROJECT ENGINEER

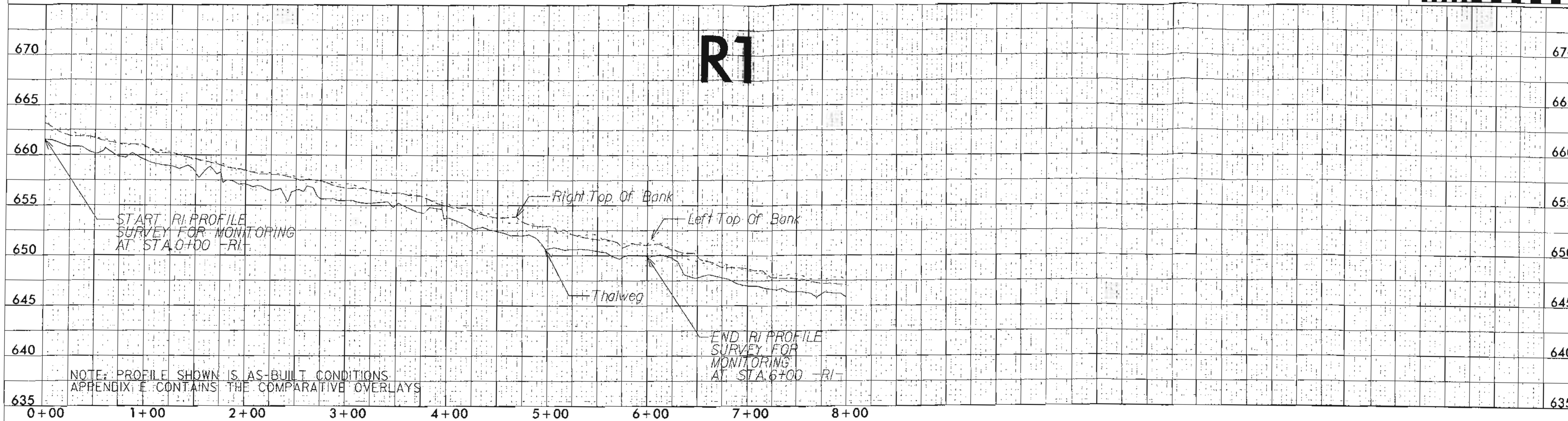
PROJECT REFERENCE NO.	SHEET NO.
TRIBUTARY TO REEDY FORK	11

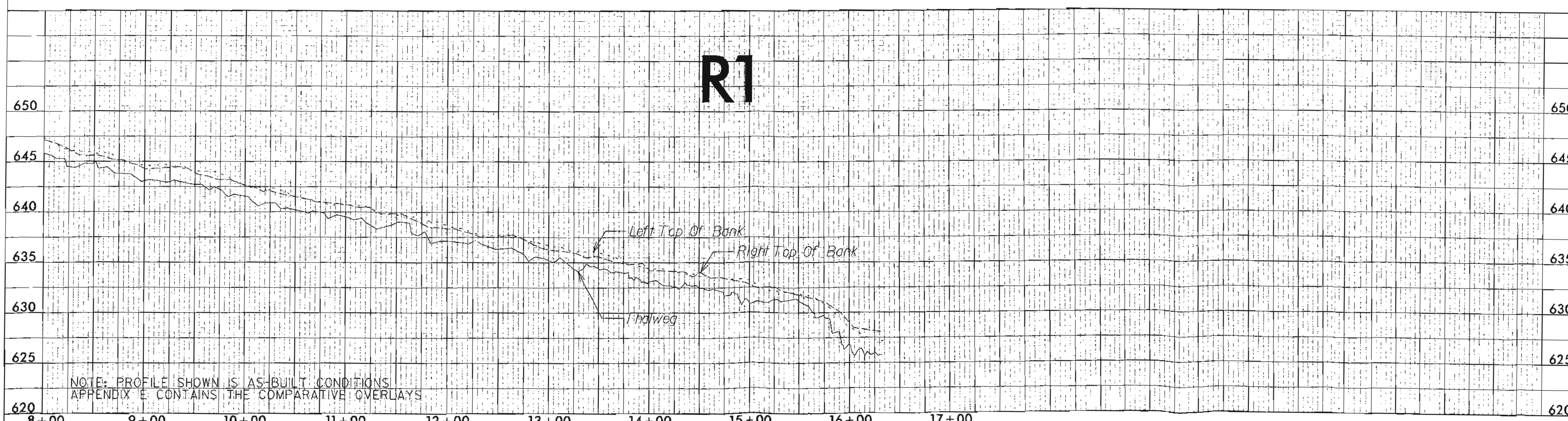
YEAR 3 MONITORING

MULKEY ENGINEERS & CONSULTANTS

HORIZONTAL SCALE 50 0 100

VERTICAL SCALE 5 0 10





AS-BUILT PROFILES

REVISIONS		
DATE	BY	DESCRIPTION
1/8/09	WBA	YEAR 1 MONITORING
10/26/09	EMP	YEAR 2 MONITORING
?/23/10	MLM	YEAR 3 MONITORING

PROJECT ENGINEER

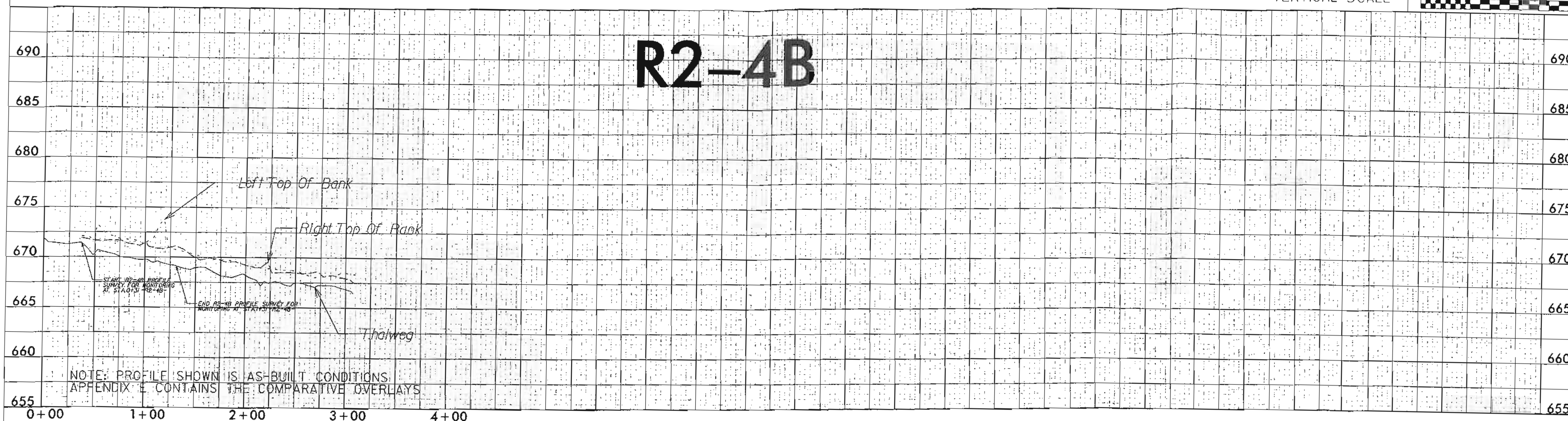
PROJECT REFERENCE NO.	SHEET NO.
TRIBUTARY TO REEDY FORK	12

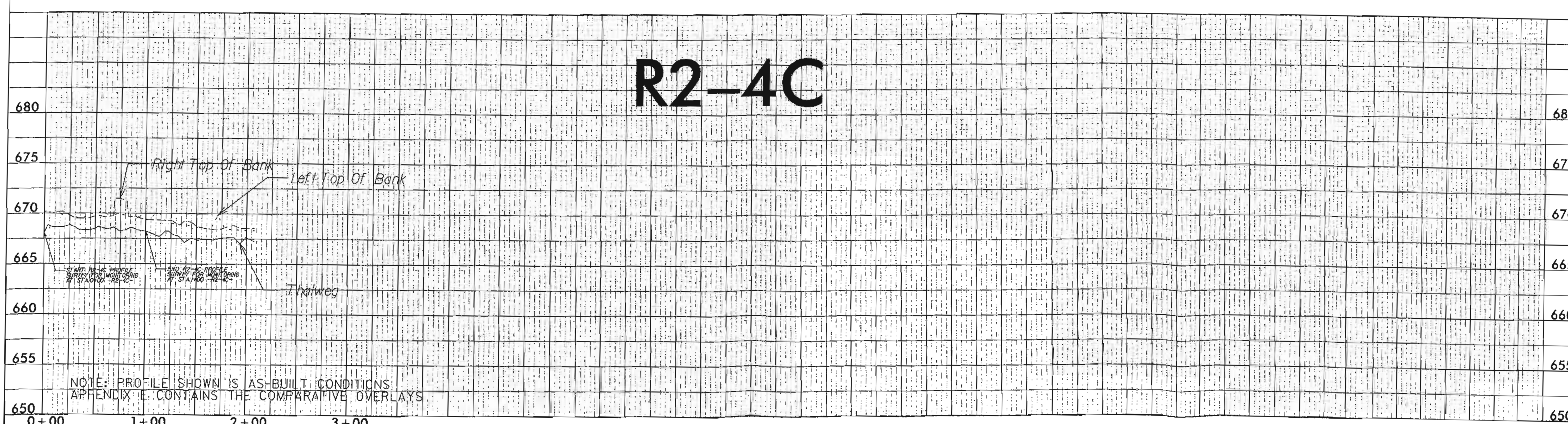
YEAR 3 MONITORING

MULKEY
ENGINEERS & CONSULTANTS

HORIZONTAL SCALE 50 0 100

VERTICAL SCALE 5 0 10





Veg Plot 1

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Veg Plot 2

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Veg Plot 3

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Veg Plot 4

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

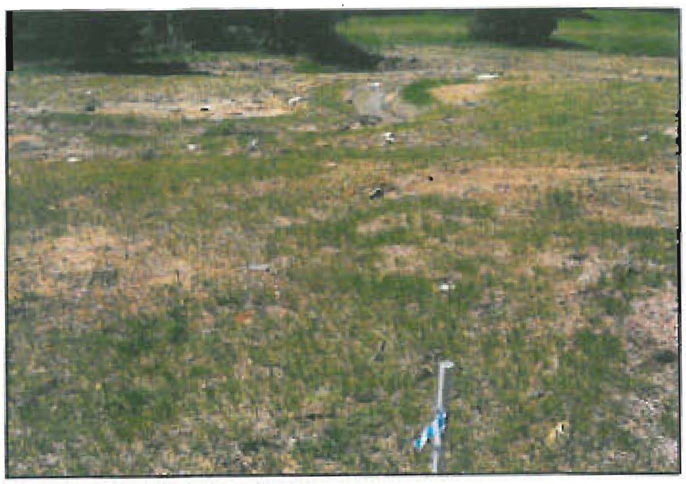
Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Veg Plot 5



As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Veg Plot 6

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Veg Plot 7

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Veg Plot 8

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Veg Plot 9

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Veg Plot 10

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Veg Plot 11

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Veg Plot 12

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Veg Plot 13

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Veg Plot 14

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Veg Plot 15

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Veg Plot 16

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 1: Looking upstream toward driveway

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 1: Looking toward Reach R2-4a and R2-4c

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 1: Looking upstream on Reach R2-4b

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 1: Looking downstream on Reach R2

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 2: Looking upstream on Reach R2

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 2: Looking downstream on Reach R2

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 3: Looking upstream on Reach R2

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 3: Looking downstream on Reach R2

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 4: Looking upstream on Reach R2

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 4: Looking downstream on Reach R2

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 5: Looking upstream on Reach R2

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 5: Looking downstream on Reach R2

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 6: Looking upstream on Reach R2

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 6: Looking downstream on Reach R2

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 7: Looking upstream on Reach R2

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 7: Looking across Reach R2, upstream on Reach R1

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 8; Looking upstream on Reach R1

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Photo Point 8: Looking downstream on Reach R1

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, September 2010

Year 4 Monitoring

Year 5 Monitoring

Permanent Cross Section 1

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, October 2010

Year 4 Monitoring

Year 5 Monitoring

Permanent Cross Section 2

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, October 2010

Year 4 Monitoring

Year 5 Monitoring

Permanent Cross Section 3

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, October 2010

Year 4 Monitoring

Year 5 Monitoring

Permanent Cross Section 4

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, October 2010

Year 4 Monitoring

Year 5 Monitoring

Permanent Cross Section 5

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, October 2010

Year 4 Monitoring

Year 5 Monitoring

Permanent Cross Section 6

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, October 2010

Year 4 Monitoring

Year 5 Monitoring

Permanent Cross Section 7

As-Built Surveys, April 2008

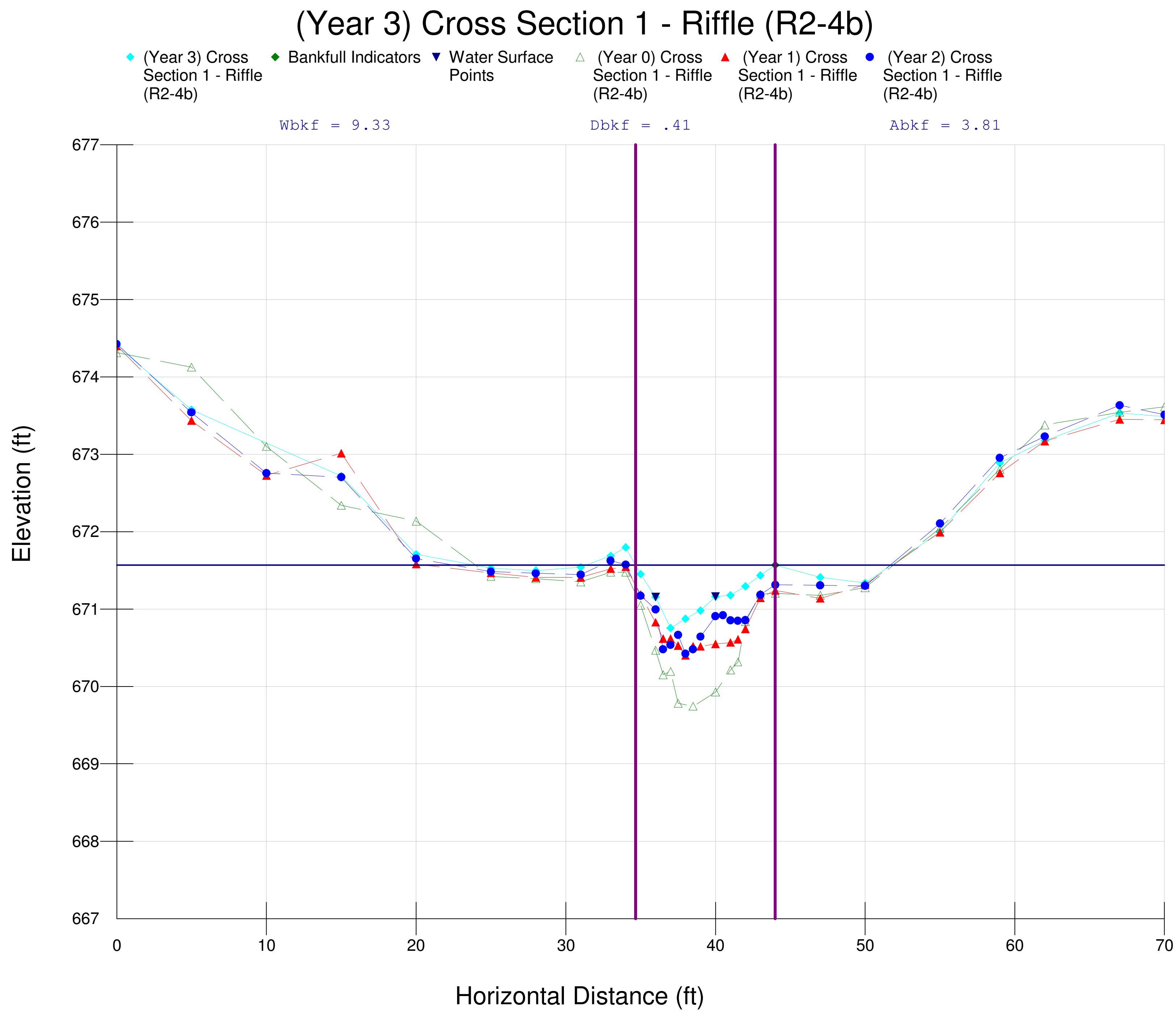
Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

Year 3 Monitoring, October 2010

Year 4 Monitoring

Year 5 Monitoring


(Year 3) Cross Section 1 - Riffle (R2-4b)
(Year 3) Cross Section 1 - Riffle (R2-4b)
Bankfull Indicators
Water Surface Points
(Year 0) Cross Section 1 - Riffle (R2-4b)
(Year 1) Cross Section 1 - Riffle (R2-4b)
(Year 2) Cross Section 1 - Riffle (R2-4b)
Wbkf = 9.33
Dbkf = .41
Abkf = 3.81
Elevation (ft)
677
676
675
674
673
672
671
670
669
668
667
0
10
20
30
40
50
60
70
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2-4b
Cross Section Name: (Year 3) Cross Section 1 - Riffle (R2-4b)
Survey Date: 10/01/2010

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	674.403	GS
5	0	673.575	GS
15	0	672.719	GS
20	0	671.71	GS
25	0	671.528	GS
28	0	671.498	GS
31	0	671.54	GS
33	0	671.688	GS
34	0	671.796	LB
35	0	671.452	GS
36	0	671.155	LEW
37	0	670.755	GS
38	0	670.875	TW
39	0	670.98	GS
40	0	671.162	REW
41	0	671.179	GS
42	0	671.293	GS
43	0	671.435	GS
44	0	671.57	BKF
47	0	671.409	RB
50	0	671.338	GS
55	0	671.995	GS
59	0	672.888	GS
62	0	673.175	GS
67	0	673.535	GS
70	0	673.486	GS

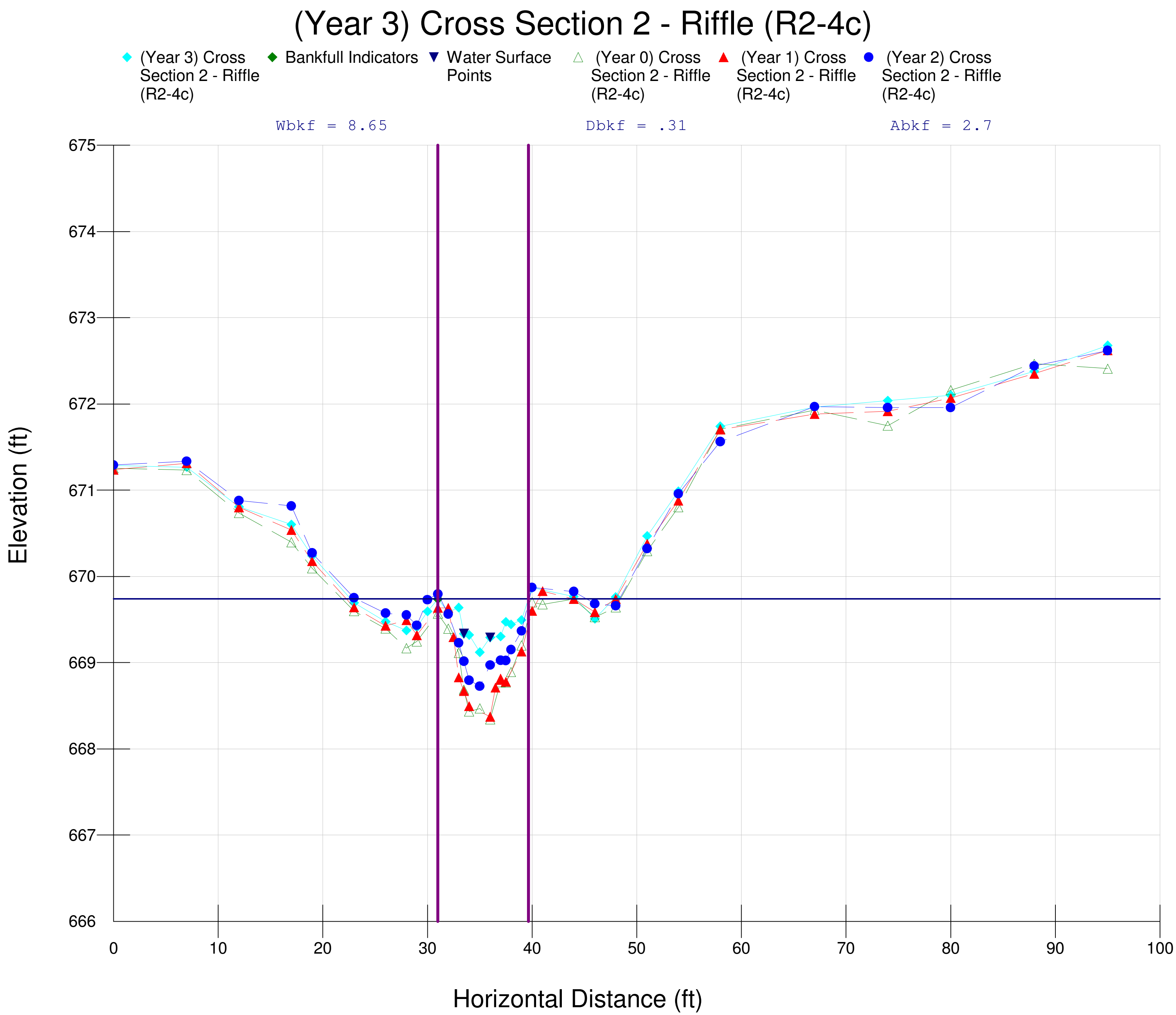
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	672.39	672.39	672.39
Bankfull Elevation (ft)	671.57	671.57	671.57
Floodprone Width (ft)	40.09	-----	-----
Bankfull Width (ft)	9.33	1.34	7.99
Entrenchment Ratio	4.3	-----	-----
Mean Depth (ft)	0.41	0.22	0.44
Maximum Depth (ft)	0.82	0.42	0.82
Width/Depth Ratio	22.76	6.09	18.16
Bankfull Area (sq ft)	3.81	0.29	3.51
Wetted Perimeter (ft)	9.53	1.83	8.54
Hydraulic Radius (ft)	0.4	0.16	0.41
Begin BKF Station	34.67	34.67	36.01
End BKF Station	44	36.01	44

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 3) Cross Section 2 - Riffle (R2-4c)
(Year 3) Cross Section 2 - Riffle (R2-4c)
Bankfull Indicators
Water Surface Points
(Year 0) Cross Section 2 - Riffle (R2-4c)
(Year 1) Cross Section 2 - Riffle (R2-4c)
(Year 2) Cross Section 2 - Riffle (R2-4c)
Wbkf = 8.65
Dbkf = .31
Abkf = 2.7
Elevation (ft)
Horizontal Distance (ft)
675
674
673
672
671
670
669
668
667
666
0
10
20
30
40
50
60
70
80
90
100

RIVERMORPH CROSS SECTION SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2-4c
Cross Section Name: (Year 3) Cross Section 2 - Riffle (R2-4c)
Survey Date: 10/01/2010

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	671.285	GS
7	0	671.267	GS
12	0	670.809	GS
17	0	670.602	GS
19	0	670.24	GS
23	0	669.694	GS
26	0	669.477	GS
28	0	669.374	GS
29	0	669.411	GS
30	0	669.594	GS
31	0	669.737	BKF
32	0	669.59	GS
33	0	669.638	GS
33.5	0	669.335	LEW
34	0	669.322	GS
35	0	669.12	TW
36	0	669.292	REW
37	0	669.303	GS
37.5	0	669.473	GS
38	0	669.444	GS
39	0	669.495	GS
40	0	669.868	RB
44	0	669.766	GS
46	0	669.508	GS
48	0	669.761	GS
51	0	670.47	GS
54	0	670.985	GS
58	0	671.74	GS
67	0	671.962	GS
74	0	672.039	GS
80	0	672.102	GS
88	0	672.378	GS
95	0	672.679	GS

Cross Sectional Geometry

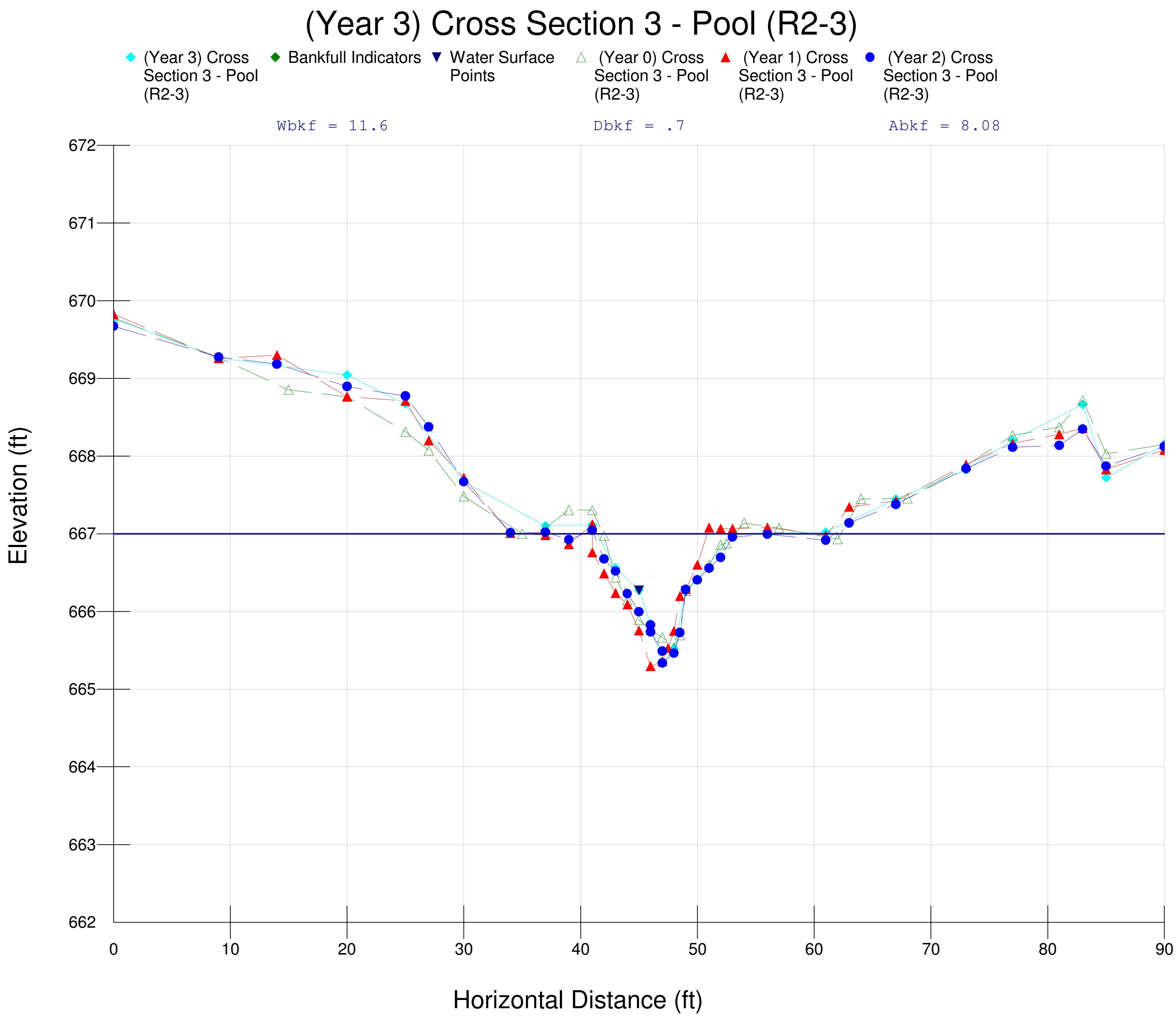
	Channel	Left	Right
Floodprone Elevation (ft)	670.36	670.36	670.36
Bankfull Elevation (ft)	669.74	669.74	669.74
Floodprone Width (ft)	32.2	-----	-----
Bankfull Width (ft)	8.65	4.33	4.32
Entrenchment Ratio	3.72	-----	-----
Mean Depth (ft)	0.31	0.29	0.34
Maximum Depth (ft)	0.62	0.62	0.56
Width/Depth Ratio	27.9	14.93	12.71
Bankfull Area (sq ft)	2.7	1.25	1.45

Wetted Perimeter (ft)	8.86	5.02	4.97
Hydraulic Radius (ft)	0.3	0.25	0.29
Begin BKF Station	31	31	35.33
End BKF Station	39.65	35.33	39.65

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 3) Cross Section 3 - Pool (R2-3)
(Year 3) Cross Section 3 - Pool (R2-3)
Bankfull Indicators
Water Surface Points
(Year 0) Cross Section 3 - Pool (R2-3)
(Year 1) Cross Section 3 - Pool (R2-3)
(Year 2) Cross Section 3 - Pool (R2-3)
Wbkf = 11.6
Dbkf = .7
Abkf = 8.08
Elevation (ft)
Horizontal Distance (ft)
672
671
670
669
668
667
666
665
664
663
662
0
10
20
30
40
50
60
70
80
90

RIVERMORPH CROSS SECTION SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2 ALL
Cross Section Name: (Year 3) Cross Section 3 - Pool (R2-3)
Survey Date: 10/01/2010

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	669.764	GS
9		669.264	GS
20		669.045	GS
25		668.673	GS
30		667.669	GS
37		667.103	GS
41		667.113	LB
43		666.562	GS
45		666.274	LEW
46		665.843	GS
47		665.328	TW
48		665.523	GS
49		666.263	REW
50		666.416	GS
53		667.004	BKF
61		667.022	GS
67		667.447	GS
73		667.824	GS
77		668.203	GS
83		668.665	GS
85		667.724	GS
90		668.148	GS

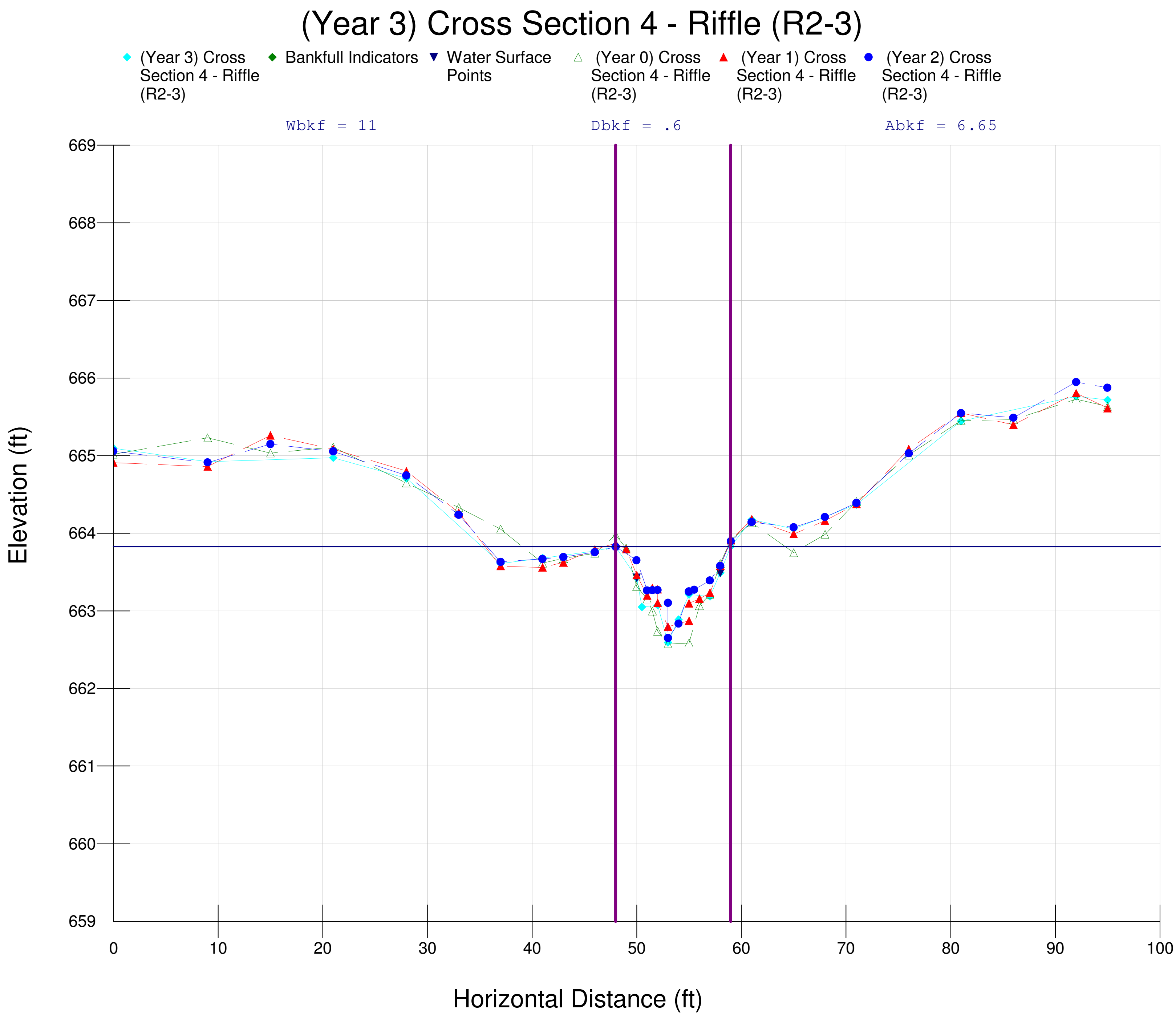
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	668.67	668.67	668.67
Bankfull Elevation (ft)	667	667	667
Floodprone Width (ft)	65	-----	-----
Bankfull Width (ft)	11.57	5.53	6.04
Entrenchment Ratio	5.62	-----	-----
Mean Depth (ft)	0.7	0.68	0.71
Maximum Depth (ft)	1.67	1.64	1.67
Width/Depth Ratio	16.53	8.13	8.51
Bankfull Area (sq ft)	8.08	3.77	4.31
Wetted Perimeter (ft)	12.19	7.46	8.02
Hydraulic Radius (ft)	0.66	0.51	0.54
Begin BKF Station	41.41	41.41	46.94
End BKF Station	52.98	46.94	52.98

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

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


(Year 3) Cross Section 4 - Riffle (R2-3)
(Year 3) Cross Section 4 - Riffle (R2-3)
Bankfull Indicators
Water Surface Points
(Year 0) Cross Section 4 - Riffle (R2-3)
(Year 1) Cross Section 4 - Riffle (R2-3)
(Year 2) Cross Section 4 - Riffle (R2-3)
Wbkf = 11
Dbkf = .6
Abkf = 6.65
Elevation (ft)
Horizontal Distance (ft)
669
668
667
666
665
664
663
662
661
660
659
0
10
20
30
40
50
60
70
80
90
100

RIVERMORPH CROSS SECTION SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2 ALL
Cross Section Name: (Year 3) Cross Section 4 - Riffle (R2-3)
Survey Date: 10/01/2010

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	665.098	GS
9	0	664.919	GS
21	0	664.973	GS
28	0	664.71	GS
37	0	663.611	GS
41	0	663.679	GS
46	0	663.774	GS
48	0	663.828	BKF
50	0	663.426	LEW
50.5	0	663.049	GS
52	0	663.074	GS
53	0	662.592	TW
54	0	662.888	GS
55	0	663.21	GS
57	0	663.187	GS
58	0	663.49	REW
59	0	663.831	GS
61	0	664.175	GS
65	0	664.057	RB
71	0	664.37	GS
81	0	665.445	GS
92	0	665.763	GS
95	0	665.718	GS

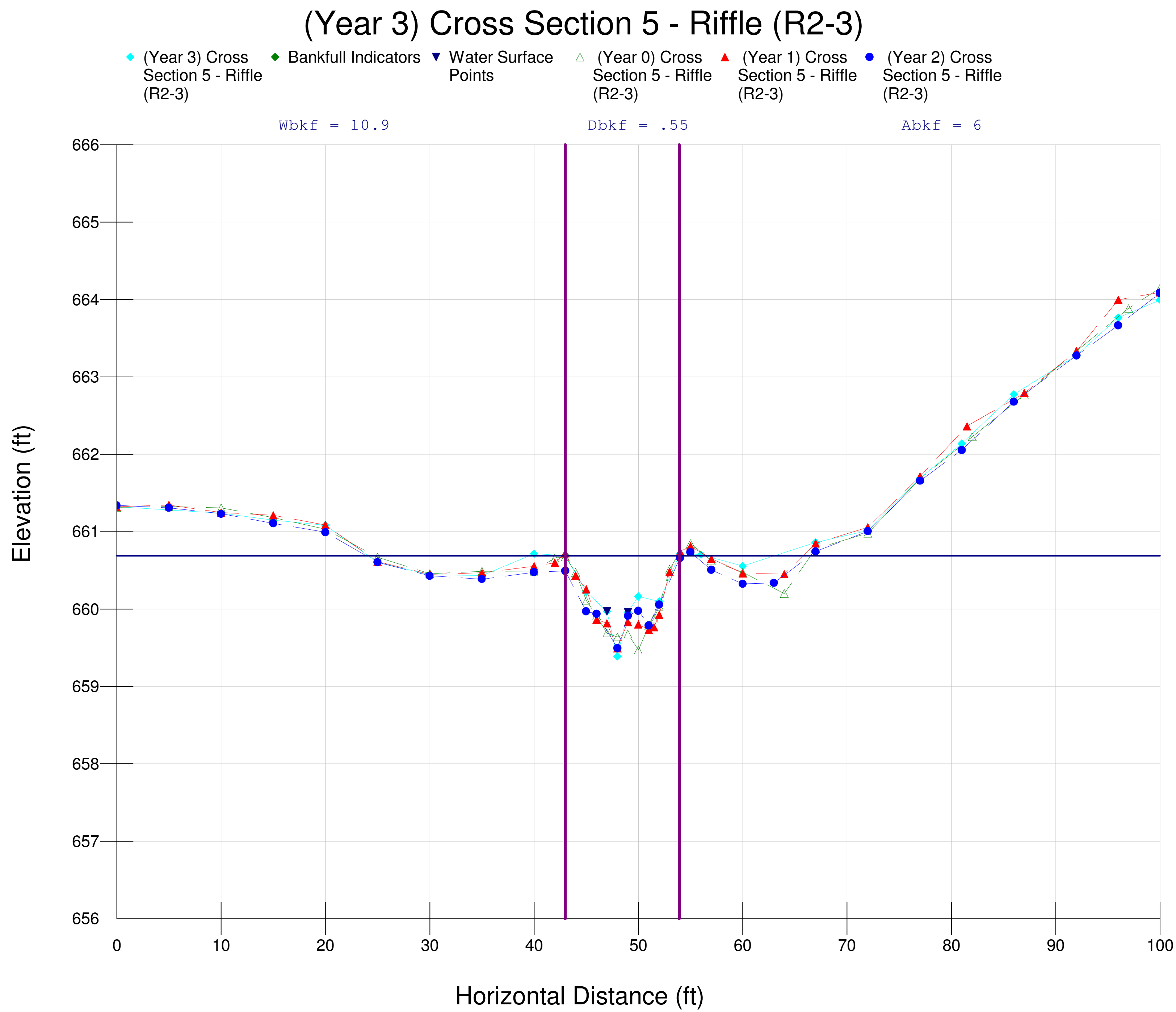
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	665.07	665.07	665.07
Bankfull Elevation (ft)	663.83	663.83	663.83
Floodprone Width (ft)	75.98	-----	-----
Bankfull Width (ft)	11	5.5	5.5
Entrenchment Ratio	6.91	-----	-----
Mean Depth (ft)	0.6	0.62	0.58
Maximum Depth (ft)	1.24	1.24	1.09
Width/Depth Ratio	18.33	8.87	9.48
Bankfull Area (sq ft)	6.65	3.43	3.21
Wetted Perimeter (ft)	11.47	6.89	6.76
Hydraulic Radius (ft)	0.58	0.5	0.48
Begin BKF Station	48	48	53.5
End BKF Station	59	53.5	59

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 3) Cross Section 5 - Riffle (R2-3)
(Year 3) Cross Section 5 - Riffle (R2-3)
Bankfull Indicators
Water Surface Points
(Year 0) Cross Section 5 - Riffle (R2-3)
(Year 1) Cross Section 5 - Riffle (R2-3)
(Year 2) Cross Section 5 - Riffle (R2-3)
Wbkf = 10.9
Dbkf = .55
Abkf = 6
Elevation (ft)
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2 ALL
Cross Section Name: (Year 3) Cross Section 5 - Riffle (R2-3)
Survey Date: 10/01/2010

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	661.322	GS
10		661.237	GS
15		661.152	GS
20		661.086	GS
25		660.605	GS
30		660.443	GS
35		660.433	GS
40		660.714	GS
43		660.692	BKF
45		660.219	GS
47		659.97	LEW
48		659.388	TW
49		659.959	REW
50		660.163	GS
52		660.098	GS
54		660.717	RB
56		660.703	GS
60		660.555	GS
67		660.86	GS
72		661.015	GS
77		661.69	GS
81		662.138	GS
86		662.775	GS
92		663.278	GS
96		663.764	GS
100		663.996	GS

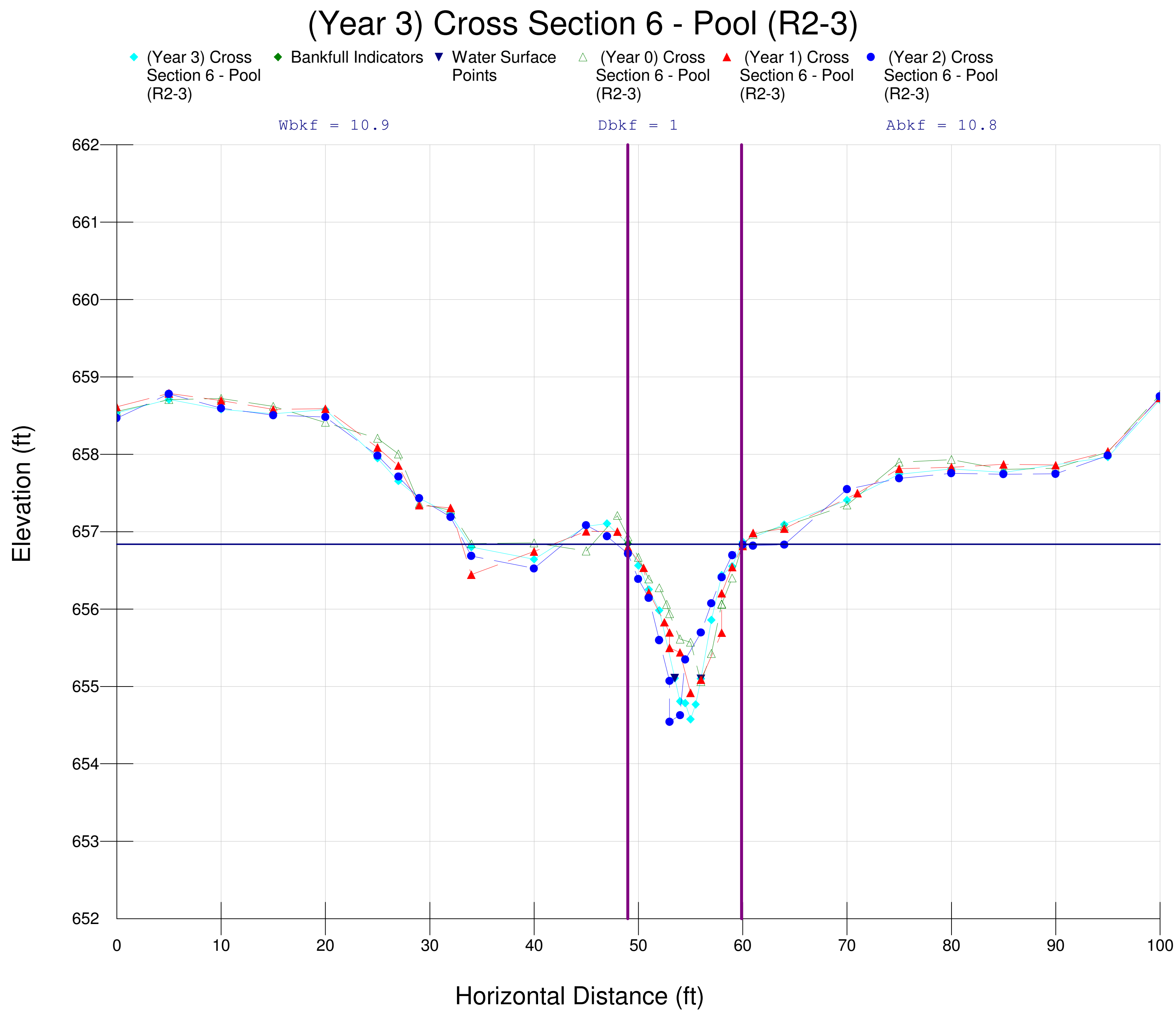
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	661.99	661.99	661.99
Bankfull Elevation (ft)	660.69	660.69	660.69
Floodprone Width (ft)	79.7	-----	-----
Bankfull Width (ft)	10.9	5.45	5.45
Entrenchment Ratio	7.31	-----	-----
Mean Depth (ft)	0.55	0.59	0.51
Maximum Depth (ft)	1.3	1.3	1.04
Width/Depth Ratio	19.82	9.24	10.69
Bankfull Area (sq ft)	6	3.21	2.79
Wetted Perimeter (ft)	11.39	6.79	6.68
Hydraulic Radius (ft)	0.53	0.47	0.42
Begin BKF Station	43.01	43.01	48.46
End BKF Station	53.91	48.46	53.91

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

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


(Year 3) Cross Section 6 - Pool (R2-3)
(Year 3) Cross Section 6 - Pool (R2-3)
Bankfull Indicators
Water Surface Points
(Year 0) Cross Section 6 - Pool (R2-3)
(Year 1) Cross Section 6 - Pool (R2-3)
(Year 2) Cross Section 6 - Pool (R2-3)
Wbkf = 10.9
Dbkf = 1
Abkf = 10.8
Elevation (ft)
662
661
660
659
658
657
656
655
654
653
652
0
10
20
30
40
50
60
70
80
90
100
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2 ALL
Cross Section Name: (Year 3) Cross Section 6 - Pool (R2-3)
Survey Date: 10/01/2010

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	658.536	GS
5		658.709	GS
10		658.581	GS
15		658.525	GS
20		658.576	GS
25		657.95	GS
27		657.654	GS
29		657.432	GS
32		657.223	GS
34		656.801	GS
40		656.643	GS
45		657.069	GS
47		657.104	GS
49		656.844	BKF
50		656.563	GS
51		656.254	GS
52		655.983	GS
53.5		655.108	LEW
54		654.809	GS
54.5		654.785	GS
55		654.576	TW
55.5		654.767	GS
56		655.1	REW
57		655.859	GS
58		656.437	GS
59		656.552	GS
60		656.869	RB
64		657.093	GS
70		657.409	GS
75		657.741	GS
80		657.811	GS
85		657.767	GS
95		657.965	GS
100		658.706	GS

Cross Sectional Geometry

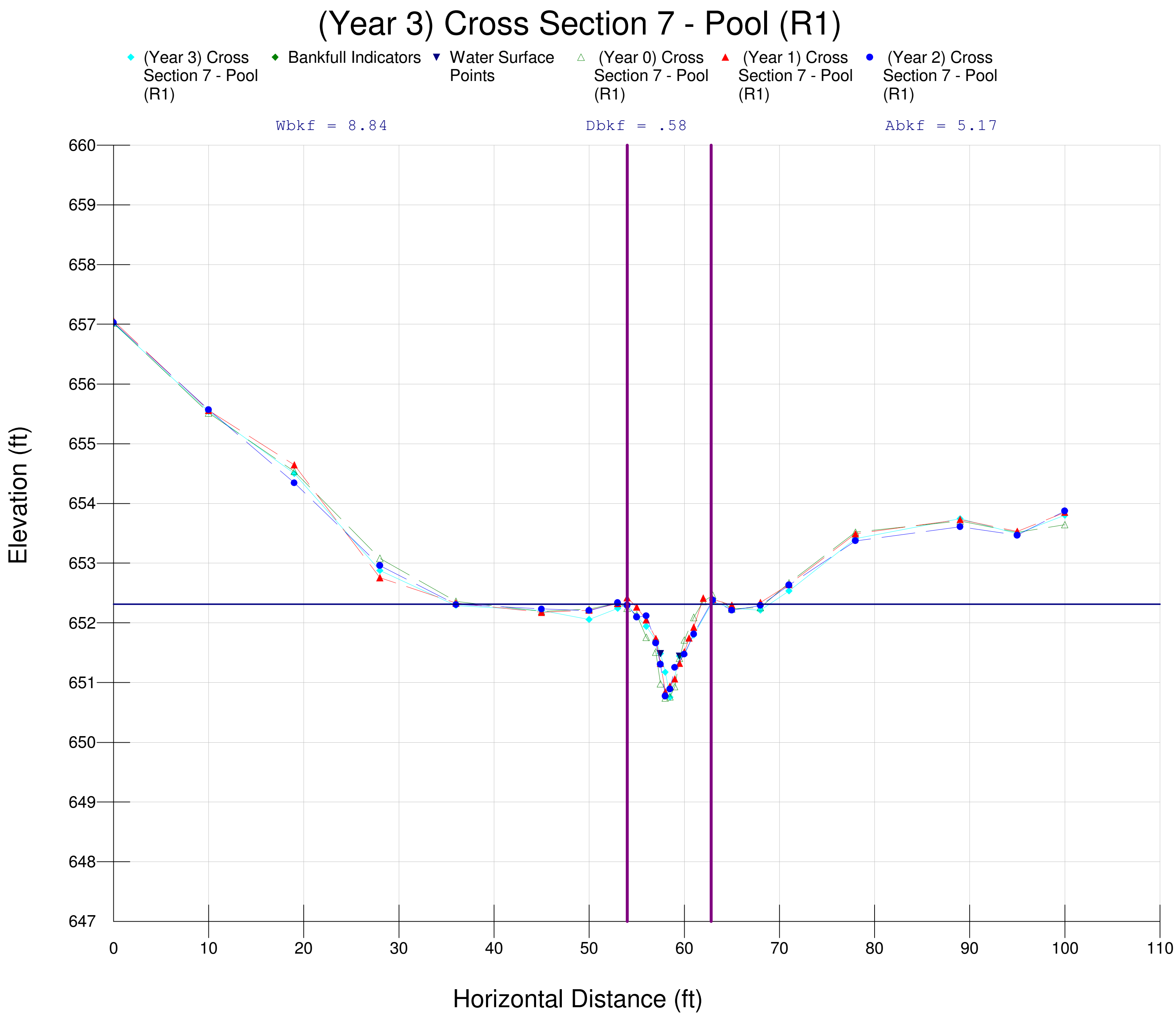
	Channel	Left	Right
Floodprone Elevation (ft)	659.1	659.1	659.1
Bankfull Elevation (ft)	656.84	656.84	656.84
Floodprone Width (ft)	100	-----	-----
Bankfull Width (ft)	10.89	5.45	5.44
Entrenchment Ratio	9.19	-----	-----
Mean Depth (ft)	1	0.94	1.05
Maximum Depth (ft)	2.26	2.05	2.26
Width/Depth Ratio	10.89	5.8	5.18

Bankfull Area (sq ft)	10.84	5.11	5.73
Wetted Perimeter (ft)	11.97	7.94	8.13
Hydraulic Radius (ft)	0.91	0.64	0.7
Begin BKF Station	49.01	49.01	54.46
End BKF Station	59.9	54.46	59.9

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

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


(Year 3) Cross Section 7 - Pool (R1)
(Year 3) Cross Section 7 - Pool (R1)
Bankfull Indicators
Water Surface Points
(Year 0) Cross Section 7 - Pool (R1)
(Year 1) Cross Section 7 - Pool (R1)
(Year 2) Cross Section 7 - Pool (R1)
Wbkf = 8.84
Dbkf = .58
Abkf = 5.17
Elevation (ft)
Horizontal Distance (ft)
660
659
658
657
656
655
654
653
652
651
650
649
648
647
0
10
20
30
40
50
60
70
80
90
100
110

RIVERMORPH CROSS SECTION SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R1
Cross Section Name: (Year 3) Cross Section 7 - Pool (R1)
Survey Date: 10/01/2010

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	657.008	GS
10	0	655.539	GS
19	0	654.499	GS
28	0	652.877	GS
36	0	652.292	GS
45	0	652.207	GS
50	0	652.058	GS
53	0	652.243	GS
54	0	652.306	BKF
55	0	652.107	GS
56	0	651.944	GS
57	0	651.709	GS
57.5	0	651.486	LEW
58	0	651.173	GS
58.5	0	650.755	TW
59.5	0	651.443	REW
60	0	651.487	GS
61	0	651.796	GS
63	0	652.355	RB
65	0	652.241	GS
68	0	652.213	GS
71	0	652.535	GS
78	0	653.41	GS
89	0	653.743	GS
95	0	653.493	GS
100	0	653.803	GS

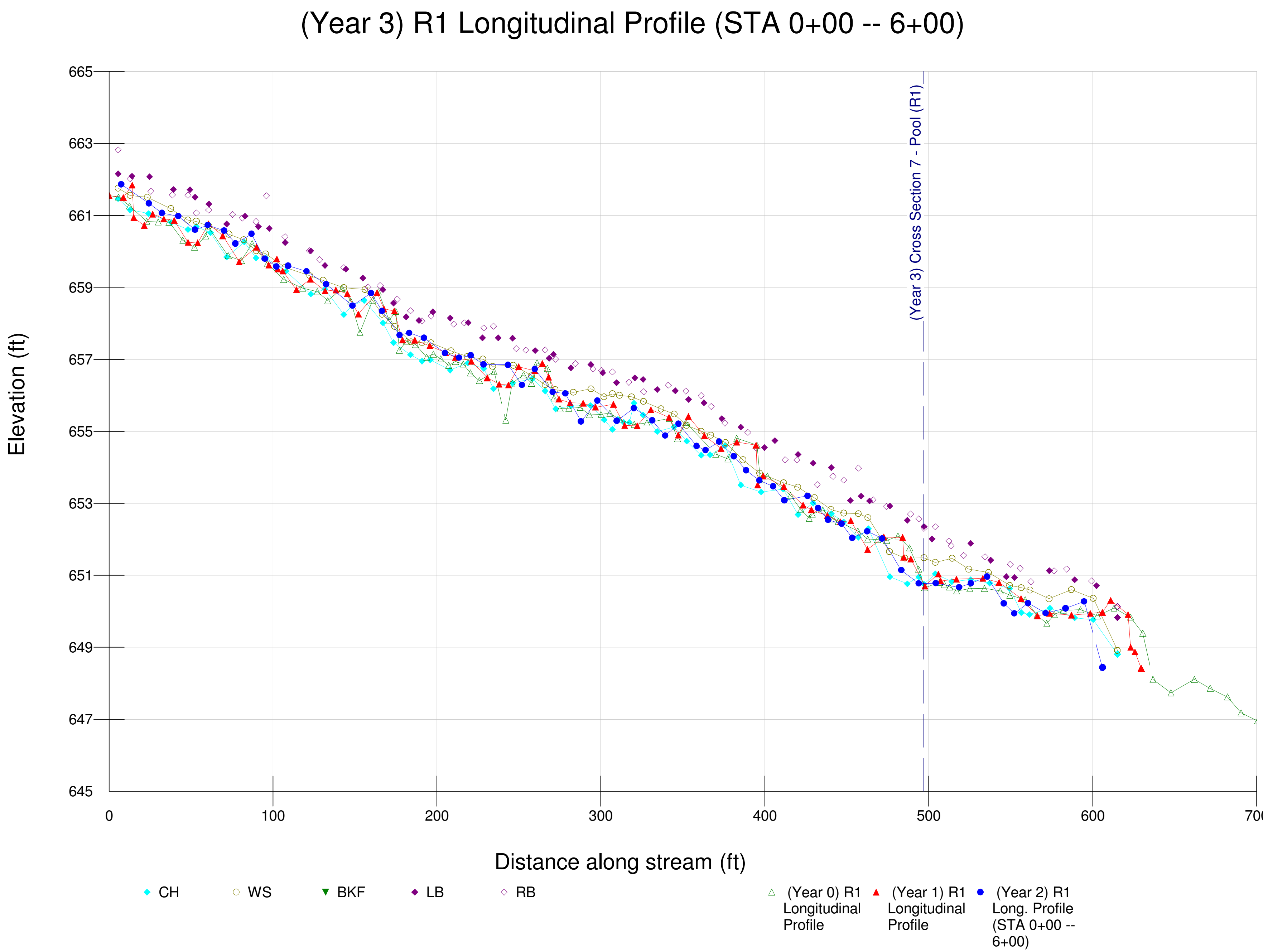
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	653.86	653.86	653.86
Bankfull Elevation (ft)	652.31	652.31	652.31
Floodprone Width (ft)	77.48	-----	-----
Bankfull Width (ft)	8.84	4.42	4.42
Entrenchment Ratio	8.77	-----	-----
Mean Depth (ft)	0.58	0.51	0.66
Maximum Depth (ft)	1.55	1.49	1.55
Width/Depth Ratio	15.24	8.67	6.7
Bankfull Area (sq ft)	5.17	2.27	2.9
Wetted Perimeter (ft)	9.52	6.24	6.26
Hydraulic Radius (ft)	0.54	0.36	0.46
Begin BKF Station	54	54	58.42
End BKF Station	62.84	58.42	62.84

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 3) R1 Longitudinal Profile (STA 0+00 -- 6+00)
Elevation (ft)
Distance along stream (ft)
(Year 3) Cross Section 7 - Pool (R1)
665
663
661
659
657
655
653
651
649
647
645
0
100
200
300
400
500
600
700
CH
WS
BKF
LB
RB
(Year 0) R1 Longitudinal Profile
(Year 1) R1 Longitudinal Profile
(Year 2) R1 Long. Profile (STA 0+00 -- 6+00)

RIVERMORPH PROFILE SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R1
Profile Name: (Year 3) R1 Long. Profile (STA 0+00 -- 6+00)
Survey Date: 11/04/2010

Survey Data

DIST	CH	WS	BKF	LB	RB
5.5	661.466				
5.5		661.759			
5.5					662.824
5.5				662.157	
12.82	661.154				
12.872					662.024
12.893		661.556			
13.965				662.091	
23.312		661.504			
24.081	661.051				
24.663				662.076	
25.442					661.674
37.773		661.186			
37.893	660.802				
38.604					661.571
39.242				661.721	
48.061		660.871			
48.115	660.611				
48.115					661.563
49.338				661.716	
52.448				661.506	
53.173	660.69				
53.218		660.835			
53.265					661.068
60.804					661.15
60.819		660.704			
60.89				661.317	
61.931	660.519				
71.77				660.762	
71.77	659.844				
73.111		660.478			
75.355					661.028
81.318					660.931
82.125		660.323			
82.46	660.262				
82.919				660.982	
89.665					660.829
89.665	659.817				
89.841		660.017			
91.041				660.689	
95.55	659.816				
95.55		659.933			
95.976					661.545
97.736				660.639	
107.303					660.409
107.419				660.247	
107.446		659.554			
107.996	659.451				
122.202					660.019
122.503		659.325			

123.013			660.016	
123.013	658.816			
128.433				659.768
130.565		659.197		
131.639			659.608	
131.639	658.948			
143.167				659.552
143.167	658.244			
143.167		658.991		
144.526			659.508	
148.347	658.494			
154.834			659.258	
155.577	658.637			
156.091		658.939		
158.083				659.01
165.349				659.049
166.66		658.248		
167.033			658.938	
167.033	658.013			
173.566			658.567	
173.566	657.465			
174.147		657.917		
175.794				658.673
181.214			658.182	
183.9				658.35
183.9	657.13			
184.129		657.485		
189.032			658.082	
190.918		657.466		
190.918				658.068
190.918	656.95			
195.961	656.987			
196.409		657.458		
196.412				658.203
197.477			658.32	
208.106	656.704			
208.106			658.149	
208.621		657.235		
210.288				657.979
216.653				658.014
218.544		657.079		
218.77	656.901			
219.057			658.018	
227.783			657.597	
228.067		657.006		
228.603	656.748			
228.603				657.875
233.984		656.807		
234.52	656.183			
234.52				657.923
237.408			657.598	
246.101			657.59	
246.101	656.341			
246.645		656.836		
248.36				657.3
254.241				657.256
257.744		656.547		
258.186	656.461			
259.921			657.248	
265.998	656.124			
265.998				657.262
266.065		656.294		
268.453			657.031	
271.071			657.142	
272.124		656.162		
272.455	655.624			

272.455				657.002
281.719			656.763	
281.719	655.707			
283.256		656.084		
284.44				656.882
293.595	655.718			
293.961			656.858	
294.031		656.183		
295.268				656.737
300.396				656.693
301.151			656.628	
301.944		655.96		
302.076	655.32			
307.029				656.653
307.029	655.054			
307.029		656.041		
309.546			656.352	
310.436	655.336			
311.4		655.998		
313.964	655.249			
317.101				656.364
317.339	655.249			
318.837		655.959		
320.186	655.783			
320.755			656.486	
325.744	655.456			
325.744			656.443	
326.028		655.83		
326.153				656.101
334.399	654.994			
334.399			656.165	
336.711		655.622		
341.085				656.284
344.644	655.12			
344.831		655.478		
345.43			656.126	
351.866				656.119
352.344		655.165		
352.381	654.728			
353.557			655.886	
361.156				655.992
361.156	654.337			
361.156		655.003		
362.89			655.794	
366.609	654.348			
367.074		654.895		
367.308				655.692
373.823			655.353	
375.674				655.229
375.674	654.601			
376.02		654.686		
385.362			655.116	
385.362	653.506			
386.697		654.207		
389.69				654.971
394.71				654.537
396.805		653.836		
397.773	653.315			
399.729			654.551	
406.125			654.744	
411.111	653.397			
411.519		653.566		
412.419				654.211
419.616				654.21
420.171		653.45		
420.305			654.359	

420.305	652.689			
429.491			654.118	
429.491	653.008			
430.205		653.156		
431.992				653.521
440.408		652.829		
440.552	652.713			
440.552			653.995	
441.555				653.749
448.172	652.482			
448.172				653.647
448.172		652.727		
452.172			653.078	
457.109				653.98
457.109	652.059			
457.109		652.711		
458.718			653.198	
462.969		652.601		
463.181	652.294			
463.93			653.066	
466.087				653.096
474.165				652.911
476.066		651.656		
476.309			652.927	
476.309	650.96			
485.456		651.478		
486.92			652.529	
486.92	650.764			
488.952				652.701
493.999				652.57
493.999	650.955			
497.14	650.755	651.486	652.355	652.306
502.069			652.009	
504.065		651.359		
504.065				652.348
504.065	651.04			
512.358				651.956
513.756				651.819
514.049	650.822			
514.259		651.473		
521.311				651.55
524.387		651.169		
525.611			651.886	
525.611	650.88			
534.325				651.514
536.468		651.077		
537.13	650.783			
537.833			651.419	
547.329			650.96	
549.475	650.632			
549.475		650.715		
549.798				651.307
552.297			650.937	
555.779				651.194
556.43	649.962			
556.43		650.655		
561.412	649.911			
561.768		650.588		
562.359				650.821
573.44		650.347		
573.621			651.129	
573.97	650.085			
576.467				651.126
584.144				651.175
587.09		650.601		
589.058			650.876	

589.058	649.819				
599.306					650.844
600.245	649.771				
600.42		650.36			
602.322				650.711	
615.178	648.807	648.911		649.824	650.126

Cross Section / Bank Profile Locations

Name	Type	Profile Station
(Year 3) Cross Section 7 - Pool (R1)	Riffle XS	497

Measurements from Graph

Bankfull Slope: 0.01919

Variable	Min	Avg	Max
S riffle	0.0114	0.03961	0.10621
S pool	0	0	0
S run	0	0	0
S glide	0	0	0
P - P	16.81	32.44	50.93
Pool length	6.31	11.43	15.27
Riffle length	4.73	8.78	11.7
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

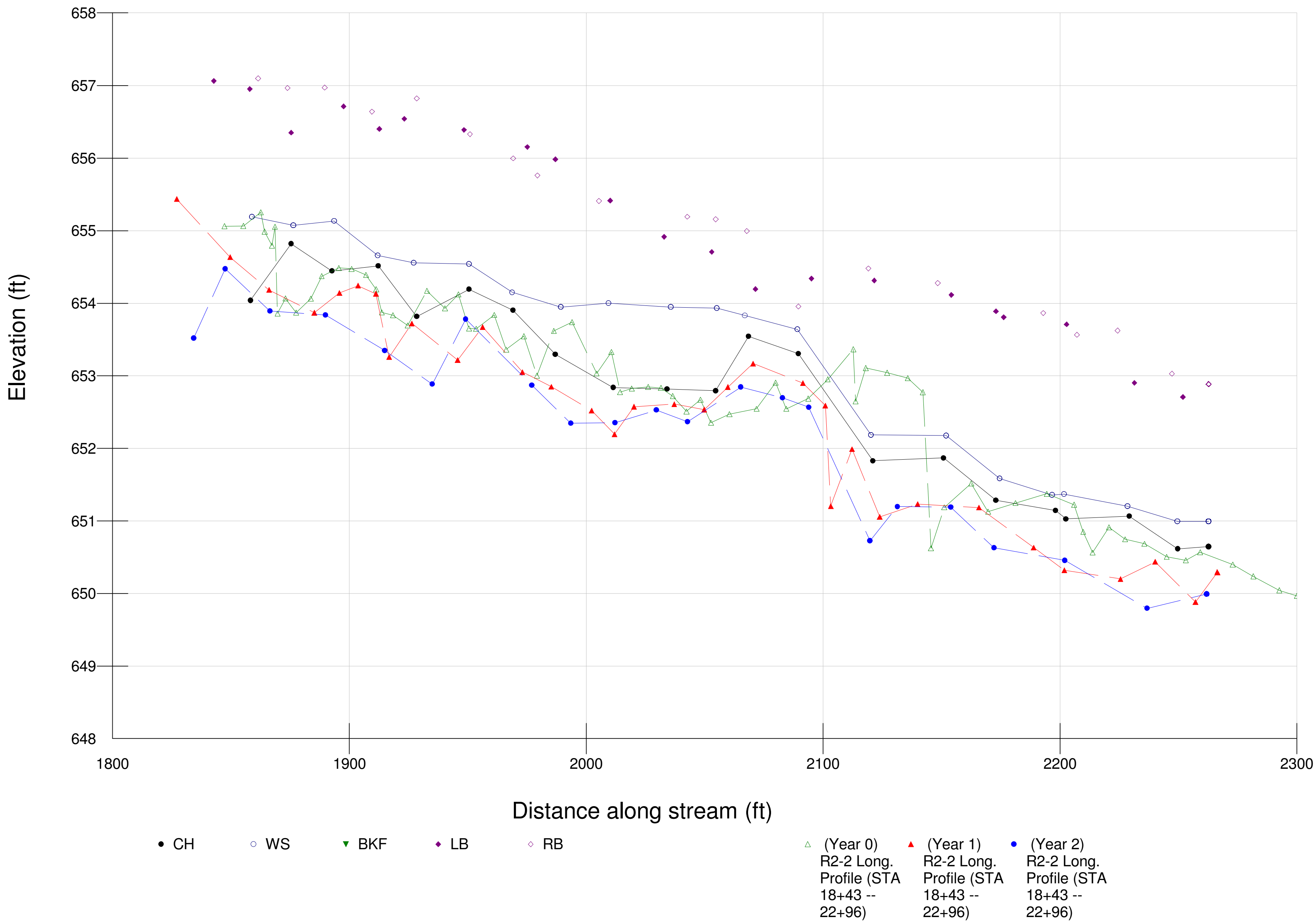
Notes

River Name: (Year 3) Reedy Fork Creek
Reach Name: R1
Profile Name: (Year 3) R1 Long. Profile (STA 0+00 -- 6+00)
Survey Date: 11/04/2010

DIST	Note
5.5	LEW
12.893	LEW
23.312	LEW
37.773	LEW
48.061	LEW
53.218	LEW
60.819	LEW
73.111	LEW
82.125	LEW
89.841	LEW
95.55	LEW
107.446	LEW
122.503	LEW
130.565	LEW
143.167	LEW
156.091	LEW
166.66	LEW
174.147	LEW
184.129	LEW

190.918	LEW
196.409	LEW
208.621	LEW
218.544	LEW
228.067	LEW
233.984	LEW
237.408	LEW
246.645	LEW
257.744	LEW
266.065	LEW
272.124	LEW
283.256	LEW
294.031	LEW
301.944	LEW
307.029	LEW
311.4	LEW
318.837	LEW
326.028	LEW
336.711	LEW
344.831	LEW
352.344	LEW
361.156	LEW
367.074	LEW
376.02	LEW
386.697	LEW
396.805	LEW
411.519	LEW
420.171	LEW
430.205	LEW
440.408	LEW
448.172	LEW
457.109	LEW
462.969	LEW
476.066	LEW
485.456	LEW
497.14	XS7 - TW Intersect @ station 497
504.065	LEW
514.259	LEW
524.387	LEW
536.468	LEW
549.475	LEW
556.43	LEW
561.768	LEW
573.44	LEW
587.09	LEW
600.42	LEW

(Year 3) R2-2 Longitudinal Profile (STA 18+43 -- 22+96)



RIVERMORPH PROFILE SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2-2
Profile Name: (Year 3) R2-2 Longitudinal Profile (STA 18+43 --
Survey Date: 11/04/2010

Survey Data

DIST	CH	WS	BKF	LB	RB
1842.7589				657.064	
1857.9769				656.952	
1858.2369	654.04				
1858.8719		655.19			
1861.4479					657.098
1873.8609					656.967
1875.4019				656.351	
1875.4019	654.819				
1876.3089		655.074			
1889.5629					656.971
1892.6549	654.444				
1893.5599		655.134			
1897.5349				656.713	
1909.4979					656.64
1911.9849		654.658			
1912.2279	654.515				
1912.6259				656.402	
1923.1919				656.541	
1927.1619		654.557			
1928.4569	653.817				
1928.4569					656.823
1948.4049				656.389	
1950.5349	654.193				
1950.5349		654.54			
1950.9019					656.33
1968.7409		654.15			
1969.0589	653.904				
1969.1489					655.997
1975.1089				656.153	
1979.4129					655.762
1986.9589				655.983	
1986.9589	653.296				
1989.3059		653.948			
2005.3449					655.409
2009.3669		654.001			
2010.1029				655.415	
2011.3779	652.838				
2032.8559				654.915	
2034.1149	652.817				
2035.7439		653.947			
2042.6339					655.192
2052.9489				654.707	
2054.6189	652.795				
2054.6189					655.157
2055.1579		653.933			
2067.0139		653.831			
2067.7909					654.995
2068.5129	653.544				
2071.4059				654.195	
2089.1469		653.64			

2089.5519	653.305			
2089.5519				653.955
2095.0579			654.341	
2119.0989				654.479
2120.1909		652.185		
2121.0119	651.828			
2121.5729			654.313	
2148.3829				654.279
2150.8229	651.869			
2151.9759		652.177		
2154.1229			654.114	
2172.9729	651.285			
2172.9729			653.889	
2174.5249		651.585		
2176.2129			653.807	
2192.9209				653.865
2196.6869		651.357		
2198.1319	651.144			
2201.6799		651.371		
2202.5179	651.027			
2202.7639			653.708	
2207.1419				653.566
2224.3119				653.624
2228.5149		651.203		
2229.2389	651.066			
2231.4219			652.902	
2247.2559				653.029
2249.5829		650.994		
2249.7029	650.615			
2251.8849			652.708	
2262.7349	650.646	650.994		652.886

Cross Section / Bank Profile Locations

Name	Type	Profile Station

Measurements from Graph

Bankfull Slope: 0.01108

Variable	Min	Avg	Max
S riffle	0.00929	0.01586	0.02499
S pool	0	0	0
S run	0	0	0
S glide	0	0	0
P - P	59.54	81.09	105.26
Pool length	17.37	32.25	55.64
Riffle length	9.92	16.66	22.33
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.

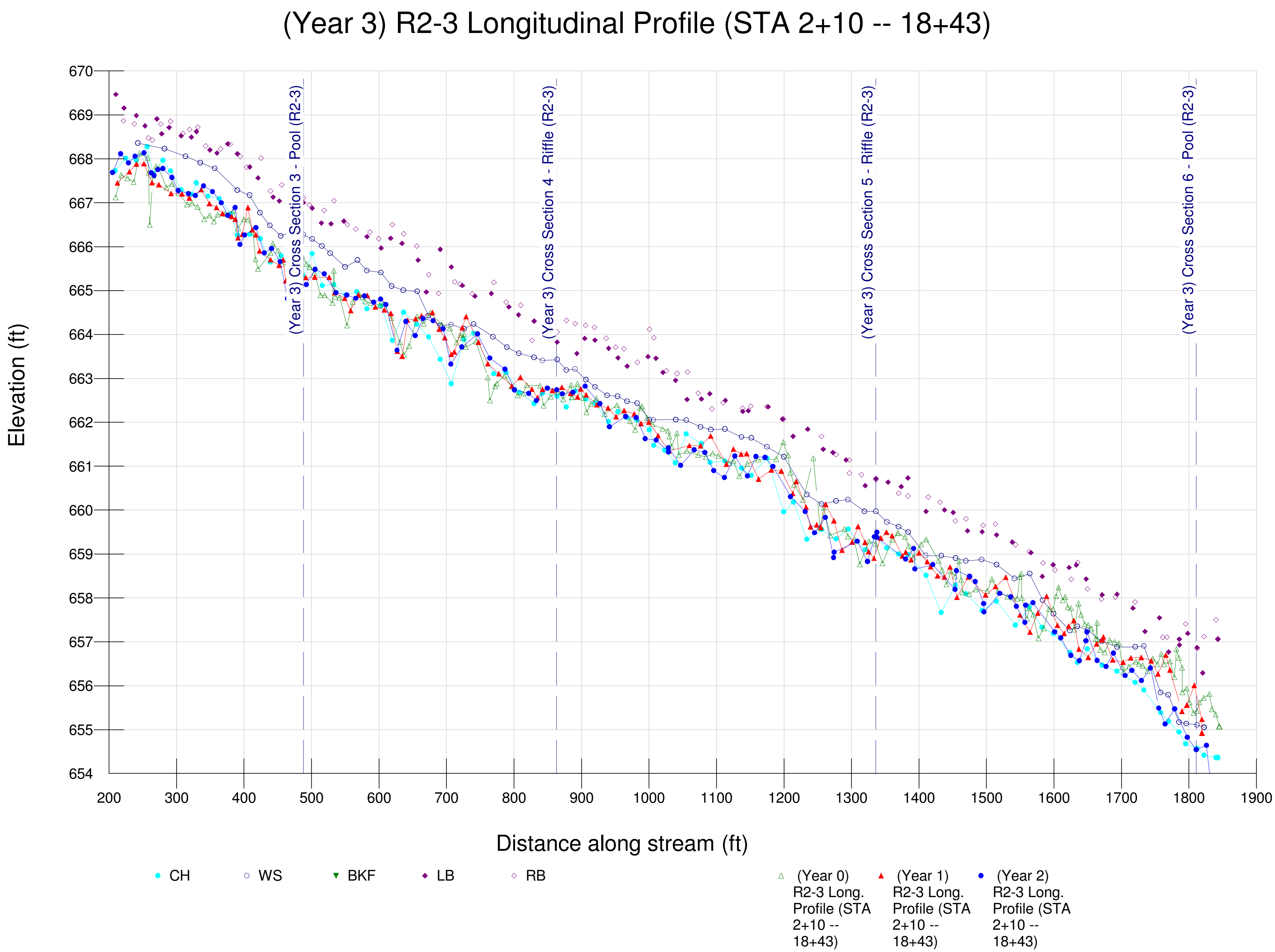
RIVERMORPH PROFILE SUMMARY

Notes

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2-2

Profile Name: (Year 3) R2-2 Longitudinal Profile (STA 18+43 --
Survey Date: 11/04/2010

DIST	Note
1858.8719	LEW
1876.3089	LEW
1893.5599	LEW
1911.9849	LEW
1927.1619	LEW
1950.5349	LEW
1968.7409	LEW
1989.3059	LEW
2009.3669	LEW
2035.7439	LEW
2055.1579	LEW
2067.0139	LEW
2089.1469	LEW
2120.1909	LEW
2151.9759	LEW
2174.5249	LEW
2196.6869	LEW
2201.6799	LEW
2228.5149	LEW
2249.5829	LEW
2262.7349	LEW



(Year 3) R2-3 Longitudinal Profile (STA 2+10 -- 18+43)
Elevation (ft)
Distance along stream (ft)
(Year 3) Cross Section 3 - Pool (R2-3)
(Year 3) Cross Section 4 - Riffle (R2-3)
(Year 3) Cross Section 5 - Riffle (R2-3)
(Year 3) Cross Section 6 - Pool (R2-3)
670
669
668
667
666
665
664
663
662
661
660
659
658
657
656
655
654
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
CH
WS
BKF
LB
RB
(Year 0) R2-3 Long. Profile (STA 2+10 -- 18+43)
(Year 1) R2-3 Long. Profile (STA 2+10 -- 18+43)
(Year 2) R2-3 Long. Profile (STA 2+10 -- 18+43)

RIVERMORPH PROFILE SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2-3
Profile Name: (Year 3) R2-3 Long. Profile (STA 2+10 -- 18+43)
Survey Date: 11/04/2010

Survey Data

DIST	CH	WS	BKF	LB	RB
209.0929	667.727				
210.0749				669.467	
221.4459					668.866
222.2259				669.156	
224.8089	668.013				
237.4579					668.798
240.2539	667.966				
240.3489				668.987	
242.8469		668.358			
253.3009				668.75	
256.6589	668.279				
258.2639					668.477
264.2669					668.426
265.5519	667.665				
270.8999				668.909	
276.5709					668.794
278.0319				668.571	
279.7259	667.966				
282.3009		668.231			
289.0629				668.713	
291.1019					668.854
291.1019	667.723				
306.8999				668.524	
307.0329	667.296				
309.4869					668.578
313.4089		668.058			
319.2869					668.667
321.9699				668.495	
321.9699	667.193				
329.5059	667.454				
329.5059				668.621	
331.4489					668.722
335.3149		667.912			
343.1609					668.295
346.6959	667.147				
349.4609				668.204	
356.6339		667.785			
359.9759				668.13	
363.4689	667.093				
365.2629					668.229
375.9149				668.341	
379.1519					668.333
380.7279	666.744				
390.1889	666.264				
390.1889		667.288			
390.1889				668.117	
394.4909					668.054
404.0549					667.812
408.4539		667.171			
408.5649	666.278				

408.5649			667.817	
420.8459			667.565	
423.7609		666.772		
424.1959	666.178			
425.2499				668.016
438.1969		666.481		
439.0379	665.647			
439.0379				667.268
443.0439			667.13	
452.2659			667.04	
454.4289		666.245		
455.1609	665.791			
455.8319				667.408
472.0079				667.265
473.7829	665.427			
473.7829			667.495	
474.5209		666.343		
488.0689	665.328	666.274	667.004	667.113
496.6859				666.956
501.1109	665.84			
501.1109		666.174		
501.1109			666.878	
514.7339			666.539	
515.5539		666.017		
516.0849	665.112			
518.7759				666.826
527.8839		665.85		
528.9389			666.521	
533.2799				667.045
533.2799	665.136			
547.9639			666.579	
549.8549		665.537		
550.9359	664.899			
553.2039				666.504
565.4009				666.402
567.0709	664.972			
567.8579				
568.1639		665.691		
582.1639			666.228	
582.1639	664.585			
582.1639		665.453		
586.5989				666.331
599.6989				666.182
602.9019		665.41		
603.0699			665.969	
603.1579	664.655			
617.3009			666.191	
618.6829		665.099		
619.8859				666.504
619.8859	663.863			
634.0879			666.075	
636.0639		665.009		
636.5119				666.291
636.5119	664.503			
655.9319				666.013
655.9319	664.23			
656.6189		664.981		
657.9119			665.692	
670.0849			664.966	
673.2619		664.426		
673.5749	663.943			
673.5749				665.363
688.3839				664.937
690.7609	663.434			
690.7609			665.938	
690.7609		664.202		

706.8659		664.228			
707.2999	662.879				
707.2999				665.538	
712.2239					665.197
719.8979					665.148
723.5919				665.115	
725.9139		664.13			
725.9139	663.883				
738.2459					664.925
740.1319	664.027				
740.2919		664.236			
742.0659				664.872	
766.4119				664.935	
768.8959		663.95			
770.1999					665.186
770.1999	663.104				
788.4549	663.135				
788.4549					664.737
789.4969		663.709			
792.2989				664.627	
806.7219				664.448	
807.2319		663.571			
808.1169	662.684				
809.8779					664.667
826.9639					663.866
829.8369				664.304	
829.8369	662.424				
829.8369		663.477			
842.3019		663.408			
842.3019	662.665				
842.3019				664.215	
846.8709					664.176
863.9259	662.592	663.426		663.828	664.057
877.6899	662.344				
877.6899					664.317
877.6899		663.189			
890.4149		663.212			
890.6129					664.248
890.6129	662.711				
893.0839				663.567	
904.7999				663.909	
906.1439					664.207
906.5929	662.528				
906.5929		662.97			
919.1689					664.164
919.8799				663.87	
920.0509		662.808			
920.3299	662.432				
936.5569					663.913
938.0699		662.614			
940.1519	662.014				
940.1519				663.684	
950.6519					663.709
953.6139		662.59			
954.1699	662.242				
954.1699				663.468	
962.7999					663.675
967.5709		662.478			
967.7649				663.277	
967.7649	662.108				
982.1279	662.051				
982.5129		662.431			
982.7359					663.369
998.5199				663.497	
1000.7719					664.117
1000.7719	661.825				

1000.7719		662.062		
1006.5599		662.053		
1007.2519	661.476			
1007.2829				663.925
1010.2999			663.459	
1020.7989			663.136	
1023.4459	661.363			
1025.6559				663.174
1038.9259	661.079			
1039.4479			662.956	
1039.7709		662.063		
1041.6809				663.112
1055.2489	661.733			
1055.4209		662.046		
1056.2679			662.519	
1057.1479				663.143
1072.9239				662.663
1076.5079		661.895		
1077.6839			662.529	
1077.6839	661.512			
1090.0679			662.65	
1090.4239	661.088			
1091.6109		661.834		
1093.2599				662.308
1109.8349				662.445
1112.1689	661.118			
1112.5659		661.845		
1113.2029			662.497	
1137.1089	660.953			
1137.1089		661.664		
1138.4799				662.317
1138.8549			662.246	
1147.2669			662.265	
1150.7099				662.368
1151.3529	660.79			
1151.6119		661.644		
1174.9069				662.356
1174.9069		661.44		
1174.9069	661.184			
1176.5809			662.353	
1197.8979			662.074	
1199.5279				662.076
1199.5419	659.961			
1199.9719		661.215		
1213.4259			661.682	
1214.2579	660.186			
1233.9739	659.334			
1233.9739		660.354		
1235.1379			661.842	
1255.5919				661.68
1255.6169		660.138		
1255.9349	659.557			
1258.1369			661.387	
1272.3979			661.312	
1277.2649				661.264
1277.2649	659.346			
1277.2649		660.207		
1291.8999			661.141	
1295.0189		660.239		
1295.2329	659.569			
1296.8949				661.143
1296.9799				660.844
1314.7669				660.805
1319.3309		659.971		
1320.3239			660.555	
1320.3239	659.095			

1336.2509	659.388	659.97	660.717	660.692
1352.1929	659.134			
1352.4319		659.729		
1354.3289			660.637	
1369.9479				660.383
1369.9479		659.622		
1369.9479	659.001			
1373.8309			660.535	
1383.6339				660.32
1383.6379			660.733	
1383.8839	658.985			
1383.9459		659.5		
1409.7829		658.964		
1410.5269	658.516			
1410.5269			659.97	
1413.9019				660.298
1431.4169				660.18
1432.9159	657.665			
1433.2339		658.96		
1437.8019			660.004	
1450.6889			659.947	
1454.1019	658.292			
1454.1019				659.753
1454.3069		658.909		
1469.6619				659.806
1469.6619	658.093			
1469.6619		658.842		
1471.8859			659.527	
1492.7609		658.873		
1493.5729	657.715			
1493.5729			659.507	
1495.1109				659.653
1513.1999				659.682
1514.9999			659.434	
1514.9999	657.925			
1515.0639		658.759		
1538.2309			659.272	
1541.6089		658.443		
1542.9509				659.212
1542.9509	657.38			
1563.4369				659.052
1563.4369	657.789			
1564.1339		658.553		
1565.8559			659.03	
1582.2839	657.334			
1582.6909			658.489	
1583.3139		657.95		
1583.9569				658.797
1598.7049			658.755	
1599.2979		657.639		
1599.2979	657.19			
1601.5269				658.637
1622.4819			658.692	
1623.6459		657.258		
1623.6759	656.757			
1625.5559				658.426
1633.0829			658.751	
1634.8329	656.527			
1634.8329		657.353		
1635.2239				658.807
1647.7149			658.431	
1649.4219	656.839			
1649.7239		657.264		
1649.7769				658.206
1670.3549				657.974
1671.1599		657.011		

1671.3109				658.072	
1671.3109	656.468				
1691.0989					658.019
1693.3029	656.331				
1693.3919				658.084	
1693.4399		656.883			
1717.0299				657.769	
1720.2699					657.907
1720.3929	656.076				
1720.5999		656.884			
1733.2899	655.901				
1733.2899		656.906			
1734.7949				657.238	
1756.1989				657.547	
1757.9989		655.848			
1758.1679	655.391				
1761.1229					657.102
1767.3199					657.105
1769.4099		655.794			
1769.8589				656.769	
1769.8589	655.189				
1785.2699	654.947				
1785.3089		655.171			
1785.6299				657.061	
1785.8029				656.929	
1795.1369					657.408
1795.1369	654.676				
1796.0309		655.138			
1798.1229				657.193	
1811.9979	654.576	655.108		656.869	656.844
1820.3669				656.291	
1822.4319	654.414				
1822.4319					657.12
1822.4319		655.053			
1840.0569					657.506
1840.0569	654.364				
1840.0879					
1842.7589	654.364			657.064	

Cross Section / Bank Profile Locations

Name	Type	Profile Station
(Year 3) Cross Section 3 - Pool (R2-3)	Pool XS	488
(Year 3) Cross Section 4 - Riffle (R2-3)	Riffle XS	863
(Year 3) Cross Section 5 - Riffle (R2-3)	Riffle XS	1336
(Year 3) Cross Section 6 - Pool (R2-3)	Pool XS	1811

Measurements from Graph

Bankfull Slope: 0.00795

Variable	Min	Avg	Max
S riffle	0.00357	0.01071	0.02243
S pool	0	0	0
S run	0	0	0
S glide	0	0	0
P - P	36.15	63.4	93.99
Pool length	8.71	19.84	25.77
Riffle length	9.02	15.38	22.13
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.

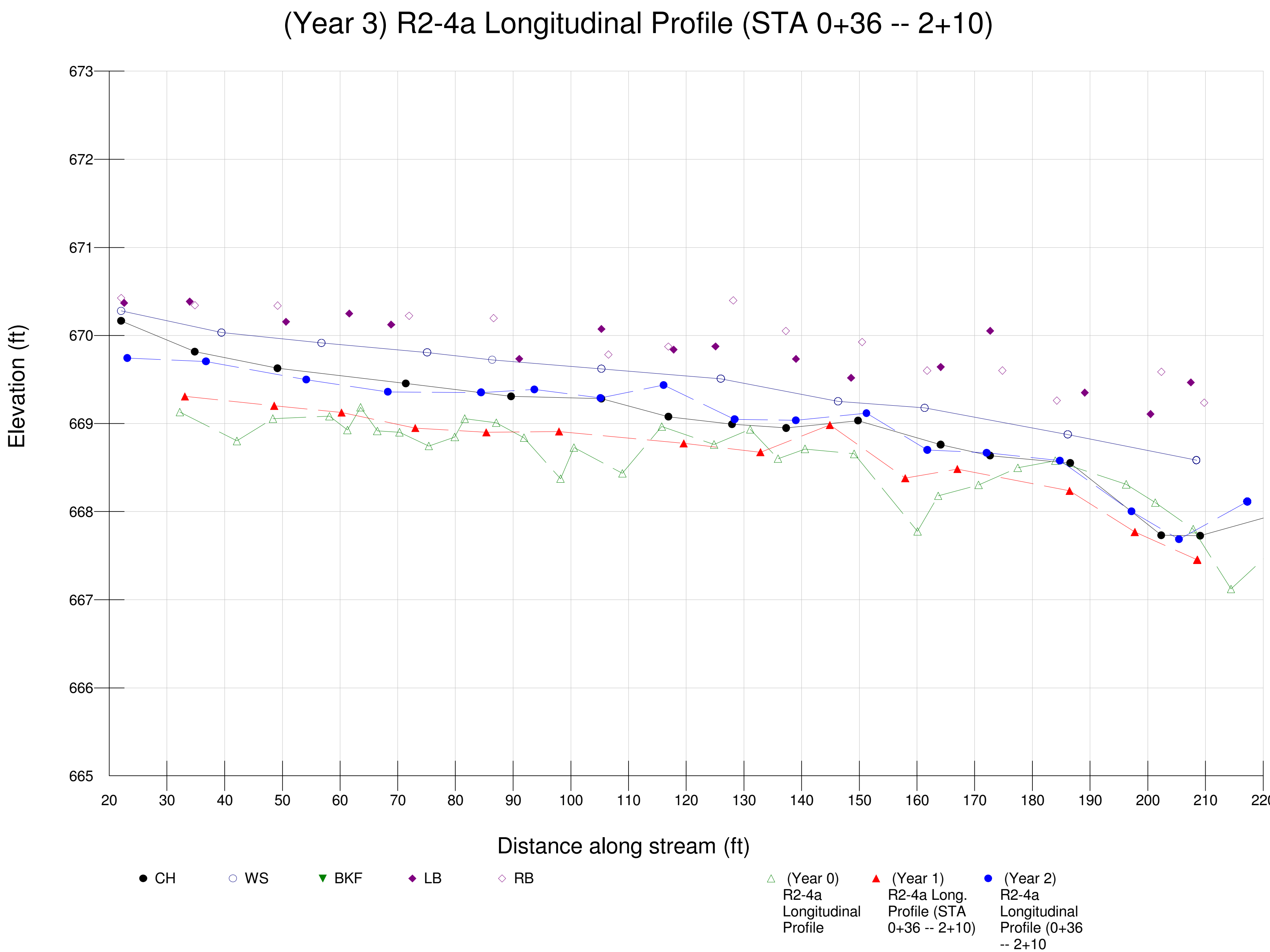
RIVERMORPH PROFILE SUMMARY

Notes

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2-3
Profile Name: (Year 3) R2-3 Long. Profile (STA 2+10 -- 18+43)
Survey Date: 11/04/2010

DIST	Note
242.8469	LEW
282.3009	LEW
313.4089	LEW
335.3149	LEW
356.6339	LEW
390.1889	LEW
408.4539	LEW
423.7609	LEW
438.1969	LEW
454.4289	LEW
474.5209	LEW
488.0689	XS3 - TW Intersect @ station 488
501.1109	LEW
515.5539	LEW
527.8839	LEW
549.8549	LEW
568.1639	LEW
582.1639	LEW
602.9019	LEW
618.6829	LEW
636.0639	LEW
656.6189	LEW
673.2619	LEW
690.7609	LEW
706.8659	LEW
725.9139	LEW
740.2919	LEW
768.8959	LEW
789.4969	LEW
807.2319	LEW
829.8369	LEW
842.3019	LEW
863.9259	XS4 - TW Intersect @ station 863
877.6899	LEW
890.4149	LEW
906.5929	LEW
920.0509	LEW
938.0699	LEW
953.6139	LEW
967.5709	LEW
982.5129	LEW
1000.7719	LEW
1006.5599	LEW
1039.7709	LEW
1055.4209	LEW
1076.5079	LEW
1091.6109	LEW
1112.5659	LEW
1137.1089	LEW
1151.6119	LEW

```
1174.9069  LEW
1199.9719  LEW
1233.9739  LEW
1255.6169  LEW
1277.2649  LEW
1295.0189  LEW
1319.3309  LEW
1336.2509  XS5 - TW Intersect @ station 1336
1352.4319  LEW
1369.9479  LEW
1383.9459  LEW
1409.7829  LEW
1433.2339  LEW
1454.3069  LEW
1469.6619  LEW
1492.7609  LEW
1515.0639  LEW
1541.6089  LEW
1564.1339  LEW
1583.3139  LEW
1599.2979  LEW
1623.6459  LEW
1634.8329  LEW
1649.7239  LEW
1671.1599  LEW
1693.4399  LEW
1720.5999  LEW
1733.2899  LEW
1757.9989  LEW
1769.4099  LEW
1785.3089  LEW
1796.0309  LEW
1811.9979  XS6 - TW Intersect @ station 1811
1822.4319  LEW
1840.0879  LEW
```


(Year 3) R2-4a Longitudinal Profile (STA 0+36 -- 2+10)
Elevation (ft)
673
672
671
670
669
668
667
666
665
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
Distance along stream (ft)
CH
WS
BKF
LB
RB
(Year 0) R2-4a Longitudinal Profile
(Year 1) R2-4a Long. Profile (STA 0+36 -- 2+10)
(Year 2) R2-4a Longitudinal Profile (0+36 -- 2+10

RIVERMORPH PROFILE SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2-4a
Profile Name: (Year 3) R2-4a Long. Profile (STA 0+36 -- 2+10)
Survey Date: 11/04/2010

Survey Data

DIST	CH	WS	BKF	LB	RB
22.0839	670.165				
22.0839		670.278			
22.0839					670.425
22.5679				670.369	
33.9449				670.385	
34.8319	669.816				
34.8319					670.344
39.4739		670.032			
49.1579	669.627				
49.1579					670.339
50.6249				670.156	
56.7779		669.916			
61.5879				670.25	
68.8589				670.123	
71.4099	669.456				
71.9529					670.223
75.1189		669.808			
86.3979		669.723			
86.6019					670.197
89.6419	669.31				
91.0629				669.734	
105.2989	669.282				
105.2989				670.073	
105.2989		669.621			
106.5329					669.783
116.9049					669.874
116.9329	669.077				
117.8119				669.839	
125.0759				669.876	
125.9949		669.509			
127.9589	668.991				
128.1529					670.399
137.2619					670.052
137.3359	668.949				
139.0049				669.733	
146.3449		669.252			
148.5839				669.519	
149.8059	669.033				
150.4829					669.925
161.3259		669.178			
161.7519					669.602
164.0989				669.642	
164.0989	668.76				
172.6769				670.054	
172.6769	668.635				
174.8049					669.603
184.2299					669.262
186.1429		668.876			
186.5639	668.551				
189.0679				669.352	

200.4759				669.108	
202.3489	667.732				
202.3489					669.586
207.4649				669.467	
208.4299		668.584			
209.0929	667.727				
209.7949					669.236
222.2259				669.156	
224.8099	668.013				

Cross Section / Bank Profile Locations

Name	Type	Profile Station

Measurements from Graph

Bankfull Slope: 0.00854

Variable	Min	Avg	Max
S riffle	0.00663	0.01086	0.01609
S pool	0	0	0
S run	0	0	0
S glide	0	0	0
P - P	29.95	37.37	44.78
Pool length	8.76	13.8	17.09
Riffle length	6.36	7.17	7.77
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.

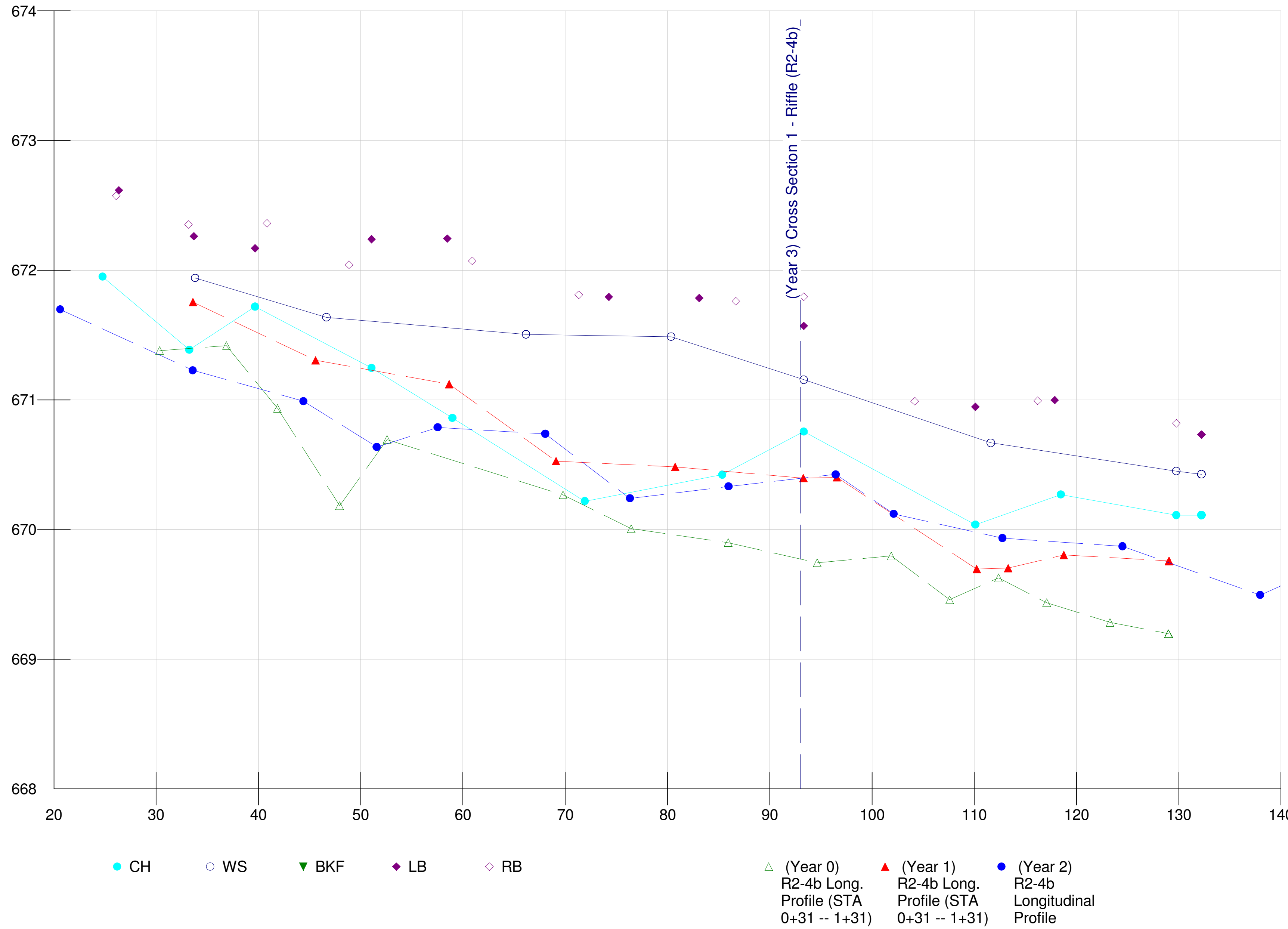
RIVERMORPH PROFILE SUMMARY

Notes

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2-4a
Profile Name: (Year 3) R2-4a Long. Profile (STA 0+36 -- 2+10)
Survey Date: 11/04/2010

DIST	Note
22.0839	LEW
39.4739	LEW
56.7779	LEW
75.1189	LEW
86.3979	LEW
105.2989	LEW
125.9949	LEW
146.3449	LEW
161.3259	LEW
186.1429	LEW
208.4299	LEW

(Year 3) R2-4b Longitudinal Profile (0+31 -- 1+31)



RIVERMORPH PROFILE SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2-4b
Profile Name: (Year 3) R2-4b Long. Profile (0+31 -- 1+31)
Survey Date: 11/04/2010

Survey Data

DIST	CH	WS	BKF	LB	RB
24.7729	671.949				
26.1089					672.574
26.3519				672.616	
33.1549					672.352
33.2439	671.386				
33.6859				672.261	
33.8149		671.94			
39.6669				672.168	
39.6669	671.719				
40.8359					672.361
46.6639		671.636			
48.8559					672.042
51.0579	671.246				
51.0579				672.238	
58.4799				672.244	
58.9809	670.86				
60.9169					672.072
66.1579		671.504			
71.3299					671.81
71.9169	670.218				
74.2639				671.794	
80.3609		671.487			
83.1039				671.785	
85.3599	670.422				
86.6849					671.76
93.3379	670.755	671.155		671.57	671.796
104.1769					670.989
110.1119	670.036				
110.1119				670.945	
111.6169		670.668			
116.2029					670.993
117.8579				670.998	
118.4709	670.269				
129.7589	670.11	670.45			670.82
132.2229	670.11	670.425		670.731	

Cross Section / Bank Profile Locations

Name	Type	Profile Station
(Year 3) Cross Section 1 - Riffle (R2-4b)	Riffle XS	93

Measurements from Graph

Bankfull Slope: 0.01539

Variable	Min	Avg	Max
S riffle	0.02213	0.0245	0.02686

S pool	0	0	0
S run	0	0	0
S glide	0	0	0
P - P	38.07	38.48	38.89
Pool length	6.19	9.47	14.62
Riffle length	7.18	7.68	8.17
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.

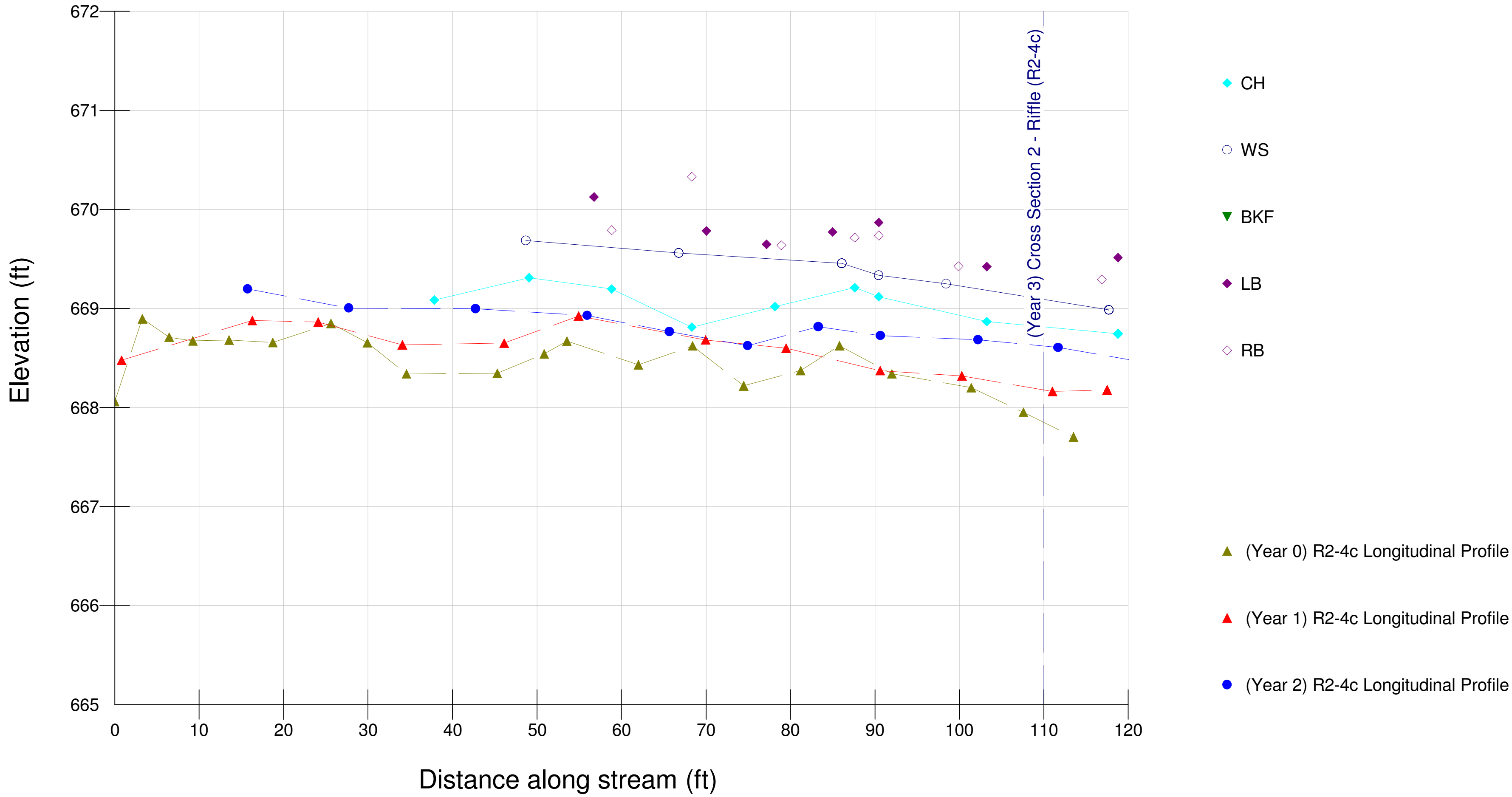
RIVERMORPH PROFILE SUMMARY

Notes

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2-4b
Profile Name: (Year 3) R2-4b Long. Profile (0+31 -- 1+31)
Survey Date: 11/04/2010

DIST	Note
33.8149	LEW
46.6639	LEW
66.1579	LEW
80.3609	LEW
93.3379	XS1 - TW Intersect @ station 93
111.6169	LEW

(Year 3) R2-4c Longitudinal Profile (STA 0+00 -- 1+00)



RIVERMORPH PROFILE SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2-4c
Profile Name: (Year 3) R2-4c Long. Profile (STA 0+00 -- 1+00)
Survey Date: 11/19/2010

Survey Data

DIST	CH	WS	BKF	LB	RB
37.843	669.085				
48.679		669.687			
49.056	669.31				
49.056					
50.505					
56.745				670.126	
58.841	669.196				
58.841					669.79
66.782		669.56			
68.34	668.812				
68.34					670.33
70.056				669.783	
77.173				669.648	
78.166	669.02				
78.933					669.639
84.986				669.772	
86.09		669.455			
87.606	669.209				
87.606					669.714
90.455	669.12	669.335		669.868	669.737
98.435		669.249			
99.897					669.426
103.234	668.868				
103.234				669.423	
116.861					669.293
117.694		668.985			
118.78				669.513	
118.78	668.744				

Cross Section / Bank Profile Locations

Name	Type	Profile Station
(Year 3) Cross Section 2 - Riffle (R2-4c)	Riffle XS	110

Measurements from Graph

Bankfull Slope: 0

Variable	Min	Avg	Max
S riffle	0.00801	0.01324	0.01847
S pool	0	0	0
S run	0	0	0
S glide	0	0	0
P - P	30.77	38.19	45.6
Pool length	11.7	11.7	11.7
Riffle length	4.49	6.27	8.05
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.

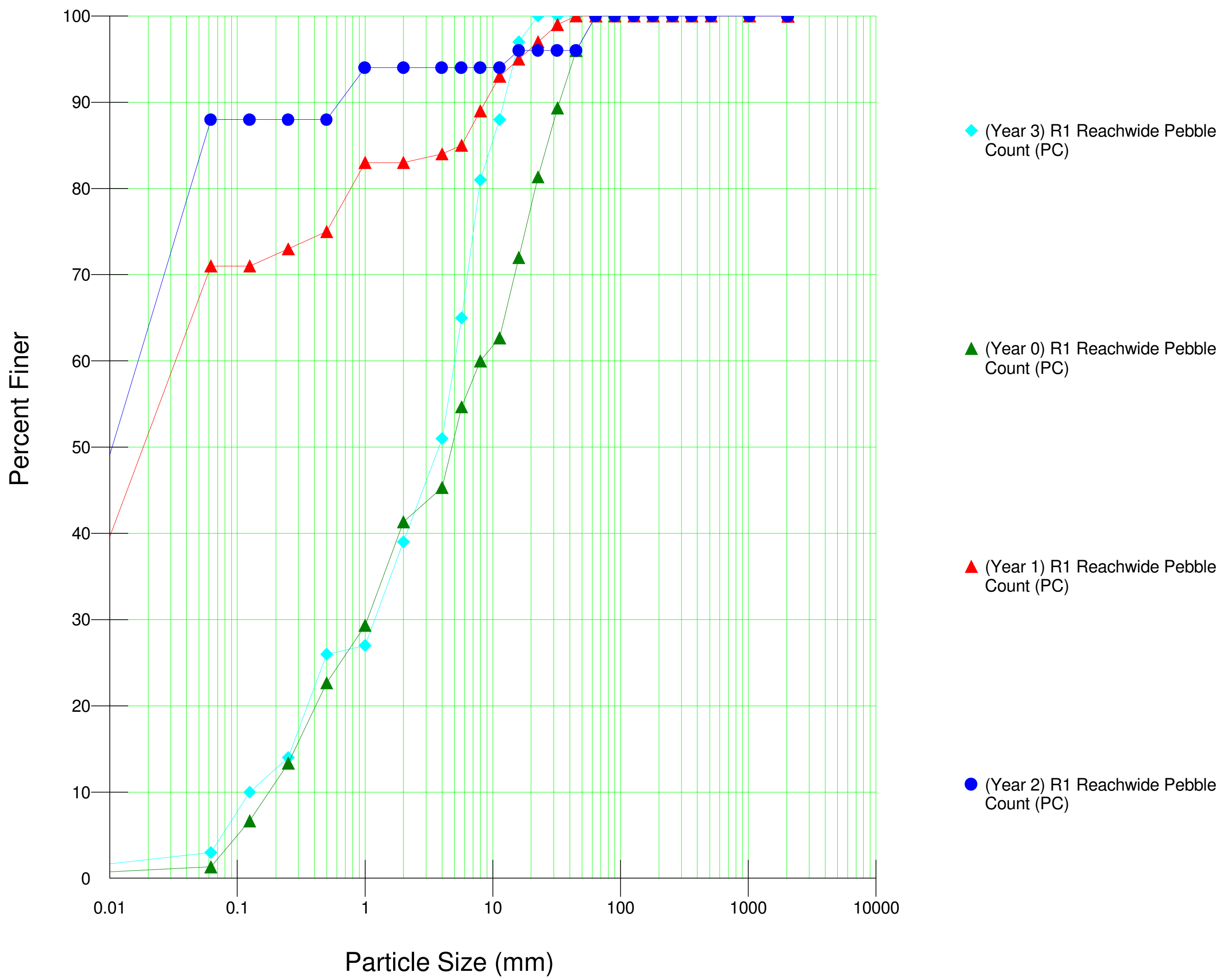
RIVERMORPH PROFILE SUMMARY

Notes

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2-4c
Profile Name: (Year 3) R2-4c Long. Profile (STA 0+00 -- 1+00)
Survey Date: 11/19/2010

DIST	Note
48.679	LEW
66.782	LEW
86.09	LEW
90.455	XS2 - TW Intersect @ station 90
98.435	LEW
117.694	LEW

(Year 3) R1 Reachwide Pebble Count



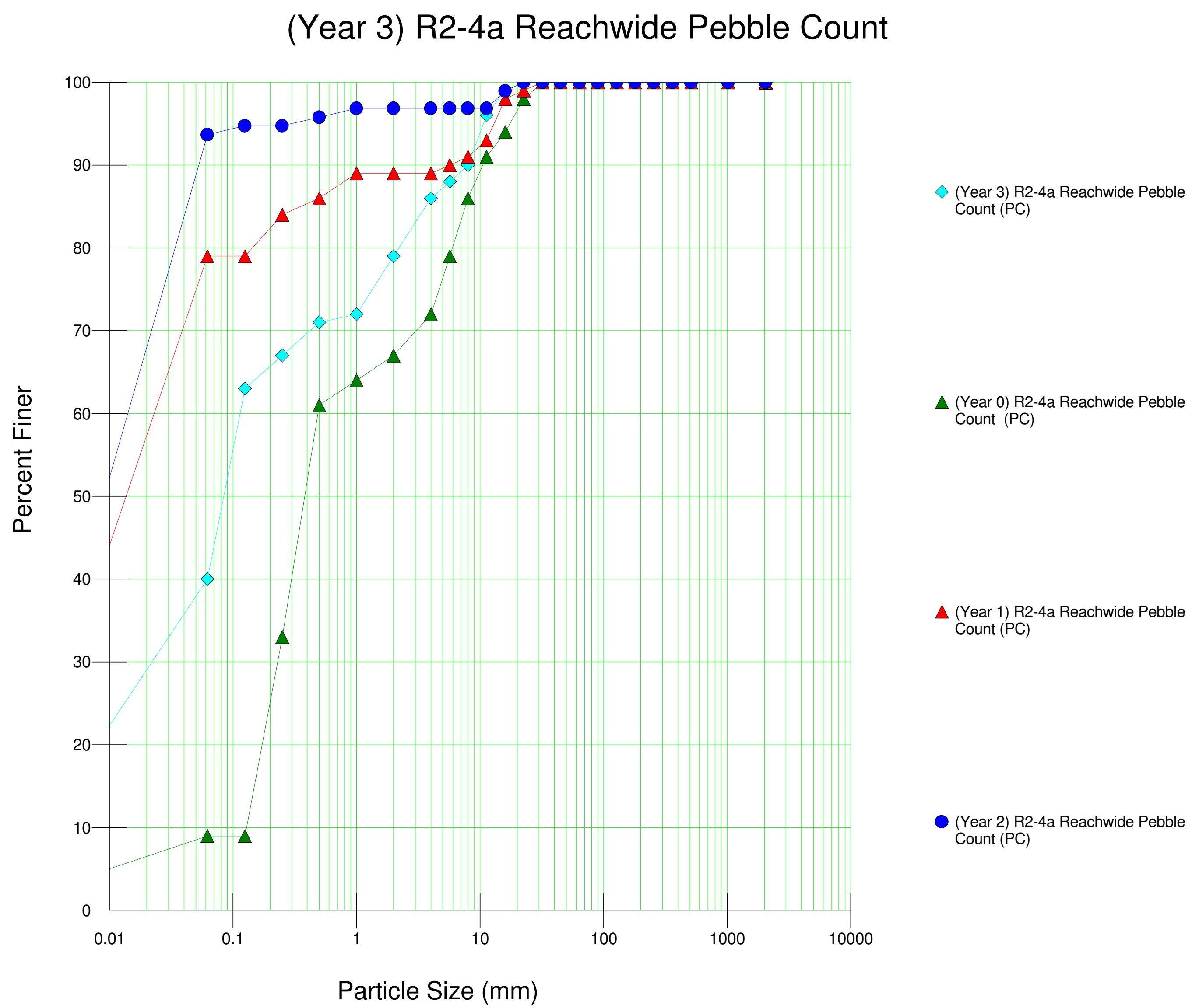
RIVERMORPH PARTICLE SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R1
Sample Name: (Year 3) R1 Reachwide Pebble Count
Survey Date: 10/06/2010

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	3	3.00	3.00
0.062 - 0.125	7	7.00	10.00
0.125 - 0.25	4	4.00	14.00
0.25 - 0.50	12	12.00	26.00
0.50 - 1.0	1	1.00	27.00
1.0 - 2.0	12	12.00	39.00
2.0 - 4.0	12	12.00	51.00
4.0 - 5.7	14	14.00	65.00
5.7 - 8.0	16	16.00	81.00
8.0 - 11.3	7	7.00	88.00
11.3 - 16.0	9	9.00	97.00
16.0 - 22.6	3	3.00	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)	0.29
D35 (mm)	1.67
D50 (mm)	3.83
D84 (mm)	9.41
D95 (mm)	14.96
D100 (mm)	22.6
Silt/Clay (%)	3
Sand (%)	36
Gravel (%)	61
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Particles = 100.



(Year 3) R2-4a Reachwide Pebble Count
Percent Finer
Particle Size (mm)
0
10
20
30
40
50
60
70
80
90
100
0.01
0.1
1
10
100
1000
10000
(Year 3) R2-4a Reachwide Pebble Count (PC)
(Year 0) R2-4a Reachwide Pebble Count (PC)
(Year 1) R2-4a Reachwide Pebble Count (PC)
(Year 2) R2-4a Reachwide Pebble Count (PC)

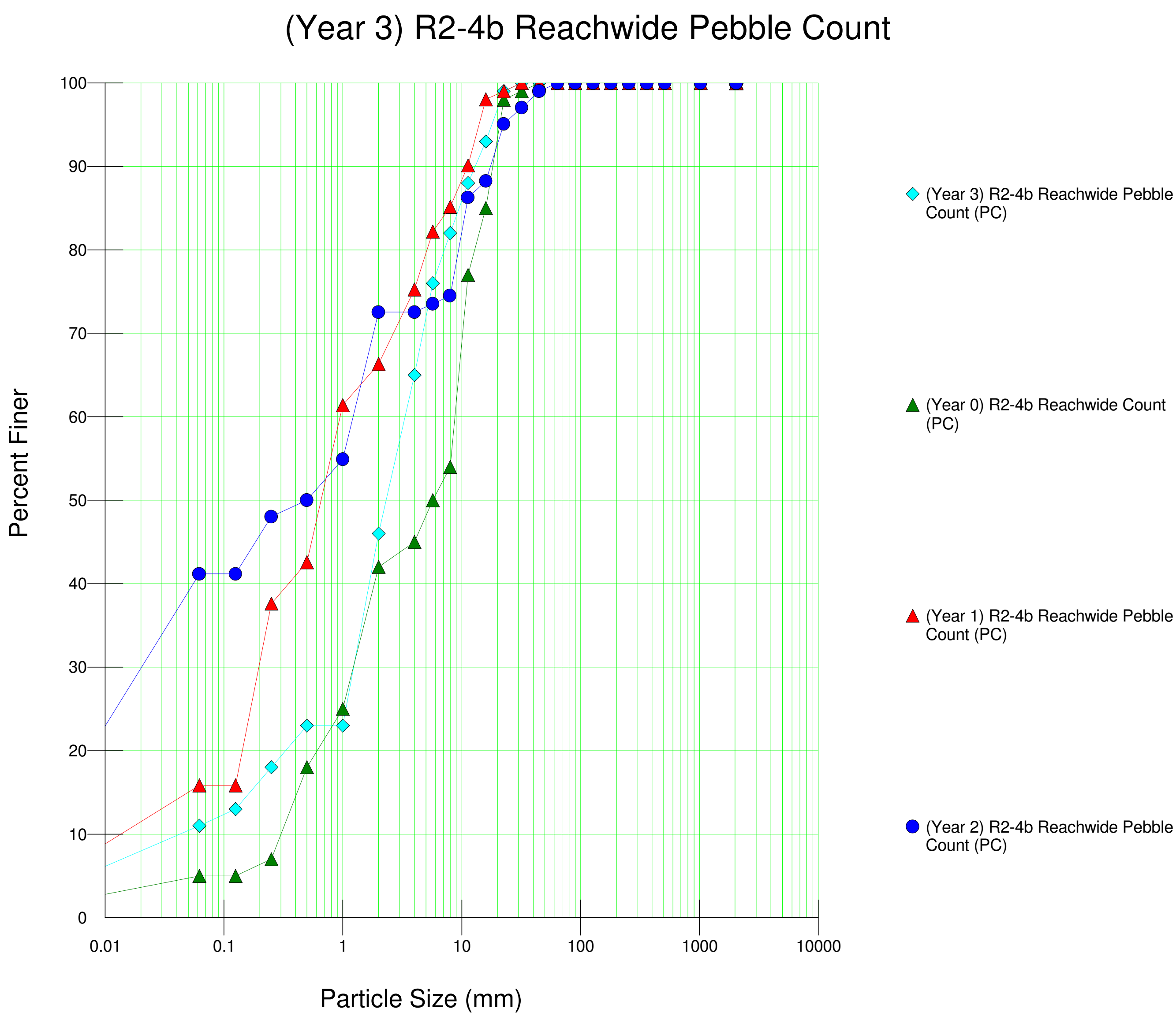
RIVERMORPH PARTICLE SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2-4a
Sample Name: (Year 3) R2-4a Reachwide Pebble Count
Survey Date: 10/06/2010

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	40	40.00	40.00
0.062 - 0.125	23	23.00	63.00
0.125 - 0.25	4	4.00	67.00
0.25 - 0.50	4	4.00	71.00
0.50 - 1.0	1	1.00	72.00
1.0 - 2.0	7	7.00	79.00
2.0 - 4.0	7	7.00	86.00
4.0 - 5.7	2	2.00	88.00
5.7 - 8.0	2	2.00	90.00
8.0 - 11.3	6	6.00	96.00
11.3 - 16.0	3	3.00	99.00
16.0 - 22.6	1	1.00	100.00
22.6 - 32.0	0	0.00	100.00
32 - 45	0	0.00	100.00
45 - 64	0	0.00	100.00
64 - 90	0	0.00	100.00
90 - 128	0	0.00	100.00
128 - 180	0	0.00	100.00
180 - 256	0	0.00	100.00
256 - 362	0	0.00	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	0.03
D35 (mm)	0.05
D50 (mm)	0.09
D84 (mm)	3.43
D95 (mm)	10.75
D100 (mm)	22.6
Silt/Clay (%)	40
Sand (%)	39
Gravel (%)	21
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Particles = 100.


(Year 3) R2-4b Reachwide Pebble Count
Percent Finer
Particle Size (mm)
0
10
20
30
40
50
60
70
80
90
100
0.01
0.1
1
10
100
1000
10000
(Year 3) R2-4b Reachwide Pebble Count (PC)
(Year 0) R2-4b Reachwide Count (PC)
(Year 1) R2-4b Reachwide Pebble Count (PC)
(Year 2) R2-4b Reachwide Pebble Count (PC)

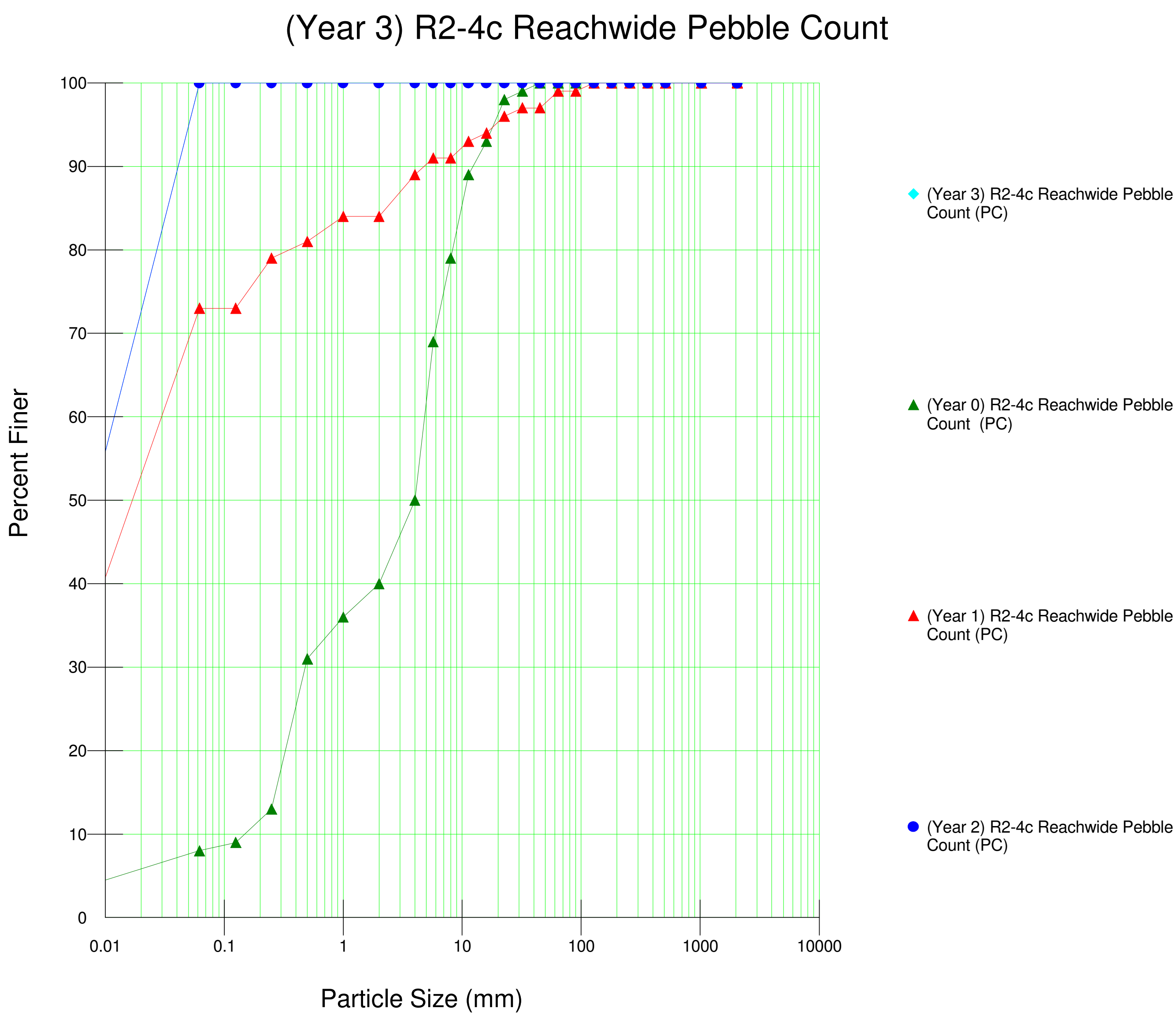
RIVERMORPH PARTICLE SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2-4b
Sample Name: (Year 3) R2-4b Reachwide Pebble Count
Survey Date: 10/06/2010

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	11	11.00	11.00
0.062 - 0.125	2	2.00	13.00
0.125 - 0.25	5	5.00	18.00
0.25 - 0.50	5	5.00	23.00
0.50 - 1.0	0	0.00	23.00
1.0 - 2.0	23	23.00	46.00
2.0 - 4.0	19	19.00	65.00
4.0 - 5.7	11	11.00	76.00
5.7 - 8.0	6	6.00	82.00
8.0 - 11.3	6	6.00	88.00
11.3 - 16.0	5	5.00	93.00
16.0 - 22.6	6	6.00	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)	0.2
D35 (mm)	1.52
D50 (mm)	2.42
D84 (mm)	9.1
D95 (mm)	18.2
D100 (mm)	32
Silt/Clay (%)	11
Sand (%)	35
Gravel (%)	54
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Particles = 100.



(Year 3) R2-4c Reachwide Pebble Count
Percent Finer
0
10
20
30
40
50
60
70
80
90
100
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)
(Year 3) R2-4c Reachwide Pebble Count (PC)
(Year 0) R2-4c Reachwide Pebble Count (PC)
(Year 1) R2-4c Reachwide Pebble Count (PC)
(Year 2) R2-4c Reachwide Pebble Count (PC)

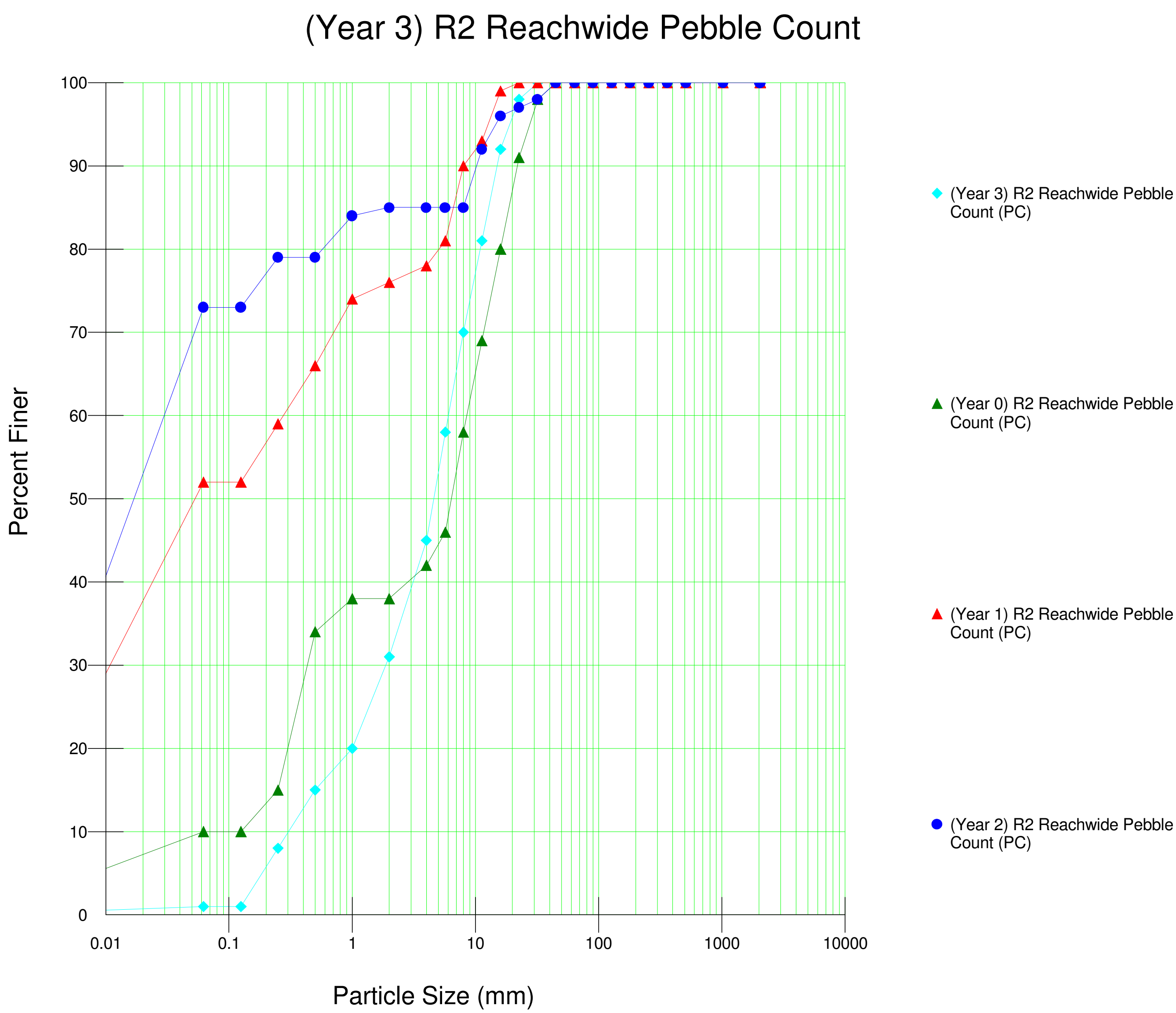
RIVERMORPH PARTICLE SUMMARY

River Name: (Year 3) Reedy Fork Creek
Reach Name: R2-4c
Sample Name: (Year 3) R2-4c Reachwide Pebble Count
Survey Date: 10/06/2010

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	100	100.00	100.00
0.062 - 0.125	0	0.00	100.00
0.125 - 0.25	0	0.00	100.00
0.25 - 0.50	0	0.00	100.00
0.50 - 1.0	0	0.00	100.00
1.0 - 2.0	0	0.00	100.00
2.0 - 4.0	0	0.00	100.00
4.0 - 5.7	0	0.00	100.00
5.7 - 8.0	0	0.00	100.00
8.0 - 11.3	0	0.00	100.00
11.3 - 16.0	0	0.00	100.00
16.0 - 22.6	0	0.00	100.00
22.6 - 32.0	0	0.00	100.00
32 - 45	0	0.00	100.00
45 - 64	0	0.00	100.00
64 - 90	0	0.00	100.00
90 - 128	0	0.00	100.00
128 - 180	0	0.00	100.00
180 - 256	0	0.00	100.00
256 - 362	0	0.00	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	0.01
D35 (mm)	0.02
D50 (mm)	0.03
D84 (mm)	0.05
D95 (mm)	0.06
D100 (mm)	0.06
Silt/Clay (%)	100
Sand (%)	0
Gravel (%)	0
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Particles = 100.


(Year 3) R2 Reachwide Pebble Count
Percent Finer
Particle Size (mm)
0
10
20
30
40
50
60
70
80
90
100
0.01
0.1
1
10
100
1000
10000
(Year 3) R2 Reachwide Pebble Count (PC)
(Year 0) R2 Reachwide Pebble Count (PC)
(Year 1) R2 Reachwide Pebble Count (PC)
(Year 2) R2 Reachwide Pebble Count (PC)

RIVERMORPH PARTICLE SUMMARY

River Name:	(Year 3) Reedy Fork Creek
Reach Name:	R2-3
Sample Name:	(Year 3) R2 Reachwide Pebble Count
Survey Date:	10/06/2010

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	1	1.00	1.00
0.062 - 0.125	0	0.00	1.00
0.125 - 0.25	7	7.00	8.00
0.25 - 0.50	7	7.00	15.00
0.50 - 1.0	5	5.00	20.00
1.0 - 2.0	11	11.00	31.00
2.0 - 4.0	14	14.00	45.00
4.0 - 5.7	13	13.00	58.00
5.7 - 8.0	12	12.00	70.00
8.0 - 11.3	11	11.00	81.00
11.3 - 16.0	11	11.00	92.00
16.0 - 22.6	6	6.00	98.00
22.6 - 32.0	2	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)	0.6
D35 (mm)	2.57
D50 (mm)	4.65
D84 (mm)	12.58
D95 (mm)	19.3
D100 (mm)	32
Silt/Clay (%)	1
Sand (%)	30
Gravel (%)	69
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Particles = 100.

Project Name: Tributary to Reedy Fork Creek **Installation Date:** 4/8/2008

County, State: Guilford County, North Carolina

Year of Sampling

Gauge washed away in 1st year

Crest Gauge Information			2008	2008	2009	2010	2011	2012	
Gauge ID	Bankfull Elevation (ft)	Zero Elevation (ft)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total Exceedance by Gauge
1	653.48	653.24	0	1	1	1	0	0	3
2	629.42	629.42	0	1	0	0	0	0	1
3	633.70	633.62	0	1	1	1	0	0	3
4			0	0	0	0	0	0	0
5			0	0	0	0	0	0	0
6			0	0	0	0	0	0	0
7			0	0	0	0	0	0	0
8			0	0	0	0	0	0	0
9			0	0	0	0	0	0	0
10			0	0	0	0	0	0	0