TRIBUTARY TO REEDY FORK CREEK
STREAM RESTORATION

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GUILFORD COUNTY, NORTH CAROLINA

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Ecosystem Enhancement Program
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ANNUAL MONITORING REPORT (YEAR 4 OF 5)

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Table of Contents

1.0 Executive Summary

This annual monitoring report details the monitoring activities through the fourth 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.

After Monitoring Year 1 where supplemental planting took place, the results of the vegetation monitoring have shown increased improvement as time passes. This trend has continued in Year 4 with 241 counted stems returning a range of 377 stems per acre to 850 stems per acre with an average of 608 stems per acre compared to Year 3 with 241 counted stems returning a range of 377 stems per acre to 769 stems per acre with an average of 596 stems per acre. Similarly, the visual appearance of trees across the site has increased as the bare roots have been able to out compete the herbaceous layer therefore becoming more visible. Given this trend, Mulkey did not make any additional recommendations or take any other action other than to proceed with the annual vegetation monitoring.

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 fourth year of monitoring, the BEHI information was not 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.

Monitoring results from the three previous years have all indicated stability in terms of geomorphic processes. Year 4 monitoring has yielded the same results with the longitudinal profiles, cross sections, horizontal geometry and pebble counts all returning data that indicates stable C type stream channels with typical yearly fluctuations. The compilation of four 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 strong 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.

3.1.6 Vegetative Monitoring Results for Year 4 of 5

In late September 2011, the vegetation monitoring for Monitoring Year 4 was conducted. The methodologies described in the Vegetation Monitoring Methodology Section above were used for the vegetation monitoring at RFC for Monitoring Year 4. 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

4 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 4 taken from the photo reference points at each of the 16 vegetation plots. Photos were also taken at each of the eight permanent photo reference points. Appendix C compares the photos from the initial baseline photos through the Monitoring Year 4 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 4 stem counts were documented and the survivability calculated from the Monitoring Year 2 totals following replanting. Monitoring Year 4 showed that the counts for the 16 vegetation plots ranged from 377 to 850 stems per acre, with an average survivability of 608 stems per acre. The current results indicate that the survivability of the planted woody vegetation at RFC has been maintained from Year 3. Slight improvements in survivability were made in Year 4 when previously flagged trees were located that had not previously been found in Year 3. Due to a heavy herbaceous cover during Years 2 and 3, many trees were not easily located or had appeared to have died. The current stem counts are on course to achieve the success criteria of 260 stems per acre after five years. The photo comparison of the baseline data through Monitoring Year 4 at the 16 vegetation plots, photo reference points, and the eight permanent photo reference points shows the planted trees are rising above the robust herbaceous layer and becoming the dominant vegetative layer. Comparisons between Year 3 and Year 4 photos showed that the planted trees have become well established and continued their increased growth pattern. Significant tree growth was visually apparent during the monitoring period due to difficulties in conducting longitudinal and cross sectional stream surveys. 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.

3.2.6 Stream Monitoring Results for Year 4 of 5

In early October 2011, the stream monitoring for Monitoring Year 4 was conducted. The methodologies described in the Stream Monitoring Methodology Section above were used for the stream monitoring at RFC for Monitoring Year 4. 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 4 with all previous photos at each of the seven cross sections. Appendix E provides an overlay of the Monitoring Years 1 through 4 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 through 4 for each of the project stream reaches indicate increased stability as the variance in data has stabilized. This variance can be attributed to expected minor adjustments to the width to depth ratios, entrenchment ratios, and depth associated with the establishment of vegetation (root mass) and minor channel adjustments; however it is more likely to be a result of human error in data collection techniques. Nonetheless, the data remains within the design tolerances and is increasingly consistent with data collected in previous monitoring years. The cross section photo comparisons of the baseline conditions with Monitoring Years 1 through 4 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. Similar to the results in the dimension variables, the pattern variables are becoming increasingly consistent as more monitoring data becomes available. The data compiled for Monitoring Year 4 is a subset of the design variable ranges in all instances except in belt width values. As in previous years, the minimum belt width values are attributed to locations where the valley changes direction thus compromising the ability to accurately measure belt width. Nonetheless, field verification has confirmed these areas are experiencing the same level of stability as the rest of the project.

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. Over successive monitoring years, the longitudinal profiles have become the least accurate tool when comparing overlays (Appendix E). The natural variance expected within a reach is overshadowed by the increased amount of human error associated with beginning and ending the survey in reproducible locations compounded by computer projections of distances calculated between survey shots. Without precisely reproducing each individual shot, the accuracy of the distance calculated for stream length is directly dependent upon the number of shots taken along a reach and indirectly dependent upon the distance of the reach and bankfull width. Thus if the distance along the channel differs for each year in known locations (i.e stream crossings, structure locations, ect.) the overlay will incorrectly indicate aggradation or degradation. This is inconsistent with the calculated variables of slope, sinuosity, depth, bankfull area, and bankfull width calculated at known locations through the reaches. Therefore, without a more developed method of determining distances to be able to accurately compare the same locations along a reach, the implications of the overlays are not as reliable as the calculated variables. Given this construct, the vertical indicators are consistent with the design parameters and with previous monitoring years' calculated variables indicating stability throughout the project.

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 4 are shown in Appendix E. Pebble count raw data for Monitoring Year 4 can be found behind each respective graph.

The comparison of the results of the pebble counts for Monitoring Year 3 and Monitoring Year 4 showed varied fluctuation of the d50 and d84 bed material along the sampled project stream reaches. The d50 and d84 bed material decreased or fined for R1, R2-4b and R2-4c. The d50 and d84 bed material remained essentially stable for stream reaches R2-4a, R2-3 and R2-2. As mentioned in Monitoring Years 2 and 3, Mulkey noted that herbaceous vegetation was thriving in the areas surrounding 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 silt may become the stable bed material as large, purging storm flows are not experienced in this reach. With the consistency in the data to present, the indication is R1, R2-4a, and R2-4c will be stable C5/6 or sand/silt bed streams while R2-4b and R2 will be stable C4/5 or small gravel bed streams.

No stream bank stability monitoring was conducted for Monitoring Year 4 using BEHI and sediment transport estimates. Previous sediment transport estimates are shown 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.

The crest gages (one each at Reach R1 and Reach R2) were not checked during the Monitoring Year 4 surveys as the previous three years have exceeded the monitoring success criteria. However, wrack lines and alluvial deposition was observed above the bankfull stage across RFC during the Monitoring Year 4 surveys, suggesting a flood event in excess of the bankfull stage. Table X lists the information related to the verification of bankfull events at RFC for the previous monitoring years while the raw data can be found in Appendix E.

Photo documentation and project-wide visual assessment were used to complement the other Monitoring Year 4 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 4. 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. No stream problems areas were identified during the monitoring period (Table XII).

Overall, the Monitoring Year 4 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 year 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 four 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

Mulkey Engineers and Consultants. 2008. Tributary to Reedy Fork Creek Stream Restoration Mitigation Report. July 2008.

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

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

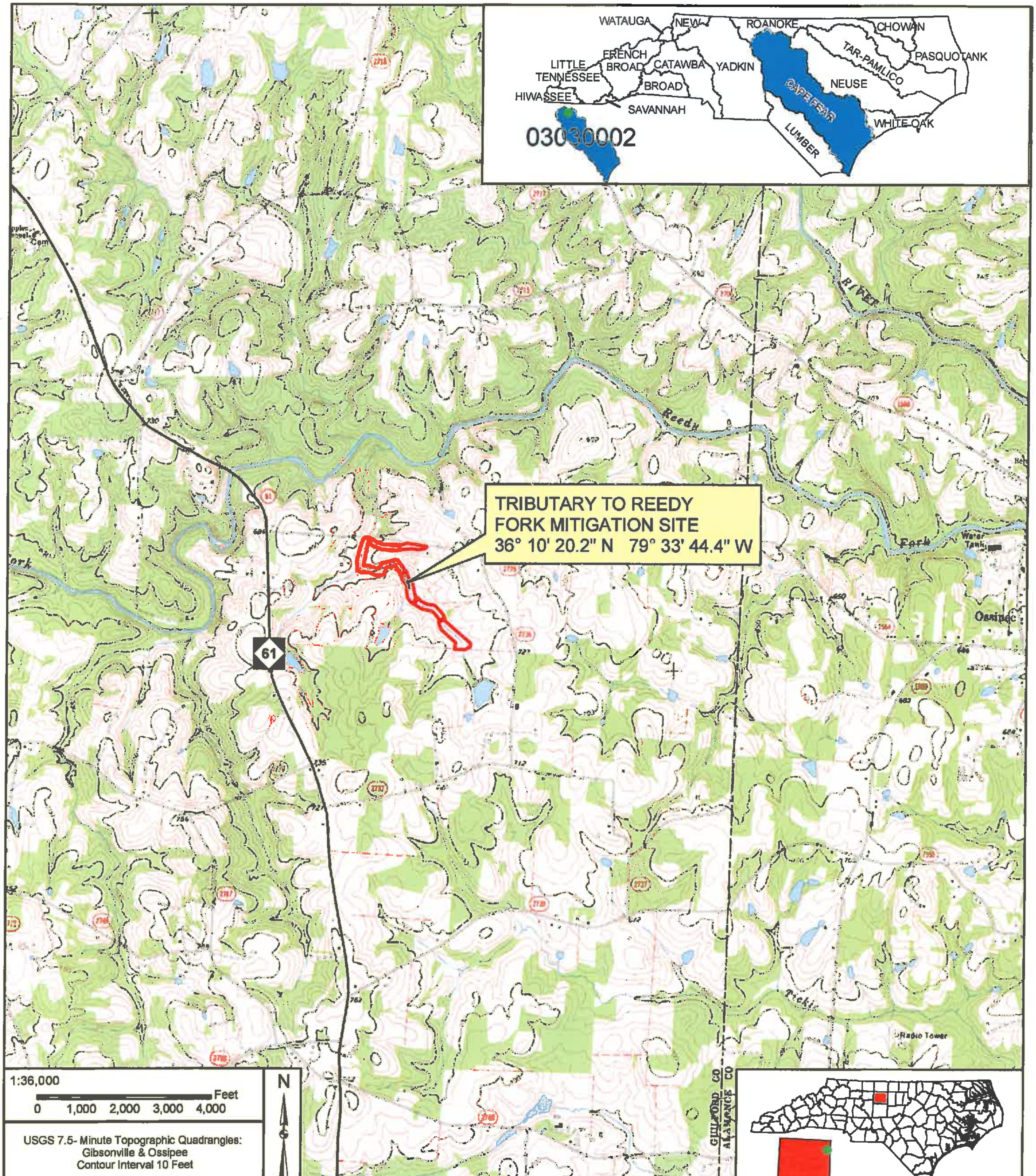
Rosgen, D.L. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.

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

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

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

Figures



MULKEY

PROJECT NO. D06028-A

LOCATION MAP

TRIBUTARY TO REEDY FORK

GUILFORD COUNTY, NORTH CAROLINA

May 30, 2008

Figure

1

Tables

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
EII = Enhancement II

P1 = Priority I
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	Oct-11	Dec-11
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 4 for Each Species Arranged by Plot
Tribury 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	Year 4 Totals	Survival % [C]
Shrubs																							
Cornus amomum																	**1**	**1**	**1**	**1**	**0**	**0**	**0%**
Trees																							
Betula nigra		6	5			1	1	4	2	2	1			3	1	1	24	23	17	29	28	27	93%
Diospyros virginiana		2		2			2			1	3	1	5		3		25	26	17	21	17	19	90%
Juglans nigra	6				3		1	1			2	4	3	1			0	0	0	28	21	21	75%
Pinus echinata				1	1								2				19	15	6	5	4	4	80%
Pinus strobus				2								3		1			14	14	4	8	5	6	75%
Pinus virginiana				1									1	1			11	15	8	4	3	3	75%
Prunus serotina																	4	4	0	0	0	0	NLE
Plantanus occidentalis				1	3		3			3	4			3	7	7	0	0	0	32	31	31	97%
Quercus alba	2	2		2	1				1		6	4			3	1	20	23	17	23	21	22	96%
Quercus falcata														1		1	32	45	25	2	2	2	100%
Quercus michauxii			3	3	1	1	1	2	4	4	1		2	3	3	4	28	32	28	38	33	32	84%
Quercus nigra		1		1	1	9		11	4	4		1				1	52	37	24	38	31	33	87%
Quercus phellos	12	1	5	3	3	5	1	3		4	1				1		62	57	40	45	38	39	87%
Salix nigra									2								2	2	2	2	2	2	100%
Totals	20	12	13	16	13	16	9	21	13	18	18	13	13	13	18	15	294	294	189	276	241	241	87%
																	Stems Per Acre Summary						
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	803.2	487.8	530.6	637.5	522.1	645.2	376.6	850.2	530.6	734.7	717.1	524.2	532.8	503.9	725.8	604.8	377	608	850				

[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 4 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 Tributary to Reedy Fork Creek Stream Restoration / D06028-A			
Feature/Issue	**Station / Range**	**Probable Cause**	**Photo No. (If Available)**
No problem areas observed in Year 4 (2011)	All project reaches	N/A	N/A
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	8.9																										
Floodprone Width (ft)	78.0	76.7	77.5	73.7																										
BKF Cross Sectional Area (sq. ft.)	5.3	5.0	5.2	4.4																										
BKF Mean Depth (ft)	0.69	0.58	0.58	0.50																										
BKF Max Depth (ft)	1.57	1.52	1.55	1.44																										
Width/Depth Ratio	11.2	14.9	15.2	17.8																										
Entrenchment Ratio	10.1	8.9	8.8	8.3																										
Wetted Perimeter (ft)	8.6	9.4	9.5	9.7																										
Hydraulic Radius (ft)	0.62	0.53	0.54	0.46																										

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	3.8	23.9	9.5			
Radius of Curvature (ft)	7.2	20.8	11.8	6.8	19.8	12.7	8.0	19.0	13.1	7.8	15.3	11.9			
Meander Wavelength (ft)	28.4	50.1	38.8	31.4	49.7	39.1	26.0	51.4	38.9	31.9	50.2	39.0			
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	6.3	13.8	8.6			
Riffle Slope (ft/ft)	0.019	0.177	0.063	0.030	0.070	0.054	0.011	0.106	0.040	0.014	0.052	0.038			
Pool Length (ft)	7.0	13.9	10.7	6.8	8.9	8.0	6.3	15.3	11.4	7.1	10.6	8.6			
Pool Spacing (ft)	23.2	68.8	37.1	21.7	41.5	31.5	16.8	50.9	32.4	17.5	40.7	29.9			
Substrate															
d50 (mm)	0.04			0.04			3.83			0.05					
d84 (mm)	4.00			0.06			9.41			0.86					
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0196			0.0196			0.0192			0.0197					
Monitored Channel Length (ft)	627			602			611			617					
Monitored Valley Length (ft)	499			493			499			499					
Sinuosity	1.26			1.22			1.22			1.24					
Total Channel Length (ft)	1632			1632			1632			1632					
Rosgen Classification	C6			C6			C4			C6					

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	2.2	70.5	40.2			
Radius of Curvature (ft)	23.6	42.6	30.1	24.1	55.9	36.0	25.8	36.0	32.4	28.8	44.0	35.6			
Meander Wavelength (ft)	81.3	102.4	90.8	80.2	152.5	110.0	84.8	157.8	111.3	86.3	155.5	110.9			
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	20.1	22.5	21.4			
Riffle Slope (ft/ft)	0.009	0.066	0.029	0.018	0.046	0.028	0.009	0.025	0.016	0.002	0.034	0.027			
Pool Length (ft)	16.5	60.3	29.7	13.6	60.9	29.2	17.4	55.6	32.3	17.1	22.0	19.9			
Pool Spacing (ft)	21.4	99.2	55.7	89.1	117.2	101.0	59.5	105.3	81.1	25.9	78.7	57.7			
Substrate															
d50 (mm)	0.06			0.04			4.65			4.00					
d84 (mm)	6.47			1.00			12.58			12.22					
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0108			0.0112			0.0111			0.0104					
Monitored Channel Length (ft)	476			442			466			447					
Monitored Valley Length (ft)	356			329			356			356					
Sinuosity	1.34			1.35			1.31			1.26					
Total Channel Length (ft)	2544			2544			2544			2544					
Rosgen Classification	C6			C6			C4			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	11.58		10.8	10.77	11.0	11.34		9.95	10.41	10.9	12.61		10.87	12.0	10.89	10.61											
Floodprone Width (ft)	71.78	64.05	65.0	67.38		60.3	62.5	76.0	77.6		76.64	75.66	79.7	77.74		92.8	100.0	100.0	100.0											
BKF Cross Sectional Area (sq. ft.)	10.0	8.6	8.1	7.5		6.2	5.1	6.7	6.1		6.3	5.4	6.0	5.7		10.05	10.35	10.84	9.6											
BKF Mean Depth (ft)	0.99	0.73	0.70	0.65		0.57	0.47	0.60	0.53		0.63	0.52	0.55	0..45		0.92	0.86	1.00	0.91											
BKF Max Depth (ft)	1.82	1.62	1.67	1.77		1.07	1.18	1.24	1.28		1.10	0.99	1.3	1.05		1.89	2.29	2.26	2.08											
Width/Depth Ratio	10.2	16.1	16.53	17.82		19.0	22.9	18.33	21.4		15.79	20.0	19.82	28.0		11.82	13.93	10.89	11.66											
Entrenchment Ratio	7.1	5.5	5.6	5.8		5.6	5.8	6.9	6.8		7.7	7.3	7.3	6.2		8.5	8.4	9.2	9.4											
Wetted Perimeter (ft)	11.1	12.6	12.19	13.0		11.2	11.5	11.5	12.0		10.38	10.7	11.39	12.89		11.7	13.5	12.0	11.6											
Hydraulic Radius (ft)	0.90	0.68	0.66	0.58		0.55	0.45	0.58	0.50		0.61	0.50	0.53	0.44		0.86	0.77	0.91	0.83											

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	4.0	58.3	23.8			
Radius of Curvature (ft)	14.3	37.2	22.7	14.0	41.5	24.3	14.5	40.5	24.8	13.8	45.1	24.4			
Meander Wavelength (ft)	57.7	98.0	79.8	55.1	98.6	79.7	56.2	99.4	79.8	57.7	98.3	80.4			
Meander Width Ratio	0.3	4.2	2.4	0.2	3.8	2.2	0.2	3.5	2.0	0.3	4.9	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	10.0	31.4	18.3			
Riffle Slope (ft/ft)	0.009	0.056	0.021	0.011	0.041	0.023	0.004	0.022	0.011	0.008	0.091	0.026			
Pool Length (ft)	11.2	30.4	19.7	9.2	35.2	18.7	8.7	25.8	19.8	15.5	33.1	24.9			
Pool Spacing (ft)	24.3	95.9	56.6	17.1	82.3	50.9	36.2	94.0	63.4	28.5	82.1	47.5			
Substrate															
d50 (mm)		0.06			0.04			4.65			4.00				
d84 (mm)		6.47			1.00			12.58			12.22				
Additional Reach Parameters															
Bankfull Slope (ft/ft)		0.0076			0.0077			0.0080			0.0075				
Monitored Channel Length (ft)		**1608**			**1629**			**1583**			1620				
Monitored Valley Length (ft)		1305			1301			1305			1305				
Sinuosity		1.23			1.25			1.21			1.24				
Total Channel Length (ft)		1771			1771			1771			1771				
Rosgen Classification		C6			C6			C4			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	10.6	22.5	16.2			
Radius of Curvature (ft)	15.1	35.4	21.6	14.5	27.4	19.8	13.7	28.0	20.7	13.8	26.5	18.4			
Meander Wavelength (ft)	58.9	66.4	62.2	59.3	67.0	63.8	60.9	65.7	63.9	59.6	70.8	64.6			
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	8.00	9.55	8.58			
Riffle Slope (ft/ft)	0.004	0.033	0.016		No water		0.007	0.016	0.011	0.007	0.032	0.018			
Pool Length (ft)	14.2	18.0	16.1	9.1	19.3	14.2	8.76	17.09	13.8	13.1	20.7	16.6			
Pool Spacing (ft)	25.1	54.8	78.3	24.7	42.5	34.4	30.0	44.8	37.4	36.5	44.2	40.2			
Substrate															
d50 (mm)	0.04			0.03			0.09			0.08					
d84 (mm)	0.25			0.06			3.43			4.34					
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0074			0.0078			0.0085			0.0088					
Monitored Channel Length (ft)	169			205			**173**			**182**					
Monitored Valley Length (ft)	147			174			147			154					
Sinuosity	1.15			1.18			1.18			1.18					
Total Channel Length (ft)	231			231			231			231					
Rosgen Classification	C6			C6			C5			C5					

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	13.0																										
Floodprone Width (ft)	37.18	38.0	40.09	40.0																										
BKF Cross Sectional Area (sq. ft.)	4.5	4.2	3.8	3.1																										
BKF Mean Depth (ft)	0.48	0.45	0.41	0.24																										
BKF Max Depth (ft)	0.84	0.89	0.82	0.54																										
Width/Depth Ratio	19.54	20.69	22.76	54.0																										
Entrenchment Ratio	4.0	4.1	4.3	3.1																										
Wetted Perimeter (ft)	9.7	9.8	9.5	13.1																										
Hydraulic Radius (ft)	0.47	0.43	0.40	0.24																										

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	2.5	15.5	9.4			
Radius of Curvature (ft)	13.2	39.3	20.4	16.0	21.6	18.1	13.2	17.4	15.4	13.6	18.5	16.5			
Meander Wavelength (ft)	46.1	56.5	51.3	43.1	55.8	49.5	45.0	54.2	50.1	47.0	55.4	51.2			
Meander Width Ratio	0.9	1.8	1.4	0.7	1.3	0.9	0.2	1.4	0.9	0.2	1.2	0.7			
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	5.03	7.83	6.43			
Riffle Slope (ft/ft)	0.004	0.048	0.025	0.011	0.027	0.017	0.022	0.027	0.025	0.019	0.088	0.054			
Pool Length (ft)	5.03	13.29	9.16	7.77	12.99	9.76	6.2	14.6	9.5	10.1	15.0	13.4			
Pool Spacing (ft)	23.92	40.72	33.48	24.71	44.75	61.9	38.1	38.9	38.5	21.8	36.1	28.6			
Substrate															
d50 (mm)	0.70			0.50			2.41			0.17					
d84 (mm)	7.11			10.66			9.10			3.81					
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.0212			0.0145			0.0154			0.0163					
Monitored Channel Length (ft)	**119**			**152**			116			118					
Monitored Valley Length (ft)	104			134			103			103					
Sinuosity	1.15			1.13			1.13			1.15					
Total Channel Length (ft)	307			307			307			307					
Rosgen Classification	C5			C5			C4			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	8.59																										
Floodprone Width (ft)	42.63	39.55	32.2	37.29																										
BKF Cross Sectional Area (sq. ft.)	6.0	5.5	2.7	2.6																										
BKF Mean Depth (ft)	0.74	0.62	0.31	0.30																										
BKF Max Depth (ft)	1.26	1.06	0.62	0.83																										
Width/Depth Ratio	10.89	14.23	27.9	28.63																										
Entrenchment Ratio	5.3	4.5	3.7	4.3																										
Wetted Perimeter (ft)	8.6	9.2	8.9	8.9																										
Hydraulic Radius (ft)	0.69	0.60	0.30	0.29																										

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	16.6	17.0	16.8			
Radius of Curvature (ft)	14.9	24.5	18.3	10.8	25.0	17.3	13.8	17.4	15.5	13.3	15.1	14.2			
Meander Wavelength (ft)	48.7	58.1	53.4	47.2	56.0	51.6	56.3	56.3	56.3	55.7	55.7	55.7			
Meander Width Ratio	0.7	2.1	1.6	0.4	1.8	1.3	1.8	1.8	1.8	1.9	2.0	2.0			
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	5.6	6.3	5.9			
Riffle Slope (ft/ft)	0.004	0.009	0.006	0.001	0.022	0.012	0.008	0.013	0.018	0.015	0.025	0.021			
Pool Length (ft)	11.7	13.0	12.4	11.8	14.9	13.4	11.7	11.7	11.7	13.9	17.2	15.9			
Pool Spacing (ft)	30.8	40.6	36.6	47.2	47.8	47.5	30.8	45.6	38.2	29.0	31.1	30.1			
Substrate															
d50 (mm)	0.04			0.05			0.03			0.03					
d84 (mm)	1.00			0.06			0.05			0.05					
Additional Reach Parameters															
Bankfull Slope (ft/ft)	0.005			0.005			0.006			0.008					
Monitored Channel Length (ft)	117			107			100			120					
Monitored Valley Length (ft)	101			93			80			100					
Sinuosity	1.15			1.15			1.25			1.20					
Total Channel Length (ft)	208			208			208			208					
Rosgen Classification	C6			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
Year 4 was not measured as the Project already exceeded requirements			

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%	100%	
Pools	100%	100%	100%	100%	100%	
Thalwegs	100%	100%	100%	100%	100%	
Meanders	100%	100%	100%	100%	100%	
Bed General	100%	100%	100%	100%	100%	
Structures	100%	100%	100%	100%	100%	
Rootwads	100%	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%	100%	
Pools	100%	100%	100%	100%	100%	
Thalwegs	100%	100%	100%	100%	100%	
Meanders	100%	100%	100%	100%	100%	
Bed General	100%	100%	100%	100%	100%	
Structures	100%	100%	100%	100%	100%	
Rootwads	100%	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%	100%	
Pools	100%	100%	100%	100%	100%	
Thalwegs	100%	100%	100%	100%	100%	
Meanders	100%	100%	100%	100%	100%	
Bed General	100%	100%	100%	100%	100%	
Structures	100%	100%	100%	100%	100%	
Rootwads	100%	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%	100%	
Pools	100%	100%	100%	100%	100%	
Thalwegs	100%	100%	100%	100%	100%	
Meanders	100%	100%	100%	100%	100%	
Bed General	100%	100%	100%	100%	100%	
Structures	100%	100%	100%	100%	100%	
Rootwads	100%	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%	100%	
Pools	100%	100%	100%	100%	100%	
Thalwegs	100%	100%	100%	100%	100%	
Meanders	100%	100%	100%	100%	100%	
Bed General	100%	100%	100%	100%	100%	
Structures	100%	100%	100%	100%	100%	
Rootwads	100%	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%	100%	
Pools	100%	100%	100%	100%	100%	
Thalwegs	100%	100%	100%	100%	100%	
Meanders	100%	100%	100%	100%	100%	
Bed General	100%	100%	100%	100%	100%	
Structures	100%	100%	100%	100%	100%	
Rootwads	100%	100%	100%	100%	100%	
Reach R2-4c (208 ft)						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
Riffles	100%	100%	100%	100%	100%	
Pools	100%	100%	100%	100%	100%	
Thalwegs	100%	100%	100%	100%	100%	
Meanders	100%	100%	100%	100%	100%	
Bed General	100%	100%	100%	100%	100%	
Structures	100%	100%	100%	100%	100%	
Rootwads	100%	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 4 (2011)	N/A	N/A	N/A
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

Appendix A

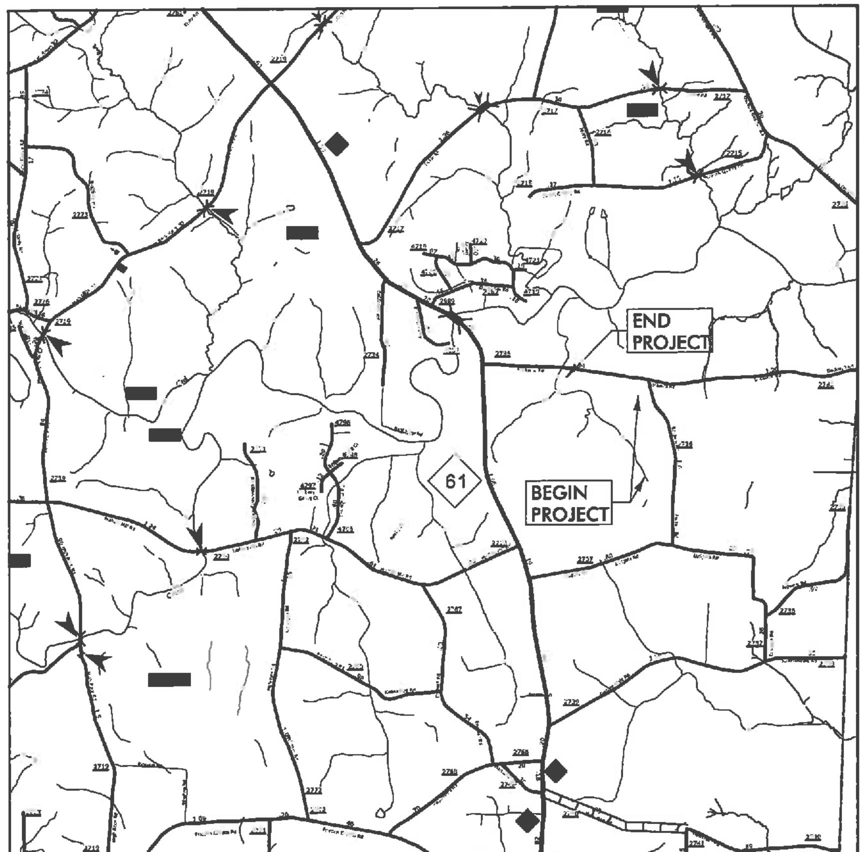
SCO ID NO. D06028-A

GUILFORD COUNTY

TRIBUTARY TO REEDY FORK STREAM RESTORATION SITE

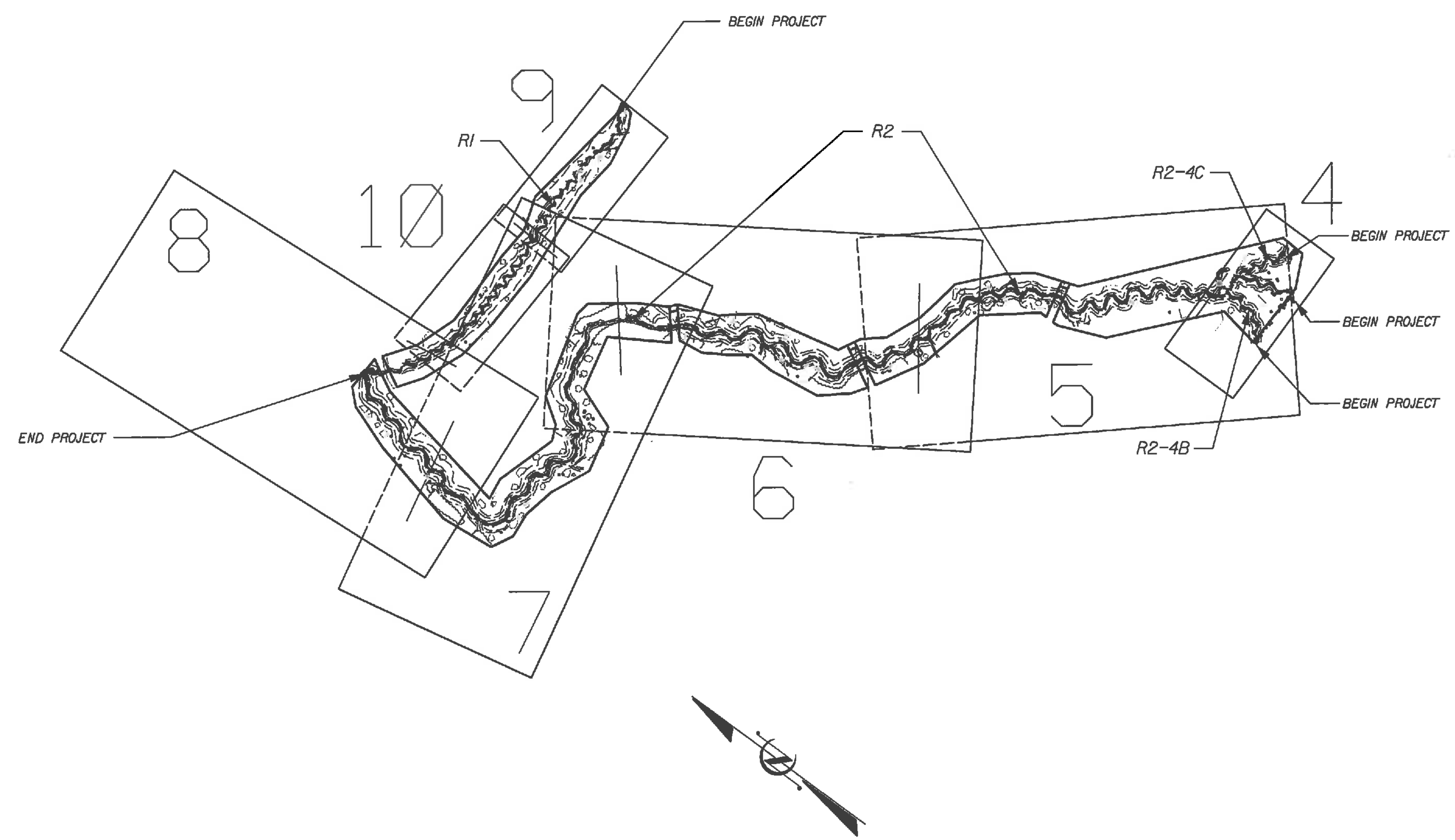
LOCATION: APPROXIMATELY 0.5 MILES EAST OF THE INTERSECTION OF NC 61
AND SR 2735 (SOCKWELL RD) AND IMMEDIATELY SOUTH OF SR 2735

YEAR 4 MONITORING



VICINITY MAP

NOT TO SCALE



INDEX OF SHEETS

SHEET NUMBER	SHEET
1	TITLE SHEET
2	LEGEND
4 - 12	YEAR 0-4 MONITORING OVERLAY

NOT TO SCALE

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
12/23/11	EMP	YEAR 4 MONITORING

SCALE AS SHOWN

DATE:	12/23/11
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

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

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

PROJECT ENGINEER

LEGEND

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NOTE: NOT TO SCALE
Not all symbols used in plans

LEGEND

BOUNDARIES AND PROPERTY:

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

BUILDINGS AND OTHER CULTURE:

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

HYDROLOGY:

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

RAILROADS:

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

ROADS AND RELATED FEATURES:

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

VEGETATION:

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

EXISTING STRUCTURES:

MAJOR:

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

MINOR:

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

UTILITIES:

POWER:

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

GAS:

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

TELEPHONE:

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

WATER:

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

TV:

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

MISCELLANEOUS:

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

SANITARY SEWER:

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

PROPOSED STREAM WORK:

STREAM STRUCTURES:

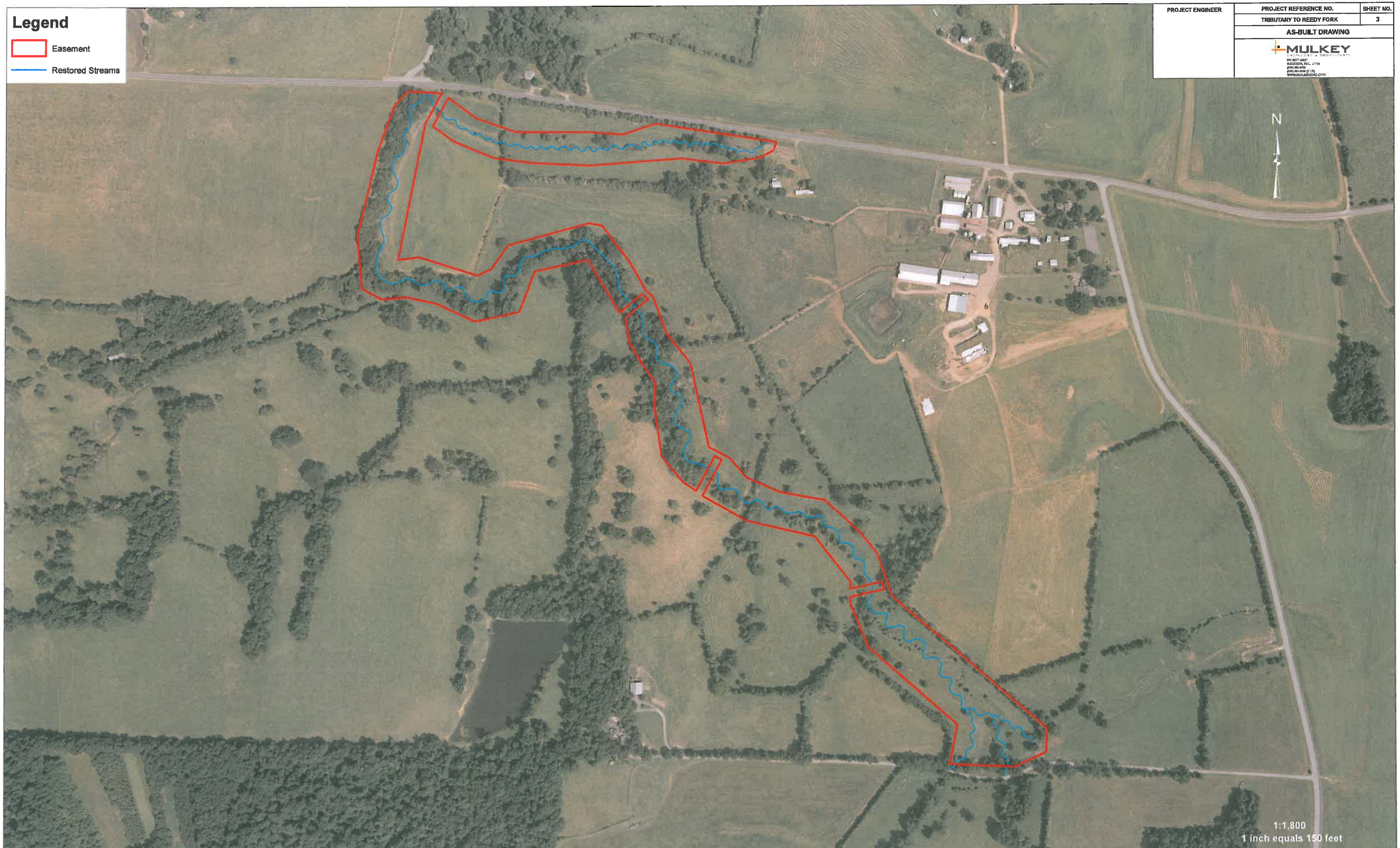
- Rock Crossvane
- Rock Vane
- J Hook Rock Vane
- Flood Plane Interceptor
- Constructed Riffle
- Root Wad
- Log Weir
- Structure Number
- Constructed Flood Plane Interceptor

STREAM FEATURES:

- Constructed Bankful/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.
TRIBUTARY TO REEDY FORK
SHEET NO.
3
AS-BUILT DRAWING
MULKEY
RALEIGH, N.C.
N
1:1,800
1 inch equals 150 feet

PROJECT REFERENCE NO.	SHEET NO.
TRIBUTARY TO REEDY FORK	4

YEAR 4 MONITORING

REVISIONS

DATE	BY	DESCRIPTION
1/8/09	MBA	YEAR 1 MONITORING
10/26/09	EMP	YEAR 2 MONITORING
11/23/10	MLM	YEAR 3 MONITORING
12/23/11	EMP	YEAR 4 MONITORING

PROJECT ENGINEER

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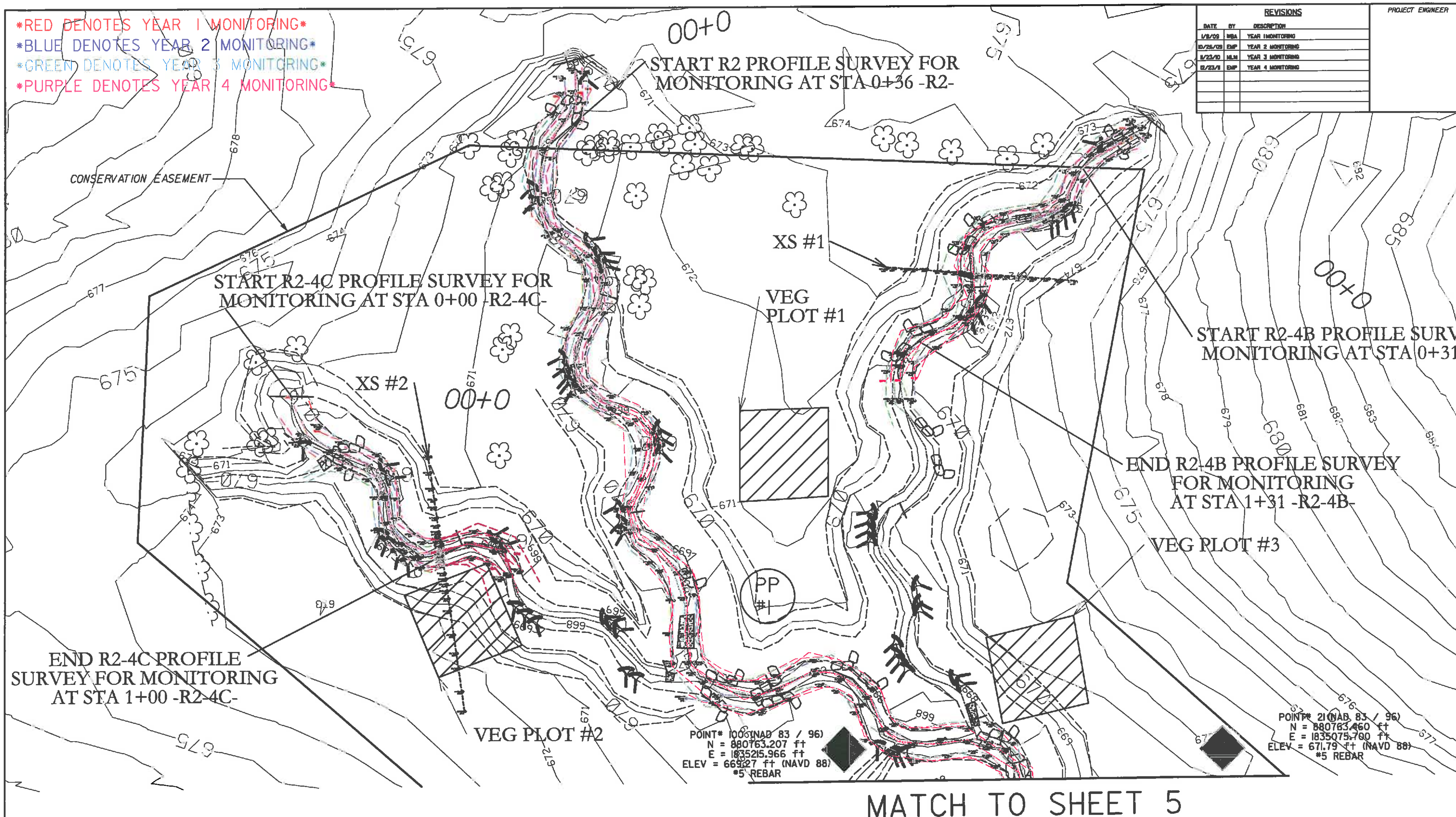

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300	882831.020	1833936.544	662.64
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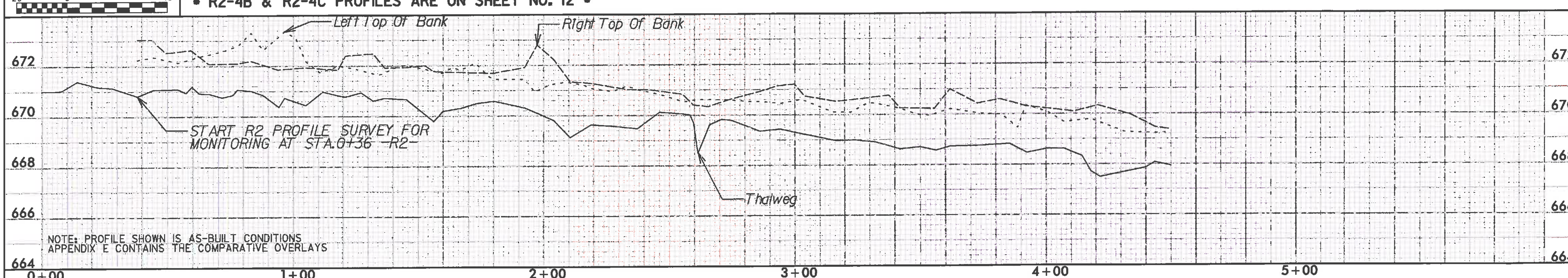
600	880847.484	1835232.374	670.54

MATCH TO SHEET 5

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



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

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RED DENOTES YEAR 1 MONITORING
BLUE DENOTES YEAR 2 MONITORING
GREEN DENOTES YEAR 3 MONITORING
PURPLE DENOTES YEAR 4 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
12/23/11	EMP	YEAR 4 MONITORING

PROJECT ENGINEER

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

YEAR 4 MONITORING

MULKEY ENGINEERS & CONSULTANTS
PO Box 33127
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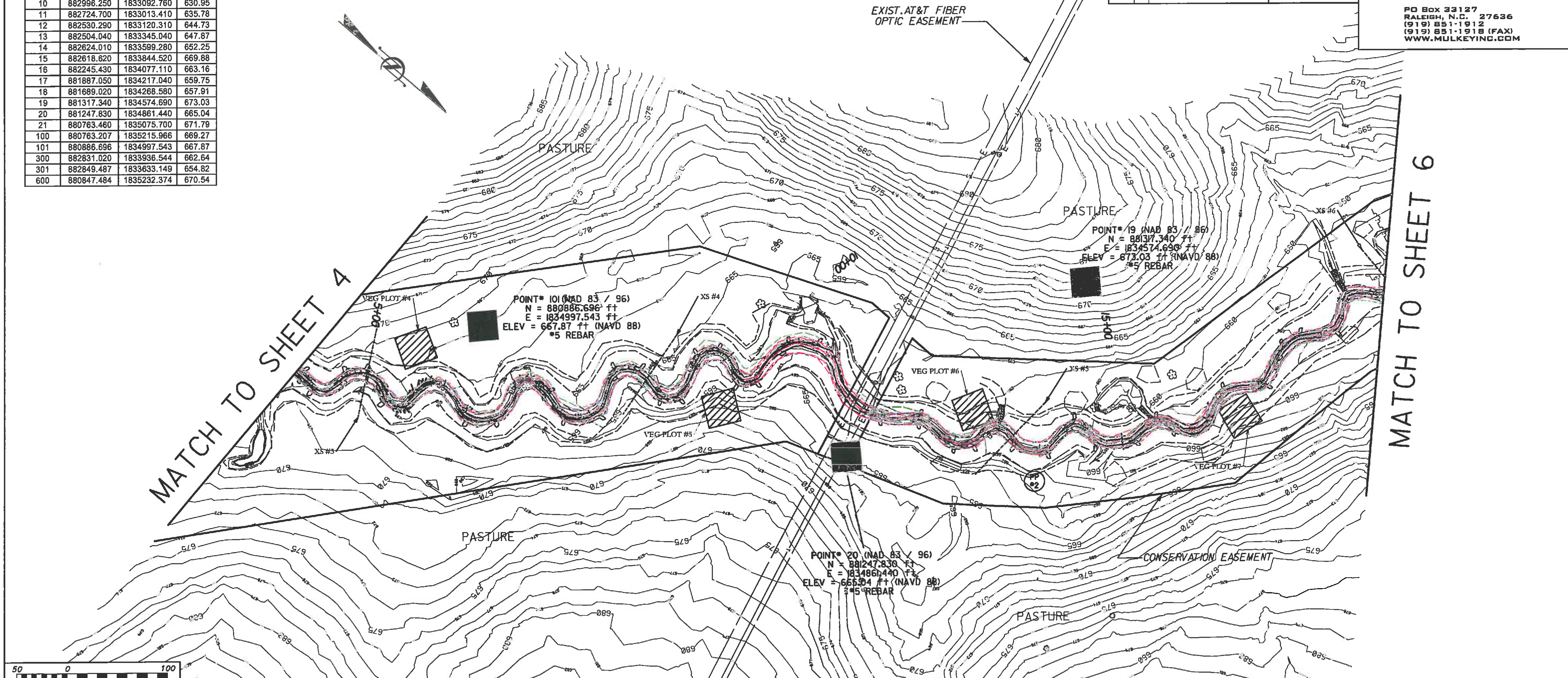

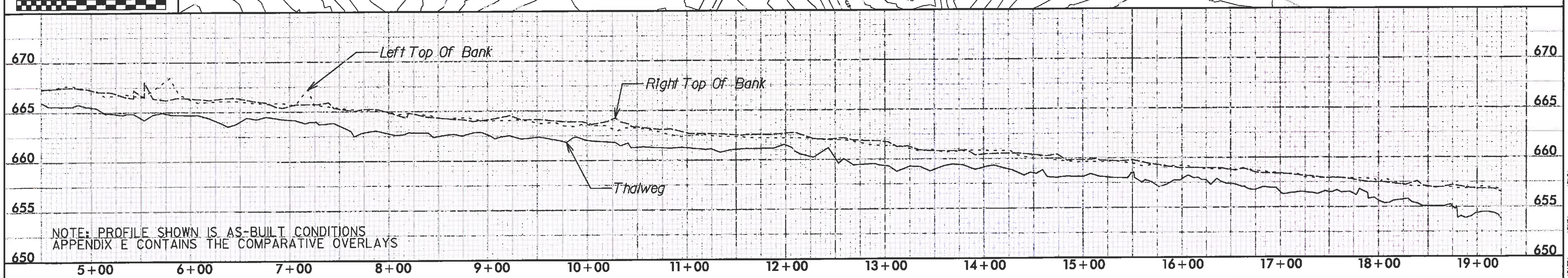

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DATE	BY	DESCRIPTION
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PROJECT ENGINEER

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

YEAR 4 MONITORING

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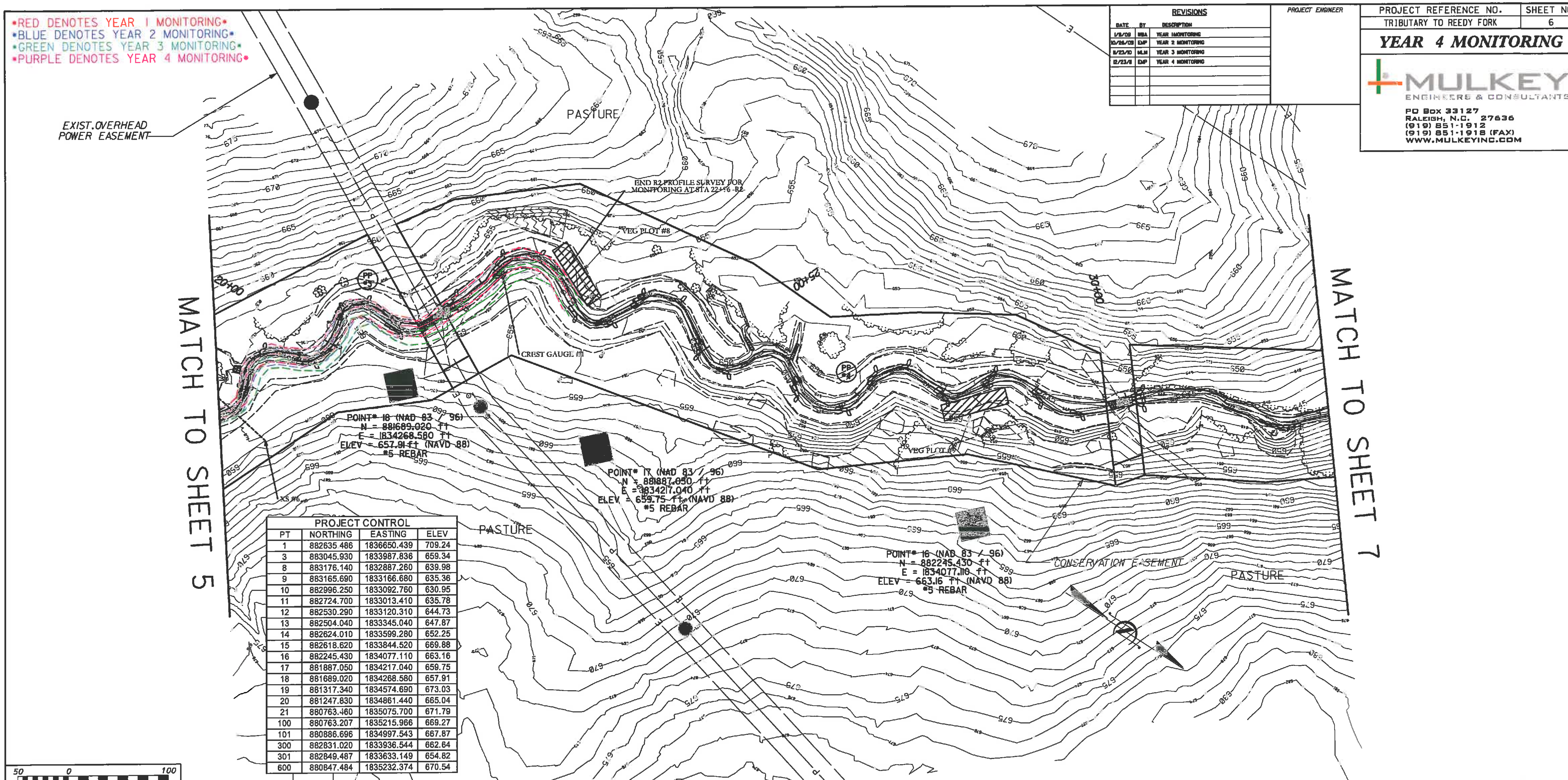

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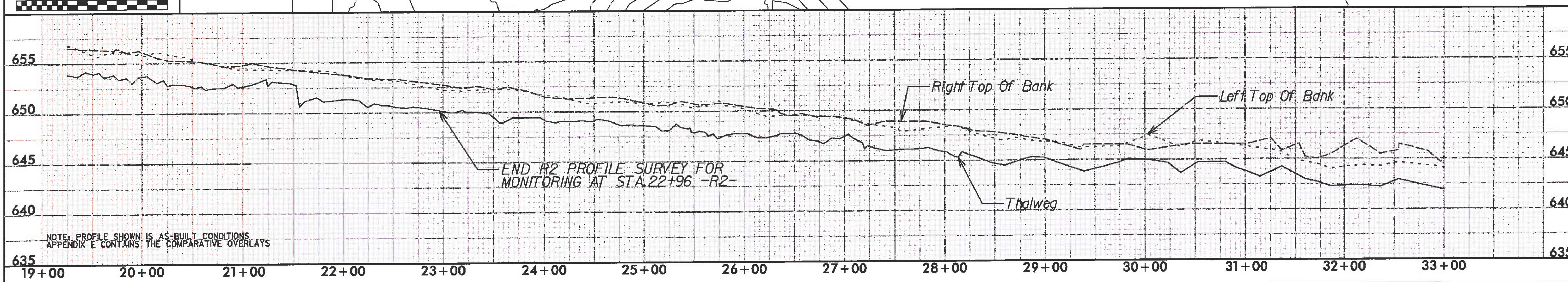

NOTE: PROFILE SHOWN IS AS-BUILT CONDITIONS
APPENDIX E CONTAINS THE COMPARATIVE OVERLAYS

RED DENOTES YEAR 1 MONITORING
BLUE DENOTES YEAR 2 MONITORING
GREEN DENOTES YEAR 3 MONITORING
PURPLE DENOTES YEAR 4 MONITORING

REVISIONS

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12/23/11	EMP	YEAR 4 MONITORING

PROJECT ENGINEER

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

YEAR 4 MONITORING

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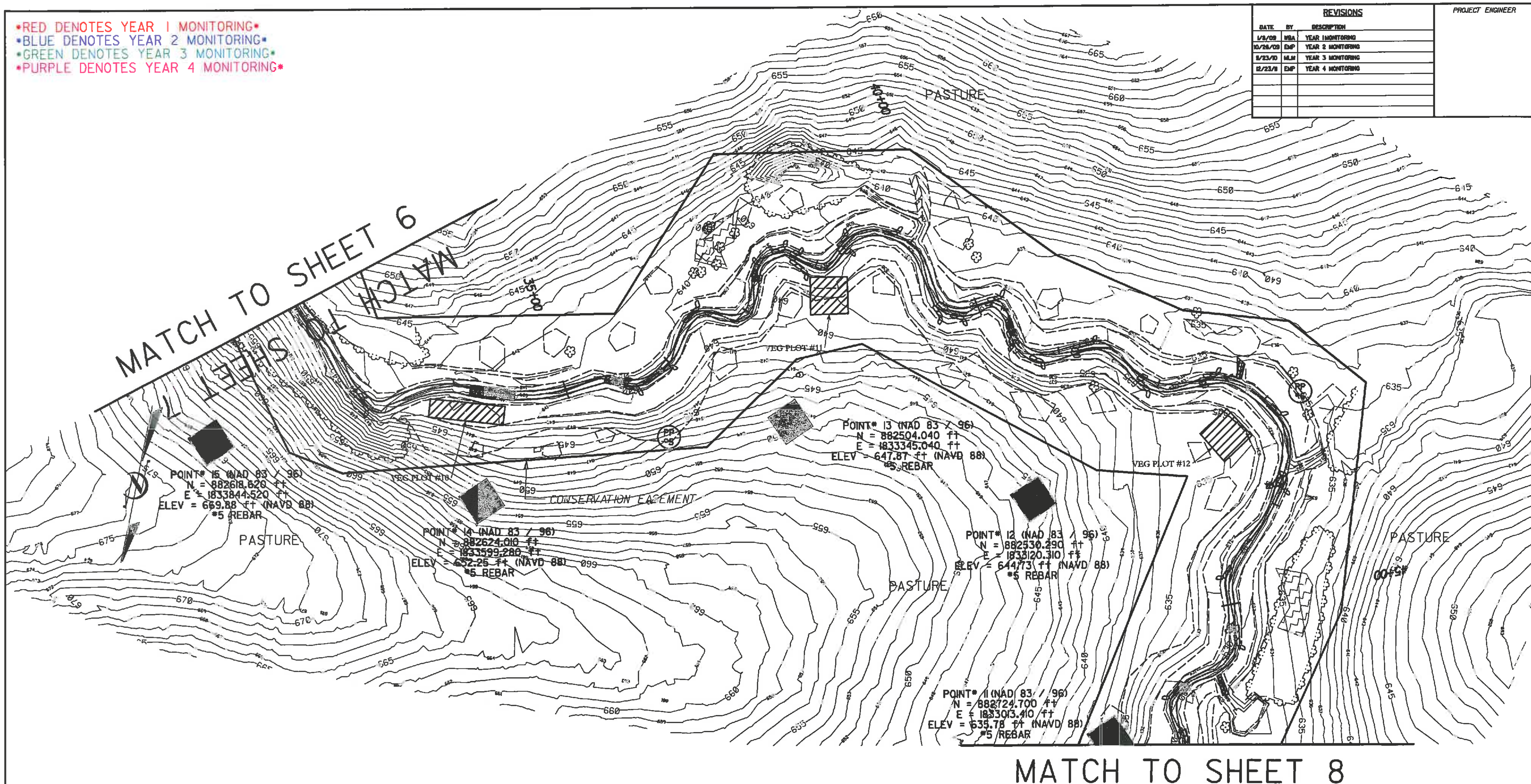

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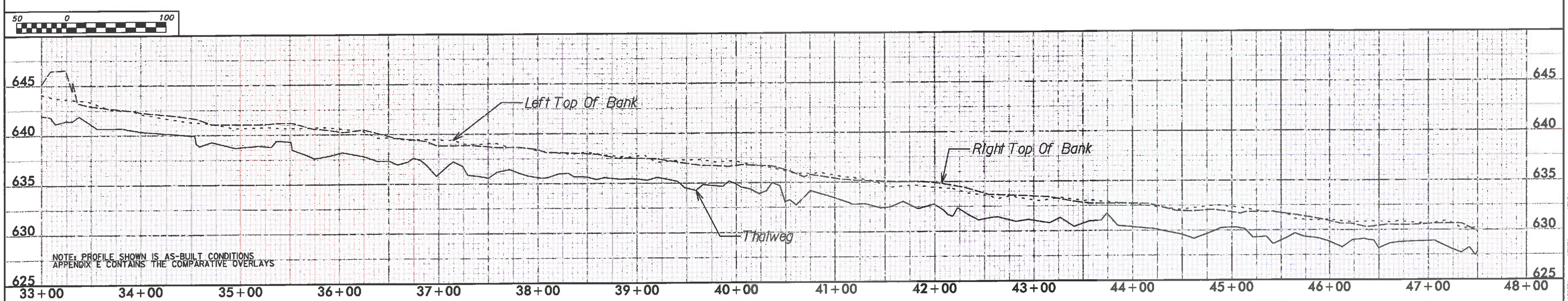

NOTE: PROFILE SHOWN IS AS-BUILT CONDITIONS
APPENDIX E CONTAINS THE COMPARATIVE OVERLAYS

RED DENOTES YEAR 1 MONITORING
BLUE DENOTES YEAR 2 MONITORING
GREEN DENOTES YEAR 3 MONITORING
PURPLE DENOTES YEAR 4 MONITORING

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PROJECT ENGINEER

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

YEAR 4 MONITORING

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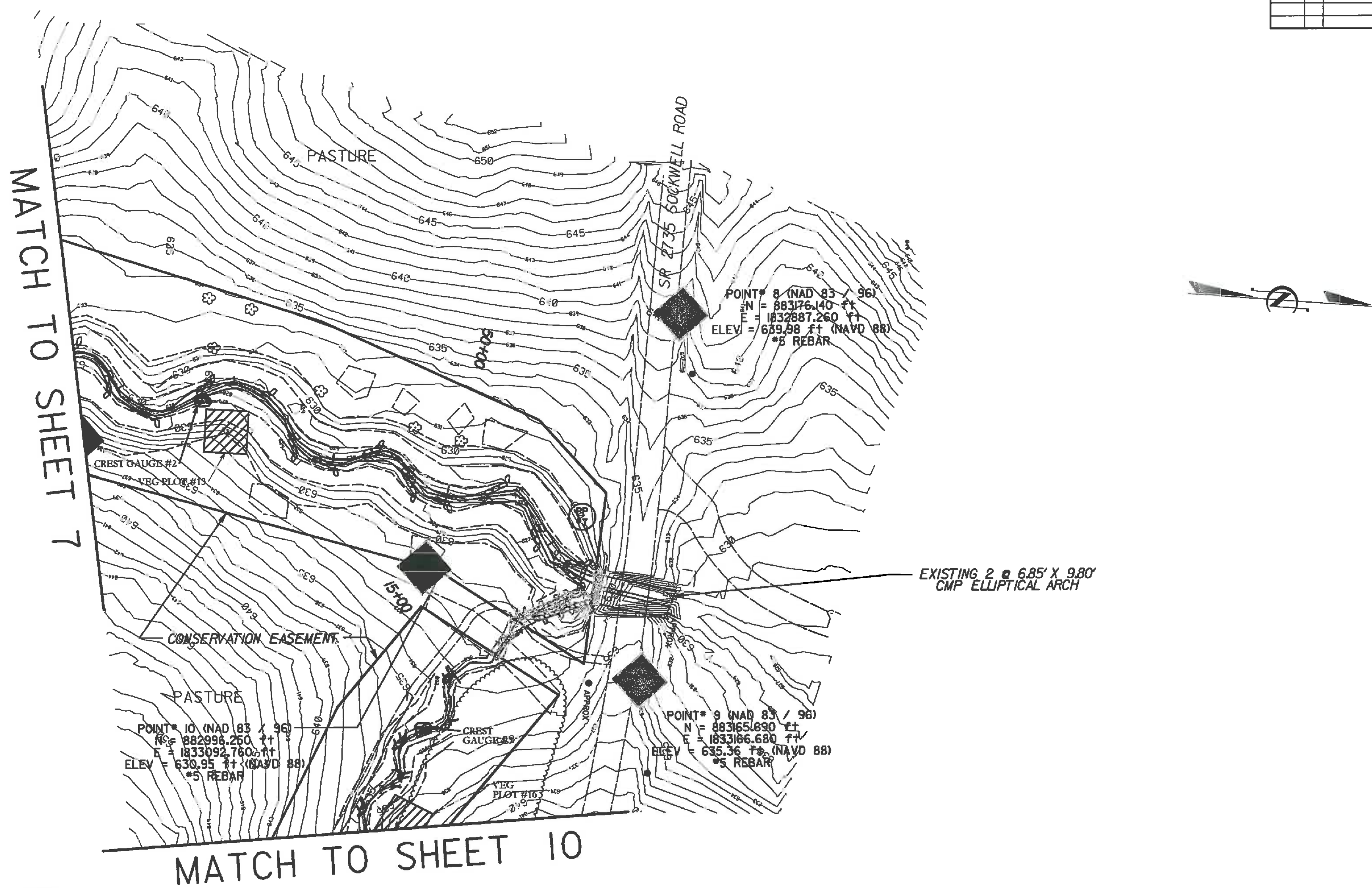
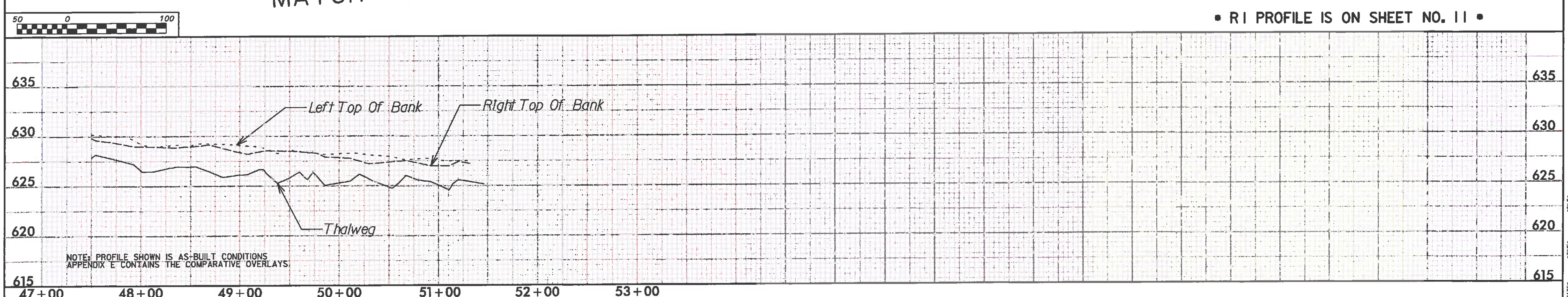
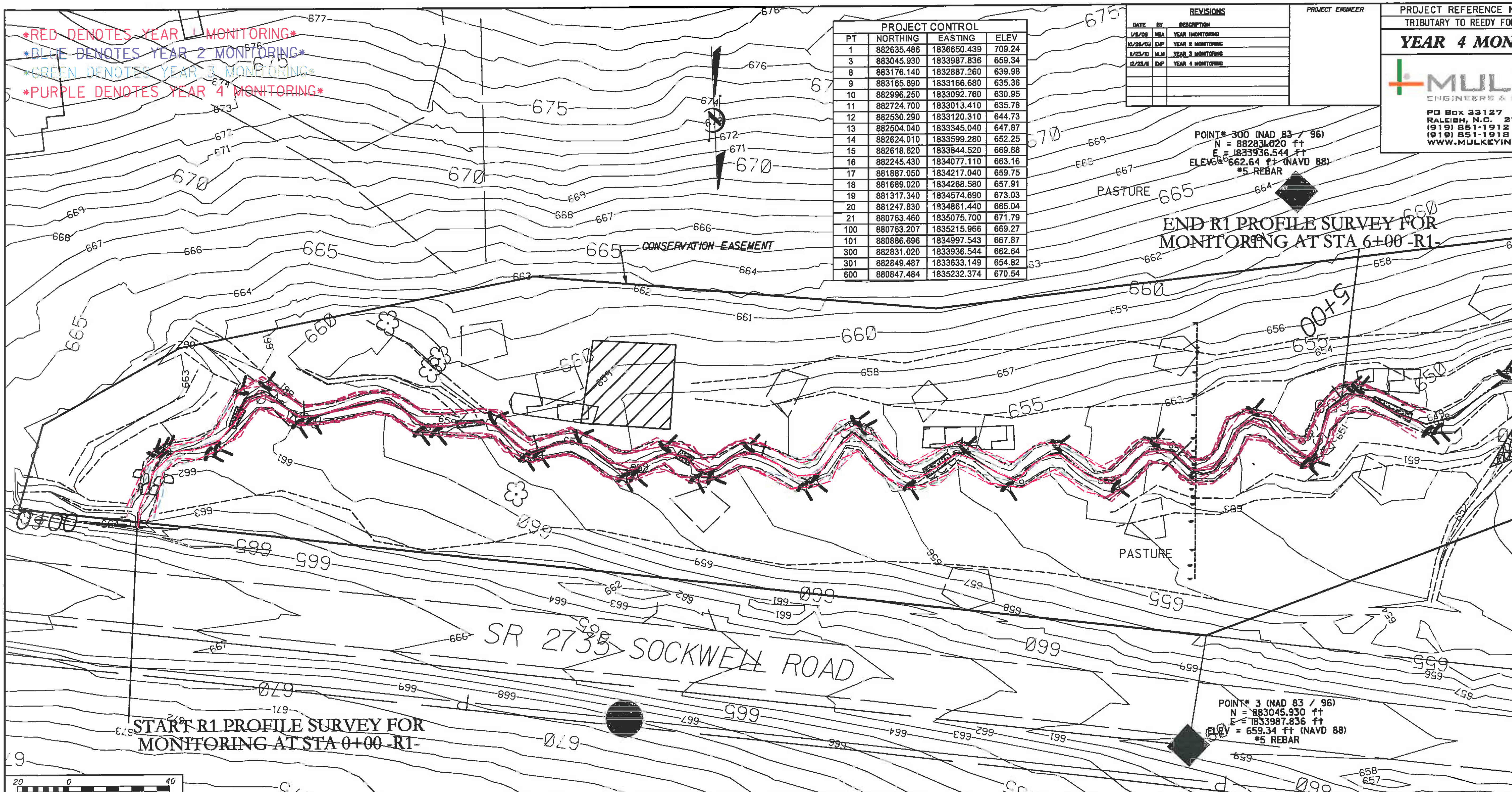


* R1 PROFILE IS ON SHEET NO. 11 *





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REVISIONS

DATE	BY	DESCRIPTION
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8/23/10	MLM	YEAR 3 MONITORING
12/23/11	EMP	YEAR 4 MONITORING

PROJECT ENGINEER

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

YEAR 4 MONITORING

MULKEY
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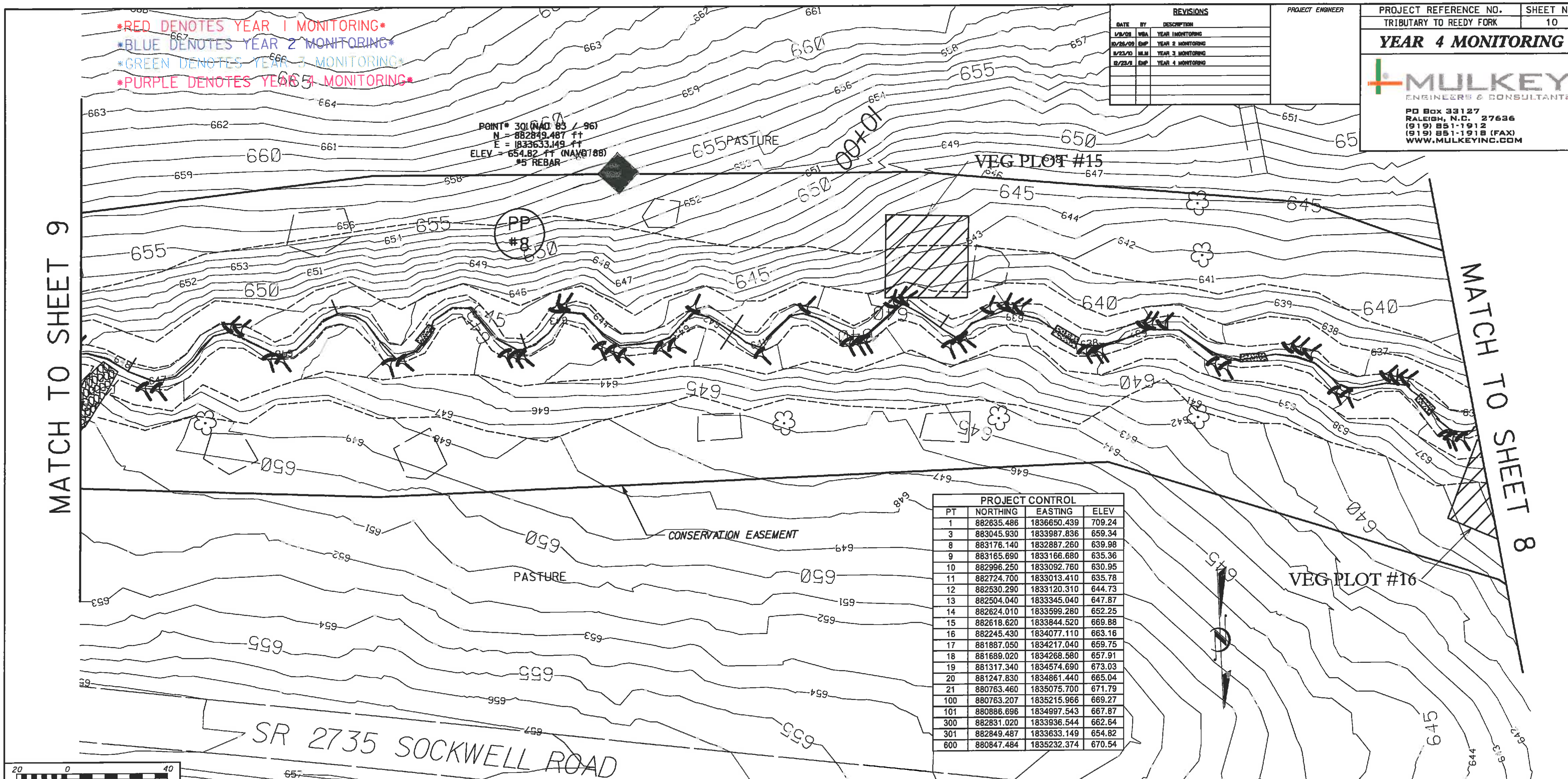
SEE SHEET NO. 11 FOR -R1- PROFILE



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DATE	BY	DESCRIPTION
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PROJECT ENGINEER

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

YEAR 4 MONITORING

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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
11/23/10	MLM	YEAR 3 MONITORING
12/23/11	EMP	YEAR 4 MONITORING

PROJECT ENGINEER

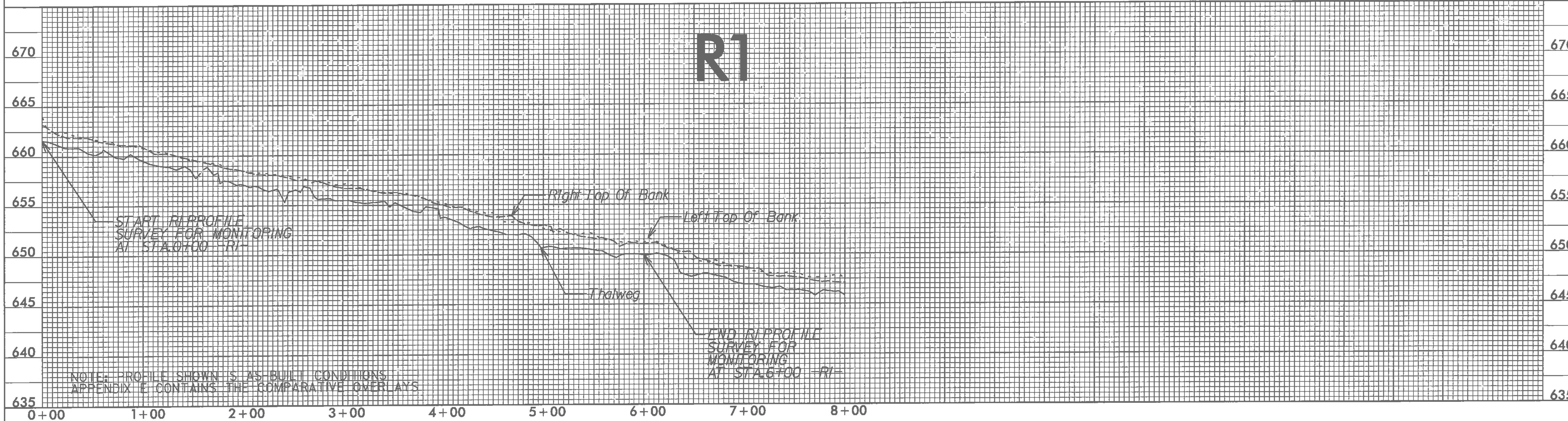
PROJECT REFERENCE NO.	SHEET NO.
TRIBUTARY TO REEDY FORK	11

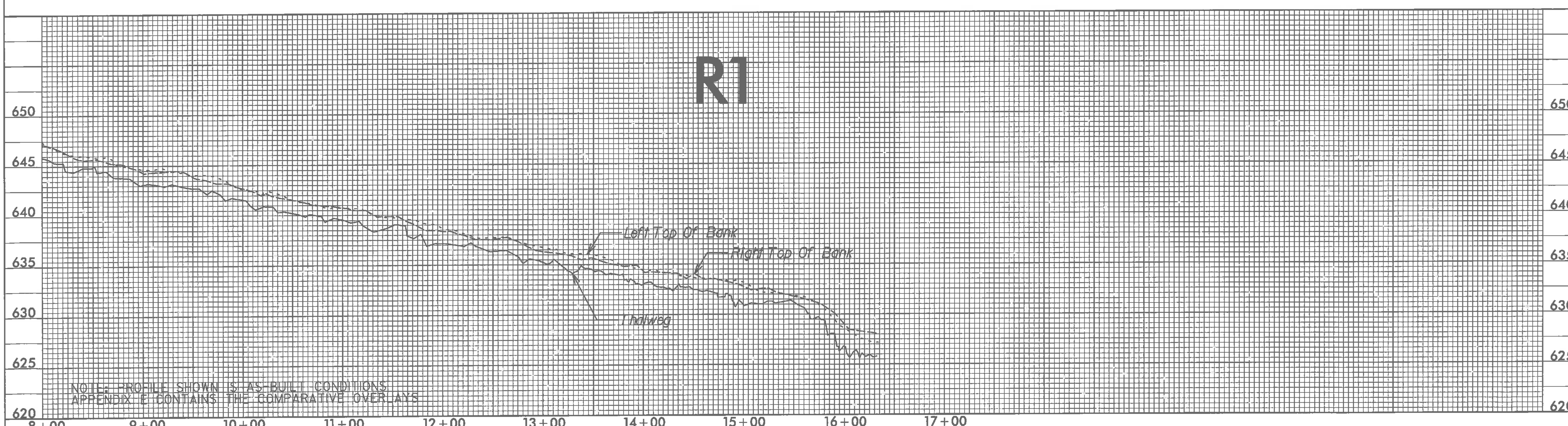
YEAR 3 MONITORING

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
11/23/10	MLM	YEAR 3 MONITORING
12/23/11	EMP	YEAR 4 MONITORING

PROJECT ENGINEER

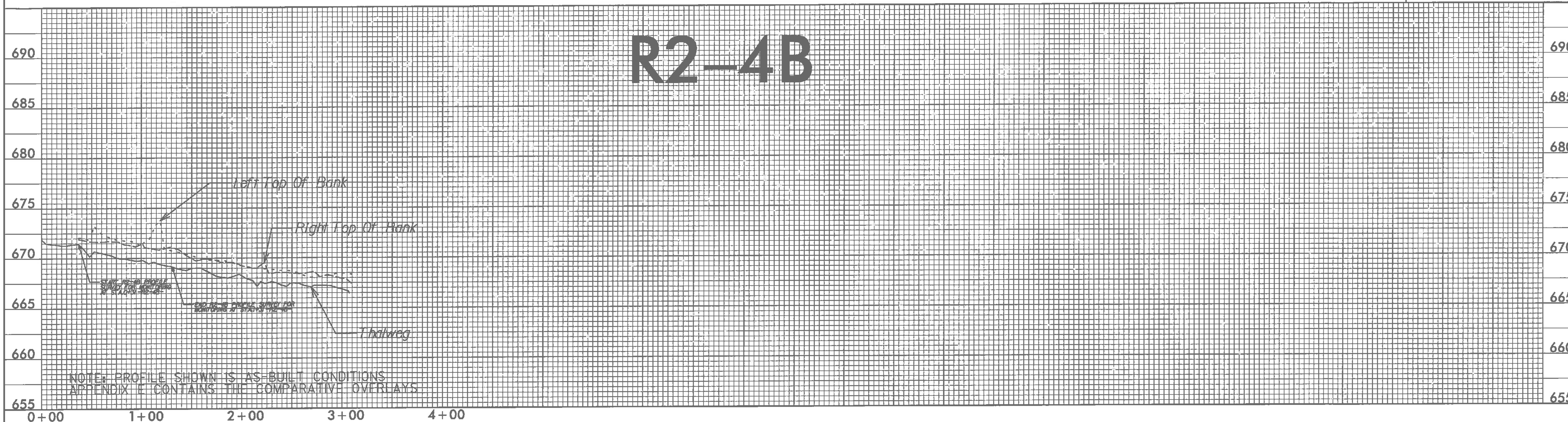
PROJECT REFERENCE NO.	SHEET NO.
TRIBUTARY TO REEDY FORK	12

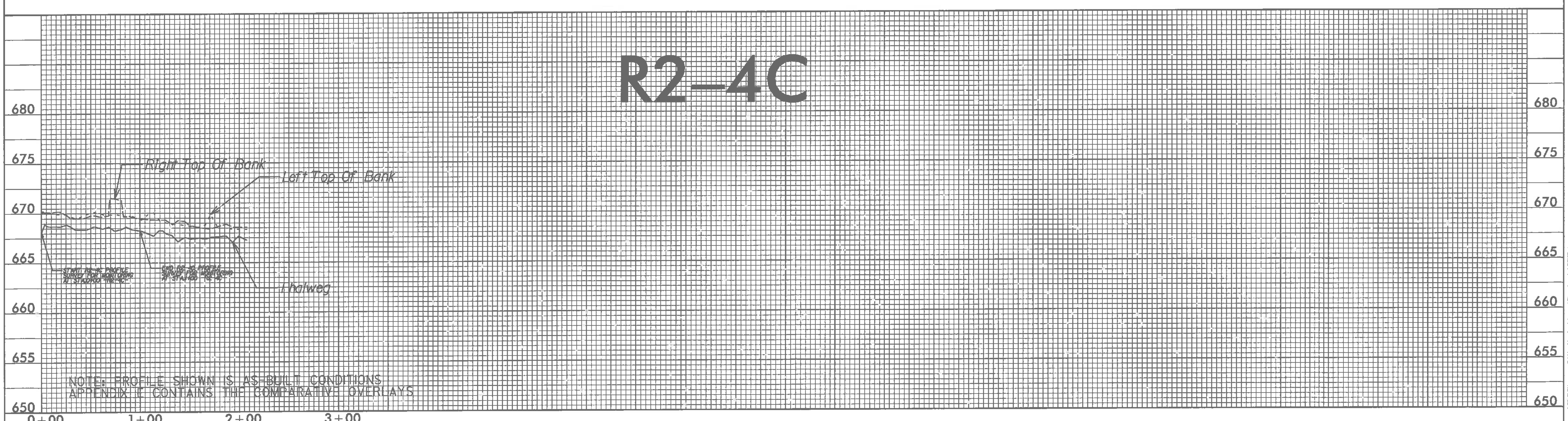
YEAR 3 MONITORING

MULKEY ENGINEERS & CONSULTANTS

HORIZONTAL SCALE 50 0 100

VERTICAL SCALE 5 0 10





Appendix B

Vegetation 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, November 2011

Year 5 Monitoring

Vegetation 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, November 2011

Year 5 Monitoring

Vegetation 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, November 2011

Year 5 Monitoring

Vegetation 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, November 2011

Year 5 Monitoring

Vegetation 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, November 2011

Year 5 Monitoring

Vegetation 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, November 2011

Year 5 Monitoring

Vegetation 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, November 2011

Year 5 Monitoring

Vegetation 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, November 2011

Year 5 Monitoring

Vegetation 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, November 2011

Year 5 Monitoring

Vegetation 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, November 2011

Year 5 Monitoring

Vegetation 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, November 2011

Year 5 Monitoring

Vegetation 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, November 2011

Year 5 Monitoring

Vegetation 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, November 2011

Year 5 Monitoring

Vegetation 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, November 2011

Year 5 Monitoring

Vegetation 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, November 2011

Year 5 Monitoring

Vegetation 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, November 2011

Year 5 Monitoring

Appendix C

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, November 2011

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, November 2011

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, November 2011

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, November 2011

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, November 2011

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, November 2011

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, November 2011

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, November 2011

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, November 2011

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, November 2011

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, November 2011

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, November 2011

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, November 2011

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, November 2011

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, November 2011

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, November 2011

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, November 2011

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, November 2011

Year 5 Monitoring

Appendix D

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, November 2011

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, November 2011

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, November 2011

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, November 2011

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, November 2011

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, November 2011

Year 5 Monitoring

Permanent Cross Section 7

As-Built Surveys, April 2008

Year 1 Monitoring, September 2008

Year 2 Monitoring, September 2009

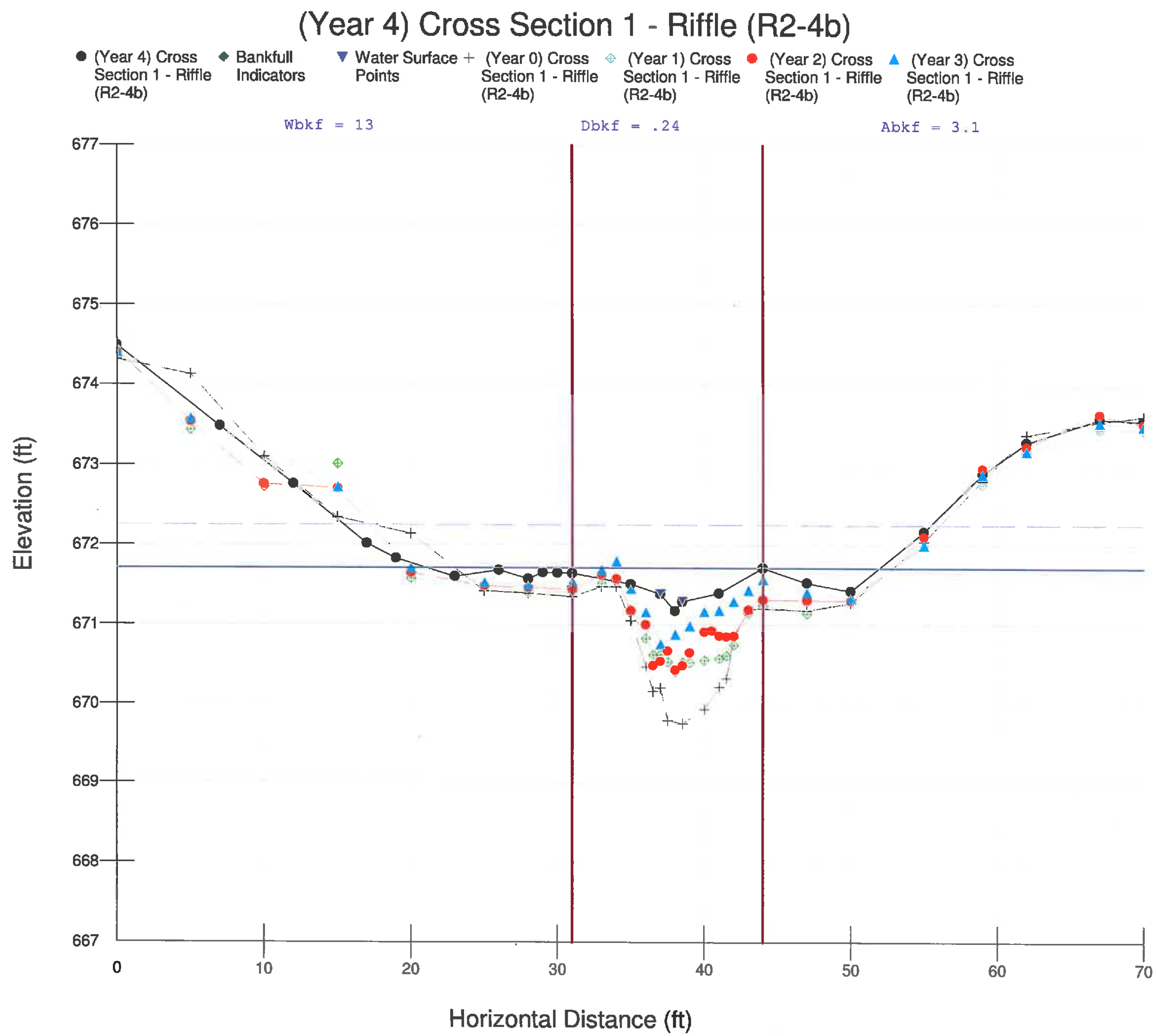
Year 3 Monitoring, October 2010

Year 4 Monitoring, November 2011

Year 5 Monitoring

Appendix E

Cross Sections



(Year 4) Cross Section 1 - Riffle (R2-4b)
(Year 4) 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)
(Year 3) Cross Section 1 - Riffle (R2-4b)
Wbkf = 13
Dbkf = .24
Abkf = 3.1
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 4) Reedy Fork Creek
Reach Name: R2-4b
Cross Section Name: (Year 4) Cross Section 1 - Riffle (R2-4b)
Survey Date: 12/06/2011

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	674.484	GS
7	0	673.482	GS
12	0	672.763	GS
17	0	672.016	GS
19	0	671.831	GS
23	0	671.605	GS
26	0	671.686	GS
28	0	671.576	GS
29	0	671.656	GS
30	0	671.651	GS
31	0	671.646	LB
35	0	671.512	GS
37	0	671.386	LEW
38	0	671.173	TW
38.5	0	671.291	REW
41	0	671.396	GS
44	0	671.713	BKF
47	0	671.529	GS
50	0	671.425	GS
55	0	672.165	GS
59	0	672.893	GS
62	0	673.283	GS
67	0	673.579	GS
70	0	673.552	GS

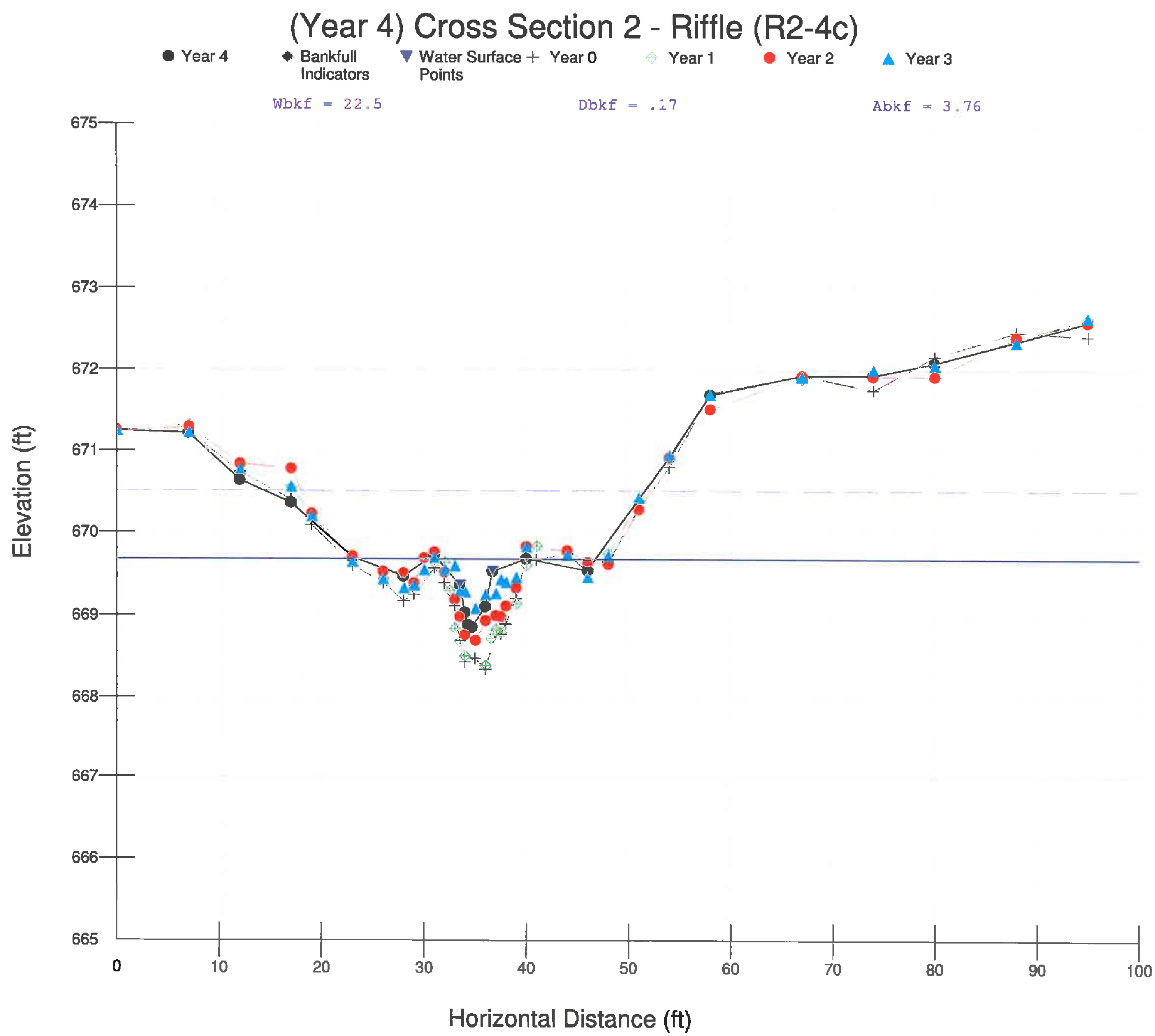
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	672.25	672.25	672.25
Bankfull Elevation (ft)	671.71	671.71	671.71
Floodprone Width (ft)	40	-----	-----
Bankfull Width (ft)	12.97	5.49	7.48
Entrenchment Ratio	3.08	-----	-----
Mean Depth (ft)	0.24	0.16	0.3
Maximum Depth (ft)	0.54	0.29	0.54
Width/Depth Ratio	54.04	34.31	24.93
Bankfull Area (sq ft)	3.1	0.89	2.21
Wetted Perimeter (ft)	13.1	5.85	7.83
Hydraulic Radius (ft)	0.24	0.15	0.28
Begin BKF Station	31	31	36.49
End BKF Station	43.97	36.49	43.97

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 4) Cross Section 2 - Riffle (R2-4c)
Year 4
Bankfull Indicators
Water Surface Points
Year 0
Year 1
Year 2
Year 3
Wbkf = 22.5
Dbkf = .17
Abkf = 3.76
Elevation (ft)
675
674
673
672
671
670
669
668
667
666
665
0
10
20
30
40
50
60
70
80
90
100
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-4c
Cross Section Name: (Year 4) Cross Section 2 - Riffle (R2-4c)
Survey Date: 09/26/2011

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	671.25	GS
7	0	671.22	GS
12	0	670.64	GS
17	0	670.36	GS
23	0	669.7	GS
28	0	669.47	GS
31	0	669.73	LB
33.5	0	669.36	LEW
34	0	669.03	GS
34.3	0	668.88	GS
34.7	0	668.85	TW
36	0	669.1	GS
36.7	0	669.53	REW
40	0	669.68	BKF
46	0	669.54	GS
54	0	670.92	GS
58	0	671.69	GS
67	0	671.93	GS
74	0	671.93	GS
80	0	672.08	GS
95	0	672.58	GS

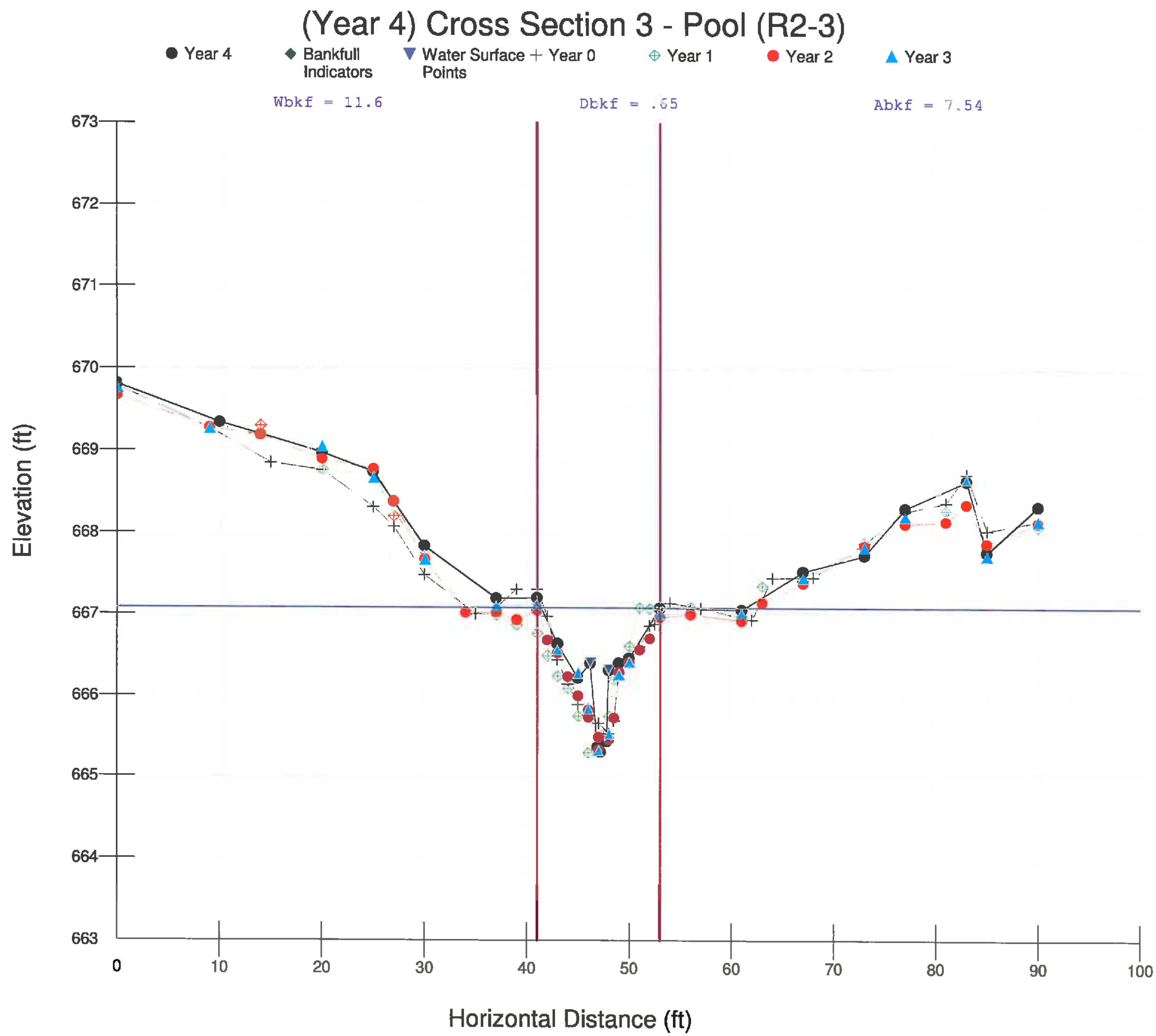
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	670.51	670.51	670.51
Bankfull Elevation (ft)	669.68	669.68	669.68
Floodprone Width (ft)	37.3	-----	-----
Bankfull Width (ft)	8.66	3.56	5.1
Entrenchment Ratio	4.31	-----	-----
Mean Depth (ft)	0.29	0.36	0.25
Maximum Depth (ft)	0.83	0.83	0.79
Width/Depth Ratio	29.86	9.89	20.4
Bankfull Area (sq ft)	2.55	1.29	1.26
Wetted Perimeter (ft)	8.97	4.52	6.04
Hydraulic Radius (ft)	0.28	0.29	0.21
Begin BKF Station	31.34	31.34	34.9
End BKF Station	40	34.9	40

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 4) Cross Section 3 - Pool (R2-3)
Year 4
Bankfull Indicators
Water Surface Points
Year 0
Year 1
Year 2
Year 3
Wbkf = 11.6
Dbkf = .65
Abkf = 7.54
673
672
671
670
669
668
667
666
665
664
663
Elevation (ft)
0
10
20
30
40
50
60
70
80
90
100
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-3
Cross Section Name: (Year 4) Cross Section 3 - Pool (R2-3)
Survey Date: 09/26/2011

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	669.81	GS
10	0	669.337	GS
20	0	668.976	GS
25	0	668.741	GS
30	0	667.836	GS
37	0	667.194	GS
41	0	667.2	LB
43	0	666.635	GS
45	0	666.216	GS
46.2	0	666.396	LEW
46.9	0	665.365	GS
47.2	0	665.307	TW
47.8	0	665.439	GS
48	0	666.312	REW
49	0	666.398	GS
50	0	666.457	GS
53	0	667.075	BKF
61	0	667.053	GS
67	0	667.528	GS
73	0	667.724	GS
77	0	668.302	GS
83	0	668.638	GS
85	0	667.76	GS
90	0	668.327	GS

Cross Sectional Geometry

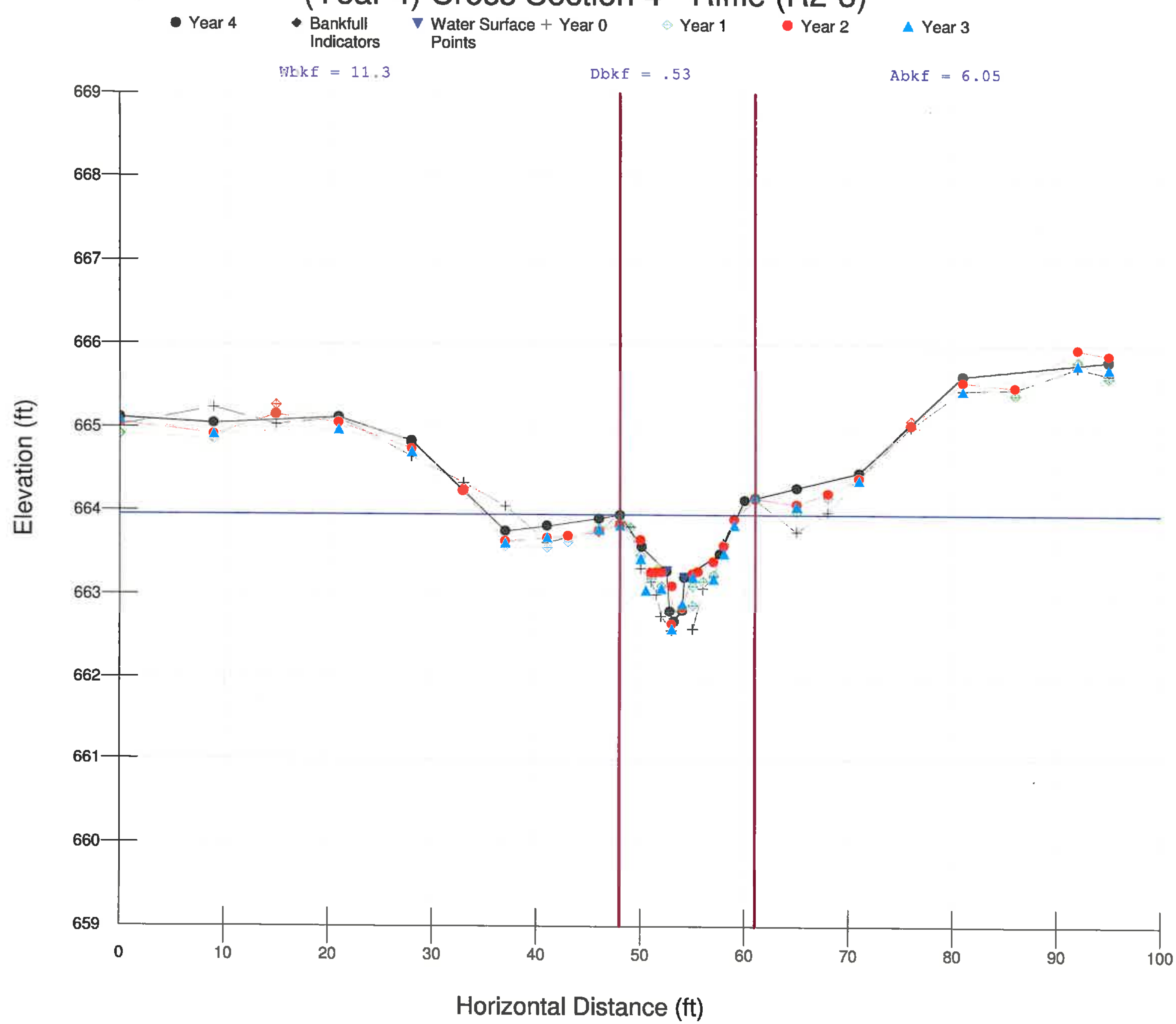
	Channel	Left	Right
Floodprone Elevation (ft)	668.85	668.85	668.85
Bankfull Elevation (ft)	667.08	667.08	667.08
Floodprone Width (ft)	67.38	-----	-----
Bankfull Width (ft)	11.58	9.96	1.62
Entrenchment Ratio	5.82	-----	-----
Mean Depth (ft)	0.65	0.73	0.17
Maximum Depth (ft)	1.77	1.77	0.34
Width/Depth Ratio	17.82	13.64	9.53
Bankfull Area (sq ft)	7.54	7.26	0.28
Wetted Perimeter (ft)	13.03	11.71	2
Hydraulic Radius (ft)	0.58	0.62	0.14
Begin BKF Station	41.42	41.42	51.38
End BKF Station	53	51.38	53

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 4) Cross Section 4 - Riffle (R2-3)



RIVERMORPH CROSS SECTION SUMMARY

River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-3
Cross Section Name: (Year 4) Cross Section 4 - Riffle (R2-3)
Survey Date: 09/26/2011

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	665.11	GS
9	0	665.046	GS
21	0	665.119	GS
28	0	664.832	GS
37	0	663.753	GS
41	0	663.815	GS
46	0	663.905	GS
48	0	663.947	BKF
50.1	0	663.568	GS
52.5	0	663.28	LEW
52.8	0	662.802	GS
53.2	0	662.675	TW
54	0	662.812	GS
54.2	0	663.205	REW
57.6	0	663.482	GS
60	0	664.127	GS
61	0	664.151	RB
65	0	664.275	GS
71	0	664.459	GS
81	0	665.619	GS
95	0	665.8	GS

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	665.23	665.23	665.23
Bankfull Elevation (ft)	663.95	663.95	663.95
Floodprone Width (ft)	77.6	-----	-----
Bankfull Width (ft)	11.34	5.67	5.67
Entrenchment Ratio	6.84	-----	-----
Mean Depth (ft)	0.53	0.53	0.54
Maximum Depth (ft)	1.28	1.28	1.19
Width/Depth Ratio	21.4	10.7	10.5
Bankfull Area (sq ft)	6.05	3	3.04
Wetted Perimeter (ft)	12.01	7.21	7.18
Hydraulic Radius (ft)	0.5	0.42	0.42
Begin BKF Station	48	48	53.67
End BKF Station	59.34	53.67	59.34

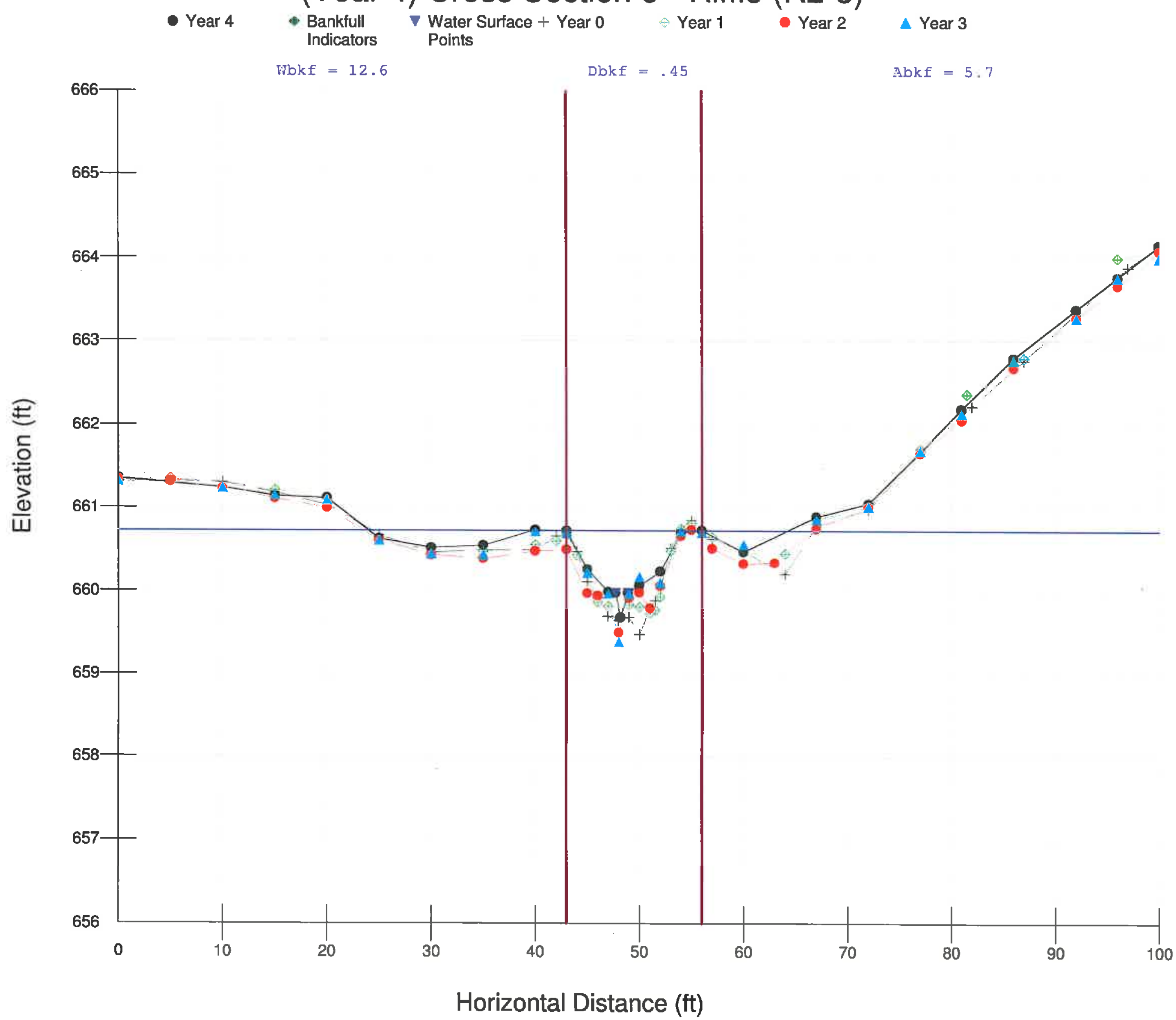
Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

Channel Left Side Right Side

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

(Year 4) Cross Section 5 - Riffle (R2-3)



RIVERMORPH CROSS SECTION SUMMARY

River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-3
Cross Section Name: (Year 4) Cross Section 5 - Riffle (R2-3)
Survey Date: 09/26/2011

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	661.348	GS
10	0	661.24	GS
15	0	661.141	GS
20	0	661.116	GS
25	0	660.626	GS
30	0	660.516	GS
35	0	660.546	GS
40	0	660.732	GS
43	0	660.721	BKF
45	0	660.259	GS
47	0	659.986	GS
47.7	0	659.974	LEW
48.2	0	659.675	TW
48.9	0	659.974	REW
50	0	660.06	GS
52	0	660.231	GS
54	0	660.695	RB
56	0	660.726	GS
60	0	660.466	GS
67	0	660.892	GS
72	0	661.051	GS
77	0	661.67	GS
81	0	662.186	GS
86	0	662.792	GS
92	0	663.376	GS
96	0	663.763	GS
100	0	664.148	GS

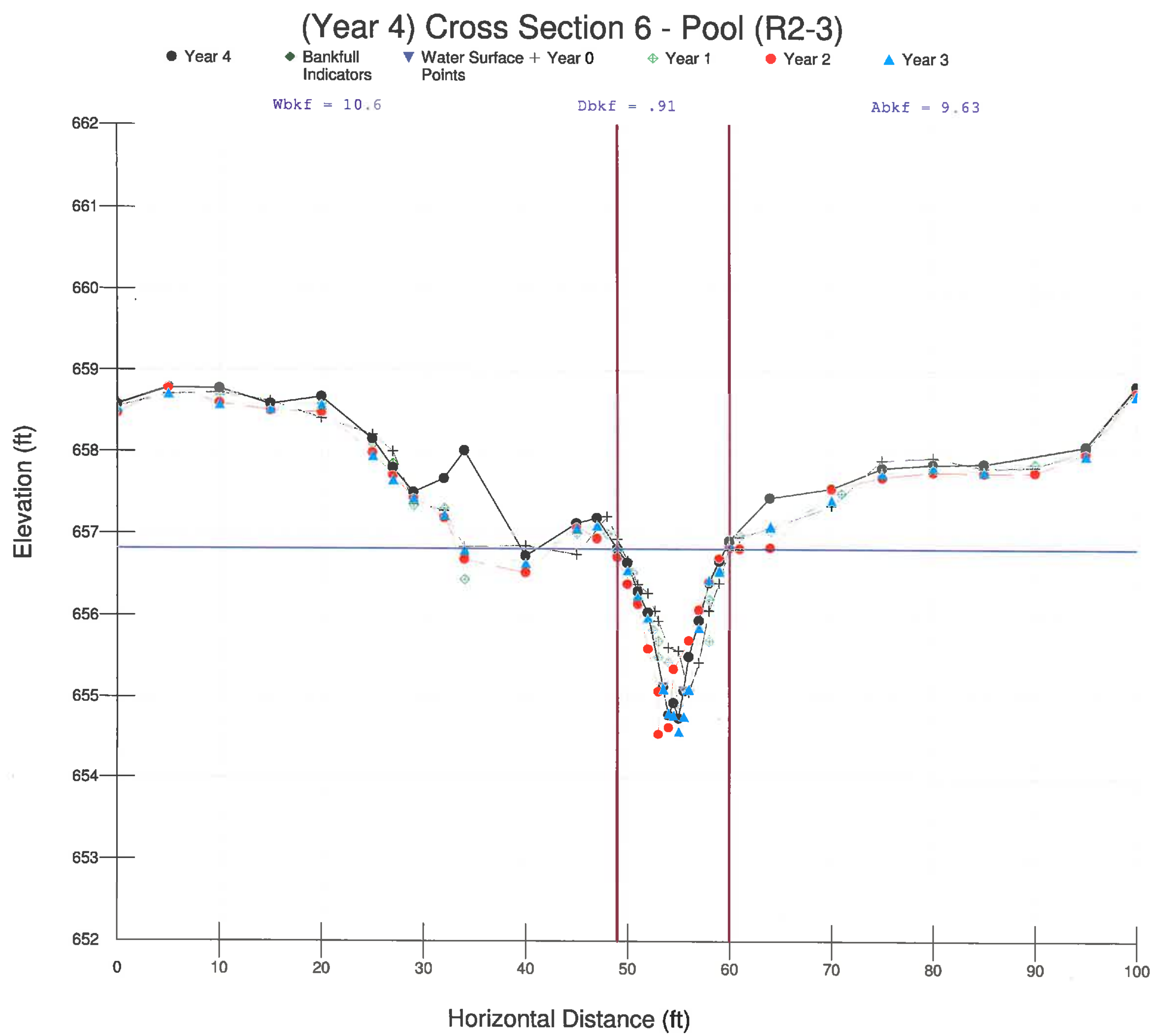
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	661.77	661.77	661.77
Bankfull Elevation (ft)	660.72	660.72	660.72
Floodprone Width (ft)	77.74	-----	-----
Bankfull Width (ft)	12.61	6.31	6.3
Entrenchment Ratio	6.17	-----	-----
Mean Depth (ft)	0.45	0.56	0.34
Maximum Depth (ft)	1.05	1.05	0.71
Width/Depth Ratio	28.02	11.27	18.53
Bankfull Area (sq ft)	5.7	3.55	2.16
Wetted Perimeter (ft)	12.89	7.24	7.08
Hydraulic Radius (ft)	0.44	0.49	0.3
Begin BKF Station	43	43	49.31
End BKF Station	55.61	49.31	55.61

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 4) Cross Section 6 - Pool (R2-3)
Year 4
Bankfull Indicators
Water Surface Points
Year 0
Year 1
Year 2
Year 3
Wbkf = 10.6
Dbkf = .91
Abkf = 9.63
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 4) Reedy Fork Creek
Reach Name: R2-3
Cross Section Name: (Year 4) Cross Section 6 - Pool (R2-3)
Survey Date: 09/26/2011

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	658.579	GS
5	0	658.785	GS
10	0	658.776	GS
15	0	658.588	GS
20	0	658.674	GS
25	0	658.155	GS
27	0	657.803	GS
29	0	657.502	GS
32	0	657.67	GS
34	0	658.013	GS
40	0	656.731	GS
45	0	657.126	GS
47	0	657.19	GS
49	0	656.82	BKF
50	0	656.647	GS
51	0	656.299	GS
52	0	656.041	GS
53.5	0	655.131	LEW
54	0	654.785	GS
54.5	0	654.933	GS
55	0	654.745	TW
55.5	0	655.081	REW
56	0	655.501	GS
57	0	655.941	GS
58	0	656.404	GS
59	0	656.669	GS
60	0	656.917	RB
64	0	657.438	GS
70	0	657.553	GS
75	0	657.804	GS
80	0	657.847	GS
85	0	657.856	GS
95	0	658.071	GS
100	0	658.815	GS

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	658.9	658.9	658.9
Bankfull Elevation (ft)	656.82	656.82	656.82
Floodprone Width (ft)	100	-----	-----
Bankfull Width (ft)	10.61	5.3	5.31
Entrenchment Ratio	9.43	-----	-----
Mean Depth (ft)	0.91	0.84	0.97
Maximum Depth (ft)	2.08	2.04	2.08
Width/Depth Ratio	11.66	6.31	5.47

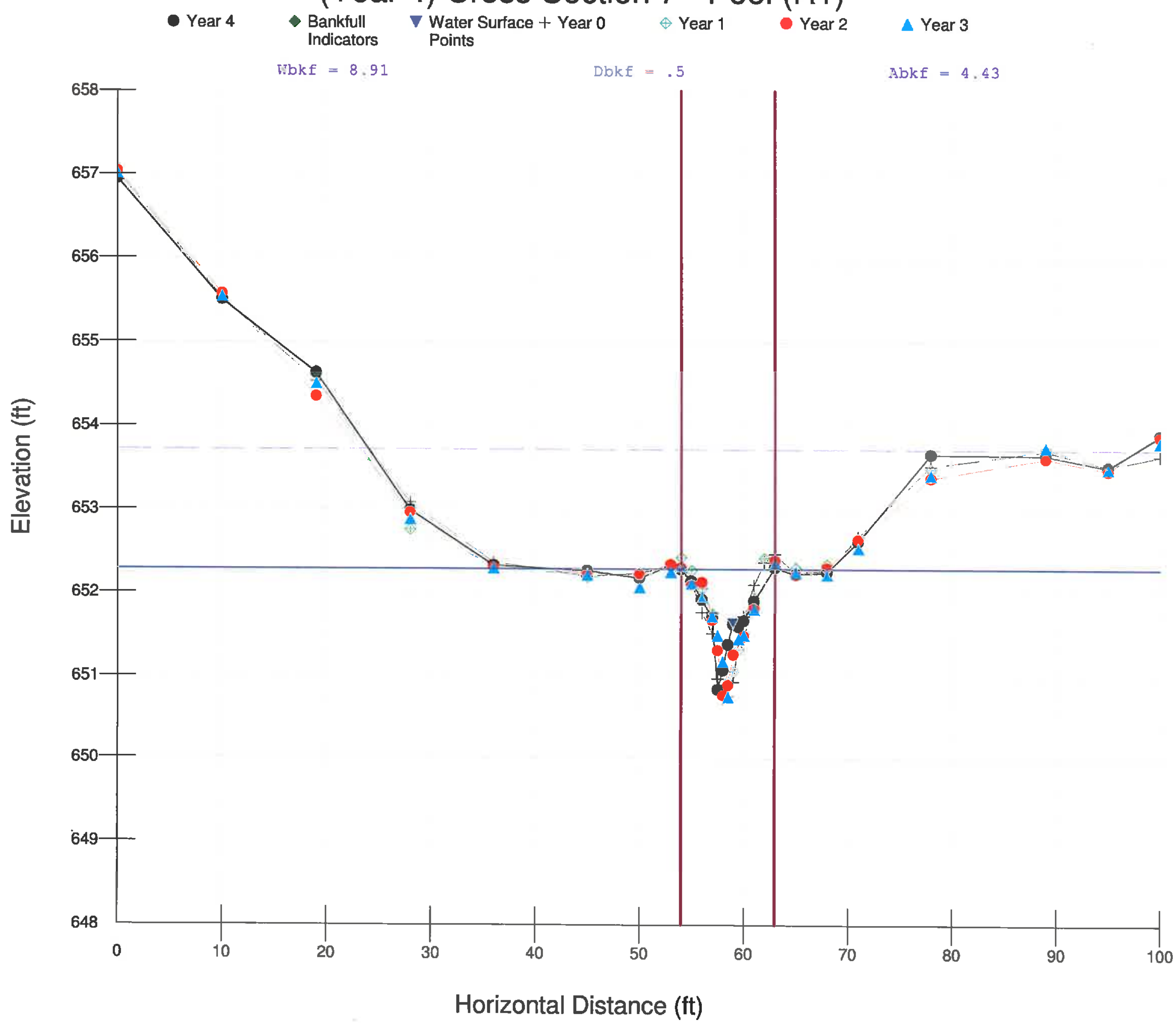
Bankfull Area (sq ft)	9.63	4.46	5.17
Wetted Perimeter (ft)	11.64	7.73	7.8
Hydraulic Radius (ft)	0.83	0.58	0.66
Begin BKF Station	49	49	54.3
End BKF Station	59.61	54.3	59.61

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 4) Cross Section 7 - Pool (R1)



RIVERMORPH CROSS SECTION SUMMARY

River Name: (Year 4) Reedy Fork Creek
Reach Name: R1
Cross Section Name: (Year 4) Cross Section 7 - Pool (R1)
Survey Date: 09/26/2011

Cross Section Data Entry

BM Elevation: 0 ft
Backsight Rod Reading: 0 ft

TAPE	FS	ELEV	NOTE
0	0	656.948	GS
10	0	655.501	GS
19	0	654.628	GS
28	0	652.989	GS
36	0	652.325	GS
45	0	652.257	GS
50	0	652.173	GS
53	0	652.327	GS
54	0	652.277	BKF
55	0	652.132	GS
56	0	651.913	GS
57	0	651.694	LEW
57.5	0	650.843	TW
58	0	651.072	GS
58.5	0	651.378	GS
59	0	651.62	REW
59.5	0	651.591	GS
60	0	651.657	GS
61	0	651.894	GS
63	0	652.299	RB
65	0	652.215	GS
68	0	652.24	GS
71	0	652.612	GS
78	0	653.66	GS
89	0	653.653	GS
95	0	653.507	GS
100	0	653.887	GS

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	653.72	653.72	653.72
Bankfull Elevation (ft)	652.28	652.28	652.28
Floodprone Width (ft)	73.76	-----	-----
Bankfull Width (ft)	8.91	4.45	4.46
Entrenchment Ratio	8.28	-----	-----
Mean Depth (ft)	0.5	0.55	0.44
Maximum Depth (ft)	1.44	1.44	0.93
Width/Depth Ratio	17.82	8.09	10.14
Bankfull Area (sq ft)	4.43	2.46	1.97
Wetted Perimeter (ft)	9.72	6.06	5.52
Hydraulic Radius (ft)	0.46	0.41	0.36
Begin BKF Station	54	54	58.45
End BKF Station	62.91	58.45	62.91

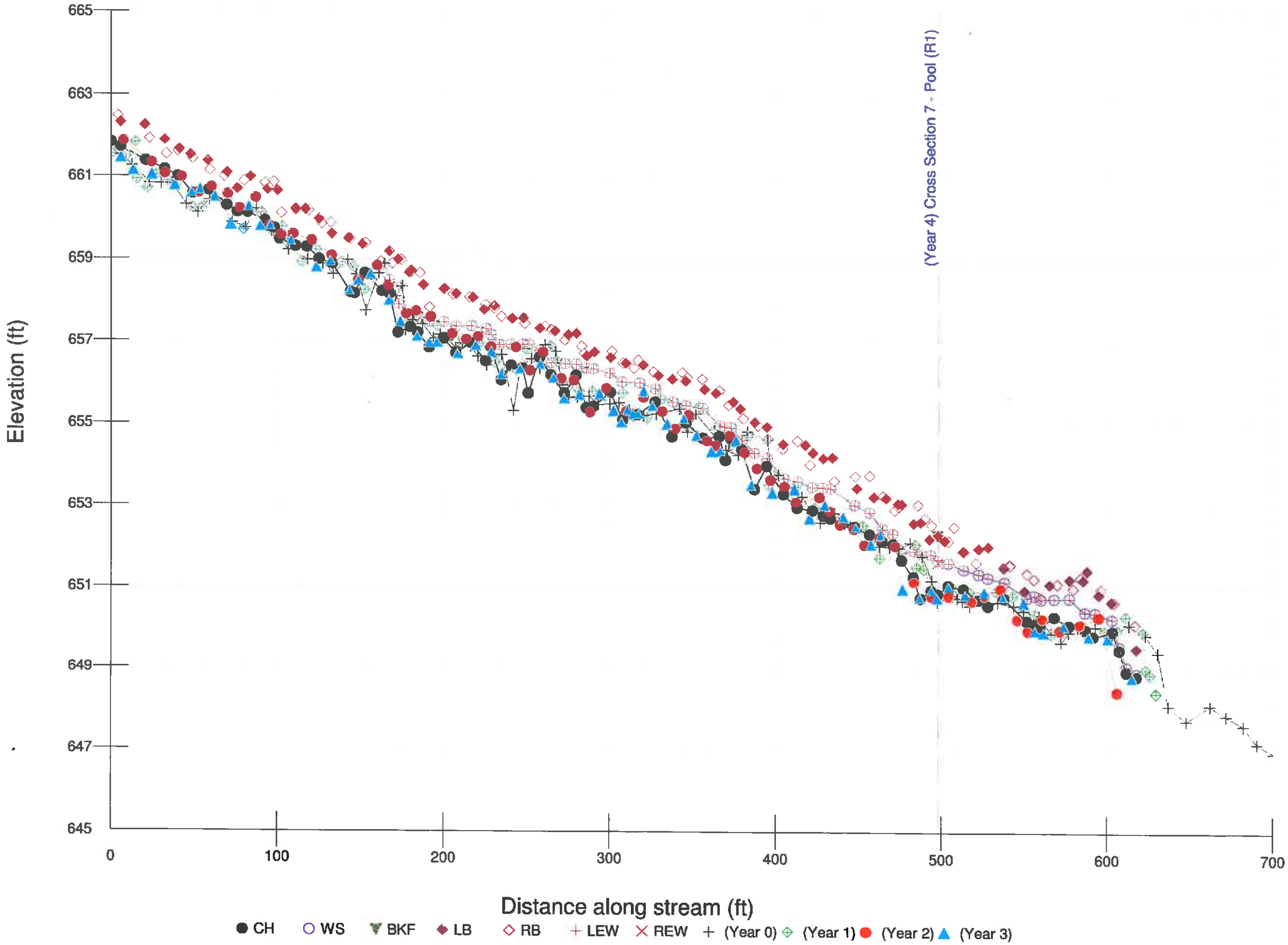
Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

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

Longitudinal Profiles

(Year 4) R1 Longitudinal Profile (0+00 to 6+00)



RIVERMORPH PROFILE SUMMARY

River Name: (Year 4) Reedy Fork Creek
Reach Name: R1
Profile Name: (Year 4) R1 Longitudinal Profile
Survey Date: 09/26/2011

Survey Data

DIST	CH	WS	BKF	LB	RB	LEW	REW
0	661.8263						
4.1323					662.471		
5.6703	661.709						
5.6703				662.314			
20.2483				662.249			
20.8133	661.376						
22.8923					661.926		
32.1723	661.163						
32.1723				661.888			
33.1833					661.542		
40.1893	660.995						
40.1893					661.611		
40.8573				661.665			
47.6453				661.529			
49.0623					661.437		
49.0743	660.575						
58.1083				661.386			
58.8113	660.663						
59.2563					661.152		
68.0063					660.999		
69.5453	660.284						
69.6323				661.096			
75.7903	660.129						
75.7903				660.704			
79.9083					660.891		
81.9283	660.119						
83.7033				660.992			
92.4433					660.843		
92.4433	659.922						
93.9103				660.686			
97.6513					660.863		
97.9443	659.739						
100.0403				660.659			
101.1903	659.475						
102.3673					660.116		
110.7633	659.303						
110.8583				660.194			
110.9043					660.218		
116.7593				660.198			
117.4693	659.285						
118.6963					660.169		
124.9023				659.971			
124.9023	658.989						
126.5133					659.859		
131.8753					659.882		
132.6283				659.61			
132.7473	658.877						
142.6713				659.502			
143.7233	658.192						
143.7233					659.492		

146.2063	658.161				
150.9983			659.362		
152.5893	658.648				
152.9973				659.394	
161.9733				658.943	
162.7163	658.215				
167.2953	658.153				
167.2953			659.19		
167.4073		658.485			658.485
168.7513				658.896	
172.3763	657.2				
172.3763			658.994		
172.7493		657.9			657.9
174.4363				658.991	
178.9883			658.673		
179.7433		657.654			657.654
179.8613	657.335				
180.1553			658.731		
180.5633				658.693	
183.6953		657.657			657.657
184.2613	657.201				
185.6133				658.67	
187.5673			658.376		
191.0473		657.482			657.482
191.1983	656.836				
191.1983				657.835	
199.9373			658.275		
199.9373	657.061				
199.9963		657.466			657.466
200.6183				658.272	
205.4713				658.147	
207.2433		657.358			657.358
207.2953	656.705				
207.2953			658.162		
215.3653				658.081	
216.5993	656.947				
216.5993		657.372			657.372
217.4643			658.072		
224.1993			657.777		
225.1423				657.903	
225.1423	656.511				
225.2883		657.302			657.302
228.3223	656.854				
228.3643		657.154			657.154
230.1213				657.812	
230.2623			657.87		
233.3423		656.917			656.917
234.5543	656.047				
234.5543				657.607	
240.3563		656.925			656.925
240.5233	656.4				
240.8183			657.556		
241.1873				657.558	
247.2953	656.341				
247.3433		656.921			656.921
247.7493			657.565		
248.6813				657.434	
250.9113	655.729				
251.0813		656.931			656.931
257.6933			657.326		
257.6933	656.598				
257.7483		656.781			656.781
260.9093				657.375	
264.4503	656.174				
264.4503				657.292	
264.6073		656.477			656.477

266.8623			657.252		
272.6193	655.728				
272.6193				657.036	
272.8743		656.452			656.452
274.8713			657.166		
279.6393	656.167				
279.6393			657.197		
279.6883		656.445			656.445
282.8453				656.887	
284.4283				656.712	
285.8383		656.345			656.345
285.8853	655.379				
286.0223			656.649		
289.9193		656.332			656.332
290.0443	655.412				
290.6173			656.749		
299.9443		656.233			656.233
300.3693			656.61		
300.3823	655.754				
301.0653				656.767	
307.2233		656.018			656.018
307.8213	655.09				
307.8213				656.483	
309.5573			656.475		
314.3183				656.352	
316.6063	655.214				
317.0583				656.551	
317.9123		655.99			655.99
319.9943			656.432		
326.2253				656.263	
327.2953	655.525				
327.4563		655.847			655.847
329.0943			656.177		
337.4543			656.089		
337.4543	654.676				
337.8433		655.534			655.534
343.4253				656.251	
345.6313			656.044		
345.6313	655.033				
345.6723		655.45			655.45
346.4803				656.129	
355.5373				656.092	
356.0173		655.382			655.382
356.1373	654.652				
356.9083			655.839		
363.7873			655.754		
365.9483				655.811	
365.9483	654.689				
366.0803		654.961			654.961
369.0203		654.926			654.926
369.7183	654.115				
371.4353				655.462	
372.8963		654.916			654.916
372.8993	654.644				
374.2793			655.538		
378.5033			655.372		
379.4423	654.374				
379.5533		654.608			654.608
380.2163				655.142	
387.0233		654.302			654.302
387.1653			655.049		
387.1653	653.401				
389.1043				654.964	
394.5053	653.968				
394.5053			654.933		
394.6173		654.172			654.172

395.0863					654.643		
403.9403					654.4		
404.2163				654.518			
404.6393	653.276						
404.7413		653.677				653.677	
412.8533					654.599		
412.8533	652.946						
413.1473		653.606				653.606	
417.7263				654.496			
420.5183					654.018		
421.8223		653.467				653.467	
422.2133				654.31			
422.2133	652.881						
428.2923		653.457				653.457	
428.5293				654.173			
428.5293	652.756						
432.8663	652.688						
432.9413		653.434				653.434	
433.9833				654.194			
435.2063					653.621		
447.4313		653.024				653.024	
447.5273	652.487						
447.7563					653.737		
448.8093				653.442			
456.4913		652.842				652.842	
456.5343					653.753		
456.5343	652.301						
459.0103				653.219			
464.1543	652.123						
464.2913		652.441				652.441	
464.4603					653.25		
466.3973				653.195			
470.4533		652.318				652.318	
470.5633	652.057						
471.6343					652.904		
473.6133				653.06			
474.3073					652.988		
475.8143	651.669						
475.8143				653.049			
475.9653		651.852				651.852	
482.9343				652.581			
482.9343	651.256						
483.3573		651.895				651.895	
485.6393					653.039		
487.2093	650.735						
487.2093				652.607			
487.5693		651.831				651.831	
489.8393					652.706		
492.5293				652.191			
493.4403		651.808				651.808	
493.7363					652.541		
493.7363	650.93						
497.6173	650.843	651.657	652.277	652.299		651.694	651.62
501.6533				652.158			
504.0383	651.05						
504.0383					652.143		
504.0553		651.602				651.602	
507.2793					652.495		
512.6683				651.896			
513.3093	650.971						
513.3093		651.442				651.442	
513.4093					651.895		
520.7743					651.618		
522.1693				651.96			
522.1693	650.701						
522.2343		651.334				651.334	

527.8953		651.247			651.247	
527.9253	650.552					
527.9253			652.01			
537.6253			651.487			
537.6253	650.743					
537.8943		651.14			651.14	
541.2883				651.553		
550.0603			650.928			
551.4363	650.184					
551.4773		650.753			650.753	
551.5453				651.35		
555.8193	650.108					
555.8193				651.214		
556.0833		650.809			650.809	
559.4933	650.071					
559.4933				650.767		
559.9733		650.719			650.719	
565.2553			651.077			
567.9803	650.286					
568.0153		650.736			650.736	
569.9393				651.097		
576.7993	650.075					
577.0823		650.742			650.742	
577.3393			651.201			
579.3453				650.982		
583.7963				651.242		
585.5143			651.187			
586.4543		650.405			650.405	
586.7473	649.976					
587.8943			651.416			
591.3133	649.809					
592.6683		650.389			650.389	
594.9323			650.832			
596.1063				650.962		
602.5403			650.65			
602.7113		650.231			650.231	
603.1063	649.923					
603.7693				650.641		
607.1273		649.553			649.553	
607.1453	649.459					
611.5043		649.056			649.056	
611.5583	648.93					
616.7463				650.098		
617.5853		648.891				648.891
617.6303	648.817		649.491			

Cross Section / Bank Profile Locations

Name	Type	Profile Station
(Year 4) Cross Section 7 - Pool (R1)	Pool XS	497.6173

Measurements from Graph

Bankfull Slope: 0.0197

Variable	Min	Avg	Max
S riffle	0.01424	0.03762	0.05154
S pool	0.00000	0.00357	0.00950
S run	0	0	0
S glide	0	0	0
P - P	17.50	29.92	40.72
Pool length	7.13	8.37	10.59
Riffle length	6.26	8.58	13.77

Dmax riffle	0.70	0.77	0.92
Dmax pool	1.34	1.51	1.71
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.

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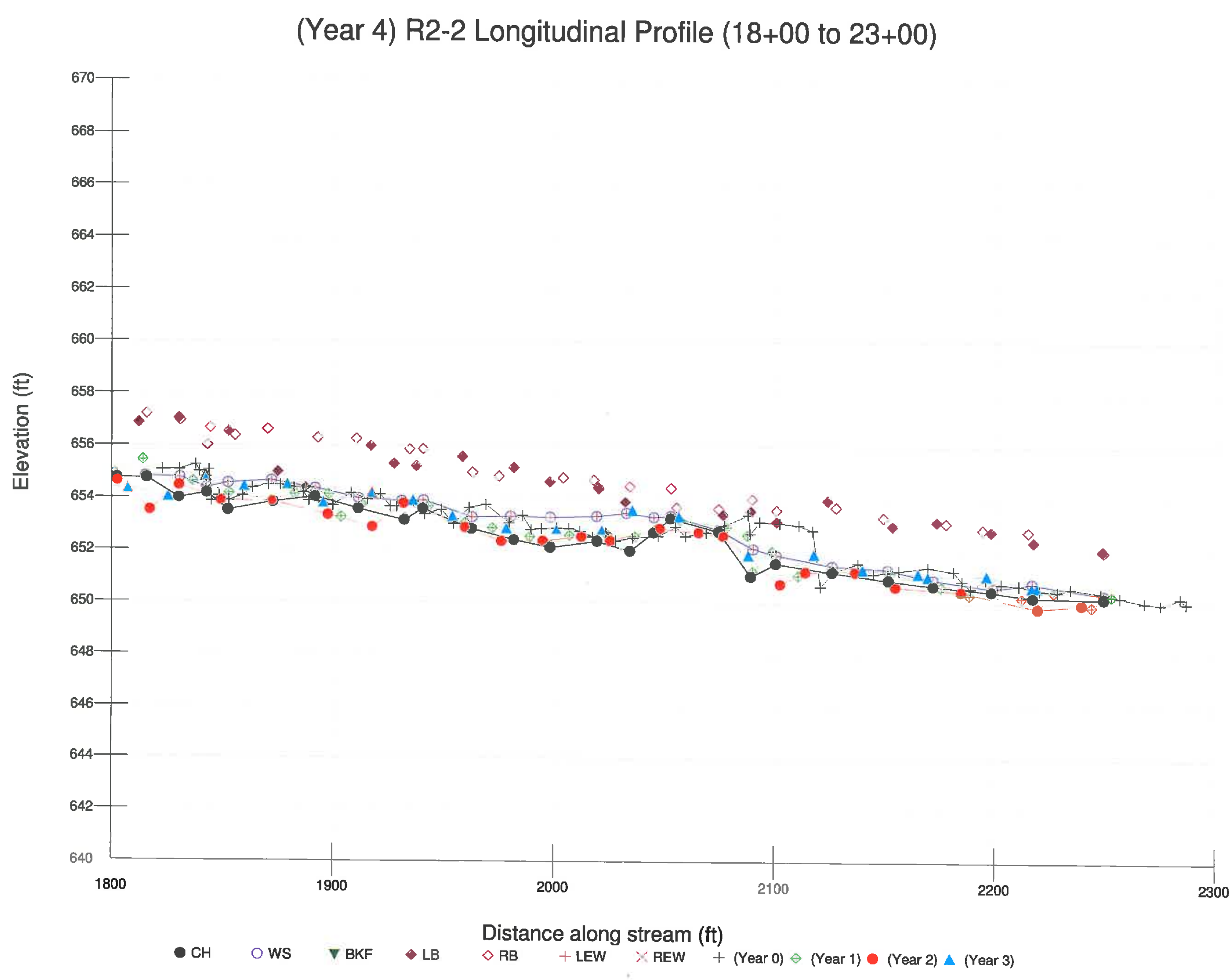
RIVERMORPH PROFILE SUMMARY

Notes

River Name: (Year 4) Reedy Fork Creek
Reach Name: R1
Profile Name: (Year 4) R1 Longitudinal Profile
Survey Date: 09/26/2011

DIST	Note
497.6173	XS7 - TW Intersect @ station 497.6173



(Year 4) R2-2 Longitudinal Profile (18+00 to 23+00)
Elevation (ft)
670
668
666
664
662
660
658
656
654
652
650
648
646
644
642
640
1800
1900
2000
2100
2200
2300
Distance along stream (ft)
CH
WS
BKF
LB
RB
LEW
REW
(Year 0)
(Year 1)
(Year 2)
(Year 3)

RIVERMORPH PROFILE SUMMARY

River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-2
Profile Name: (Year 4) R2-2 Longitudinal Profile
Survey Date: 09/26/2011

Survey Data

DIST	CH	WS	BKF	LB	RB	LEW	REW
1802.29	654.75						
1812.26				656.866			
1815.1		654.827				654.827	
1815.77	654.741						
1815.77					657.204		
1830.31				657.032			
1830.37	653.978						
1830.72		654.778				654.778	
1830.94					656.962		
1842.67		654.396				654.396	
1842.89	654.172						
1843.35					656.003		
1844.57					656.672		
1852.5		654.562				654.562	
1852.5	653.51						
1852.96				656.529			
1855.76					656.384		
1870.57					656.62		
1872.18		654.666				654.666	
1872.84	653.83						
1874.99				654.989			
1887.44				654.397			
1891.9	654.034						
1891.94		654.373				654.373	
1893.41					656.285		
1910.81					656.255		
1911.43		653.99				653.99	
1911.53	653.567						
1917.38				655.979			
1927.86				655.301			
1931.11		653.881				653.881	
1932.34	653.141						
1934.95					655.859		
1937.96				655.218			
1940.78	653.576						
1940.86		653.91				653.91	
1940.97					655.877		
1958.76				655.58			
1962.78	652.808						
1962.95		653.265				653.265	
1963.37					654.982		
1975.3					654.842		
1980.44		653.303				653.303	
1981.97	652.385						
1981.97				655.163			
1998.26				654.629			
1998.37		653.269				653.269	
1998.37	652.101						
2004.34					654.789		
2018.16					654.708		

2019.45		653.314			653.314
2019.69	652.343				
2020.17			654.424		
2020.45			654.382		
2032.47			653.861		
2032.93		653.438			653.438
2034.54	651.972				
2034.54				654.468	
2045.26	652.676				
2045.35		653.286			653.286
2053.02	653.221				
2053.02		653.331			653.331
2053.33				654.399	
2055.68				653.656	
2074.7				653.614	
2074.78	652.718	652.8			652.8
2076.73			653.385		
2089.35			653.529		
2089.35	651.007				
2089.91				653.989	
2090.34		652.078			652.078
2100.65	651.498				
2100.83		651.835			651.835
2101.21				653.55	
2101.24			653.106		
2124.3			653.918		
2126.2		651.427			651.427
2126.2	651.177				
2128.1				653.659	
2149.81				653.277	
2151.43		651.288			651.288
2151.83	650.872				
2153.79			652.948		
2172.12		650.91			650.91
2172.12	650.654				
2173.85			653.113		
2178.1				653.061	
2194.62				652.819	
2198.53			652.743		
2198.53	650.455				
2199.18		650.591			650.591
2215.27				652.74	
2217.03		650.776			650.776
2217.34	650.212				
2217.69			652.35		
2249.03			652.019		
2249.61	650.17	650.334		651.979	650.334

Cross Section / Bank Profile Locations

Name	Type	Profile Station

Measurements from Graph

Bankfull Slope: 0.01039

Variable	Min	Avg	Max
S riffle	0.02088	0.02650	0.03384
S pool	0.00000	0.00206	0.00445
S run	0	0	0
S glide	0	0	0
P - P	25.92	57.70	78.73
Pool length	17.11	19.88	22.00

Riffle length	20.05	21.35	22.49
Dmax riffle	0.91	1.63	2.09
Dmax pool	2.21	2.49	2.97
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.
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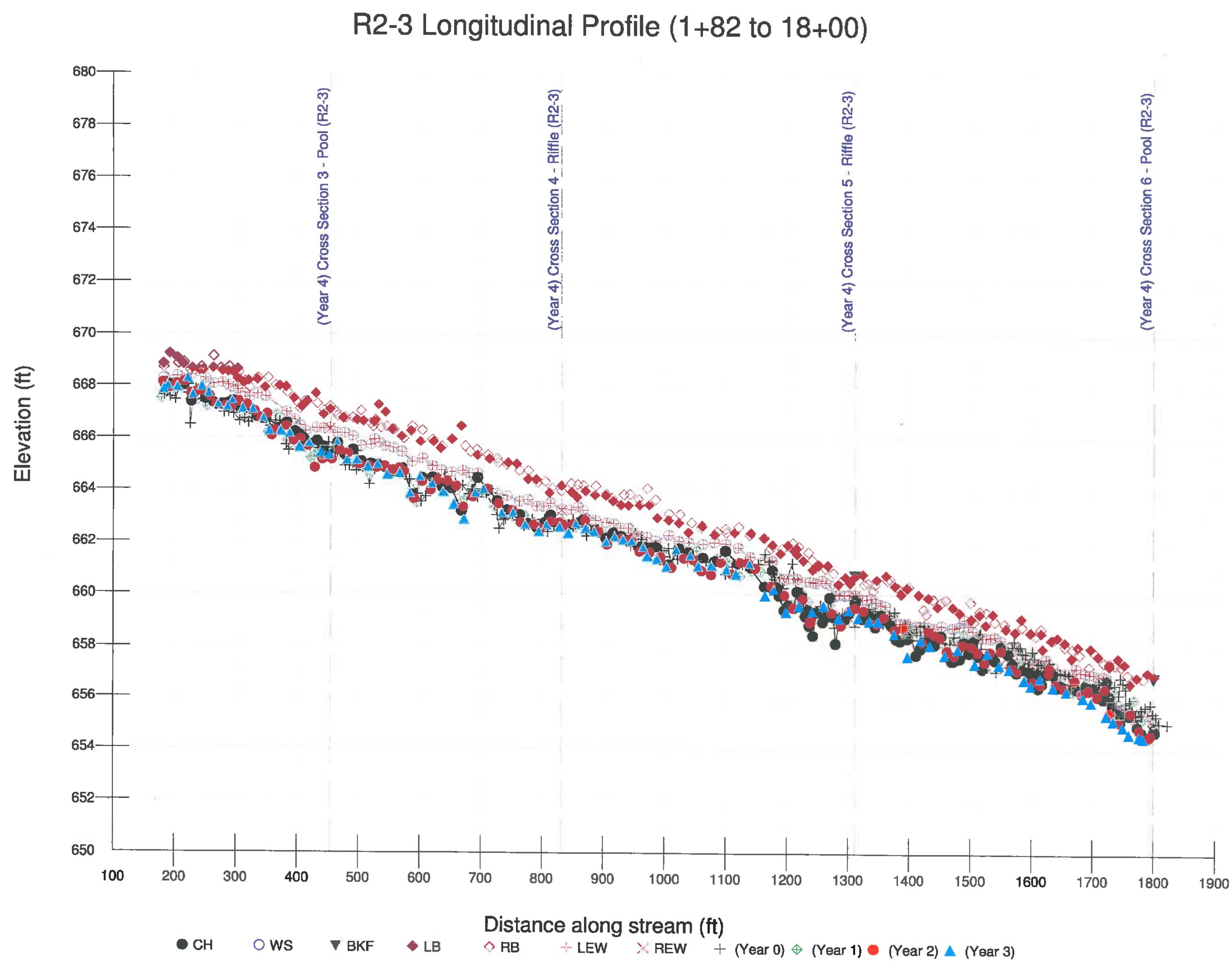
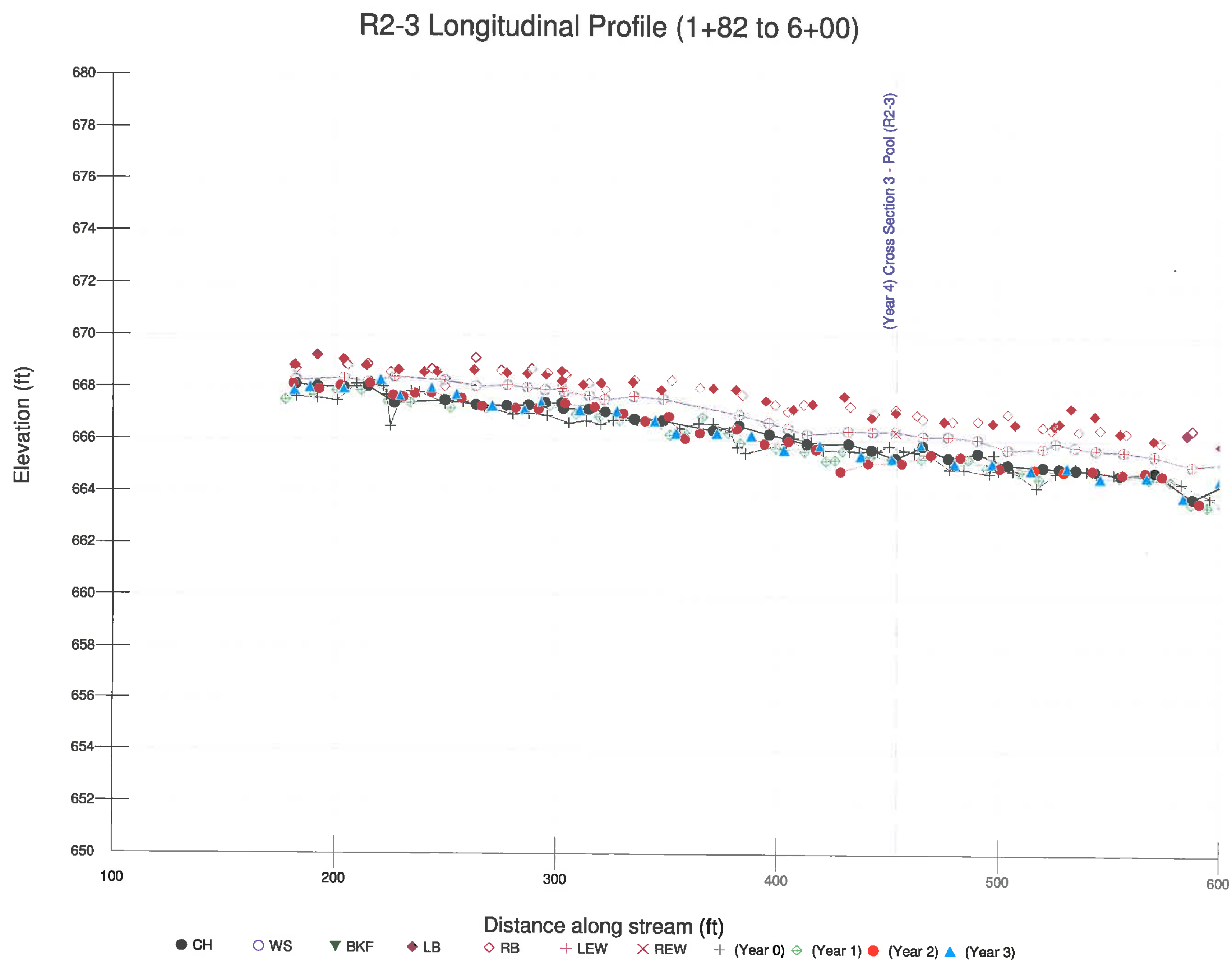
RIVERMORPH PROFILE SUMMARY

Notes

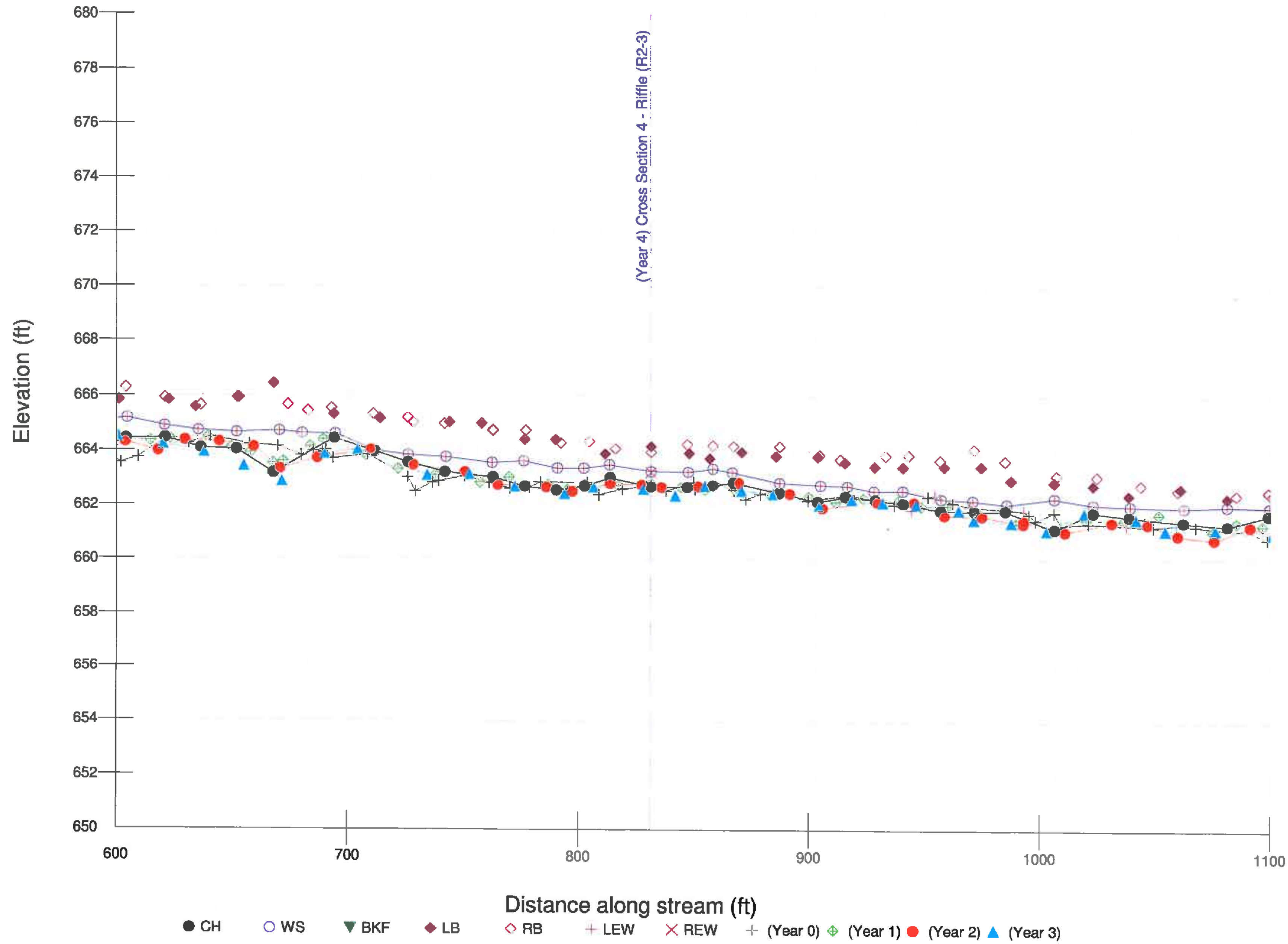
River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-2
Profile Name: (Year 4) R2-2 Longitudinal Profile
Survey Date: 09/26/2011

DIST	Note

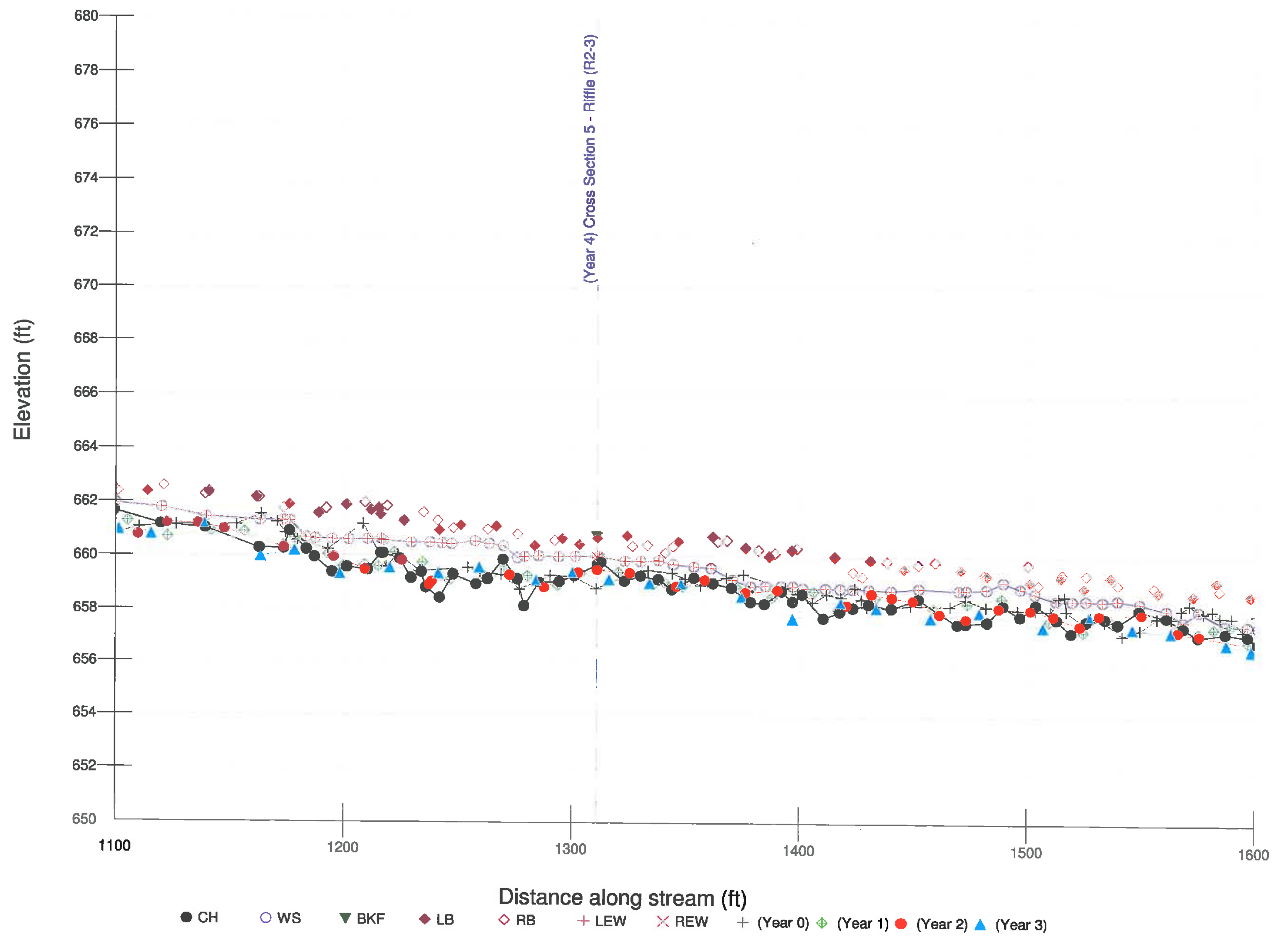

R2-3 Longitudinal Profile (1+82 to 18+00)
Elevation (ft)
680
678
676
674
672
670
668
666
664
662
660
658
656
654
652
650
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
(Year 4) Cross Section 3 - Pool (R2-3)
(Year 4) Cross Section 4 - Riffle (R2-3)
(Year 4) Cross Section 5 - Riffle (R2-3)
(Year 4) Cross Section 6 - Pool (R2-3)
Distance along stream (ft)
CH
WS
BKF
LB
RB
LEW
REW
(Year 0)
(Year 1)
(Year 2)
(Year 3)


R2-3 Longitudinal Profile (1+82 to 6+00)
Elevation (ft)
680
678
676
674
672
670
668
666
664
662
660
658
656
654
652
650
100
200
300
400
500
600
Distance along stream (ft)
(Year 4) Cross Section 3 - Pool (R2-3)
CH
WS
BKF
LB
RB
LEW
REW
(Year 0)
(Year 1)
(Year 2)
(Year 3)

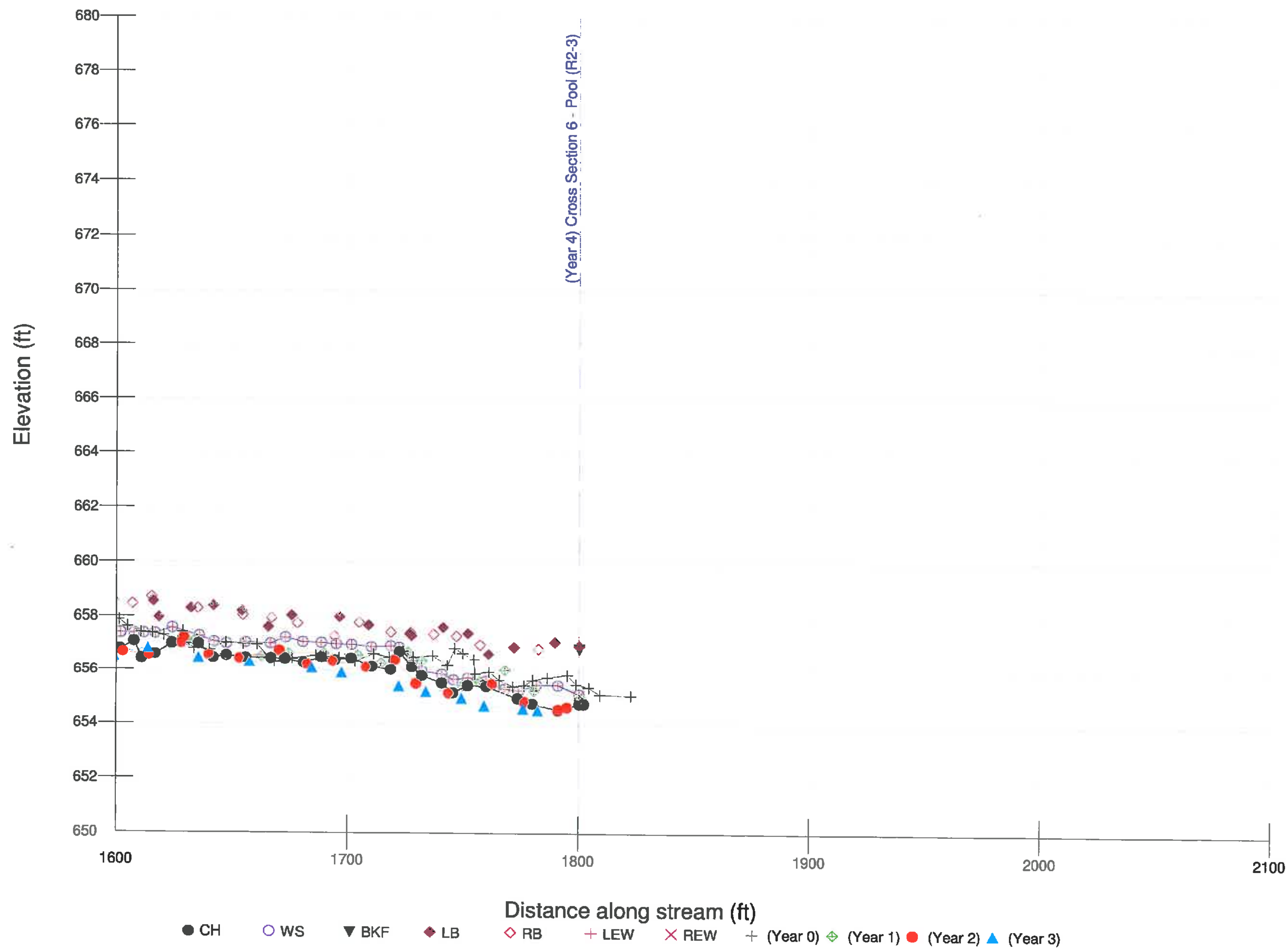
R2-3 Longitudinal Profile (6+00 to 11+00)



R2-3 Longitudinal Profile (11+00 to 16+00)



R2-3 Longitudinal Profile (16+00 to 18+00)



RIVERMORPH PROFILE SUMMARY

River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-3
Profile Name: (Year 4) R2-3 Longitudinal Profile
Survey Date: 09/26/2011

Survey Data

DIST	CH	WS	BKF	LB	RB	LEW	REW
182.12	668.09	668.28		668.836			
182.679	668.11	668.28			668.705		
192.34	668.021						
192.34				669.232			
204.24				669.06			
204.24	667.986						
204.42		668.352				668.352	
206.1					668.842		
214.48				668.816			
215.11					668.886		
215.21	668.022						
215.32		668.201				668.201	
225.47					668.574		
227.01	667.374						
227.2		668.405				668.405	
229.02				668.652			
240.43				668.57			
243.95					668.708		
246.36				668.581			
249.84		668.278				668.278	
249.9	667.491						
249.9					668.029		
263.06				668.66			
263.8	667.317						
263.8					669.134		
263.82		668.051				668.051	
275.27					668.655		
277.85	667.281						
277.85				668.554			
278.15		668.09				668.09	
286.99				668.531			
287.08		667.999				667.999	
287.64	667.309						
289.05					668.72		
294.97		667.911				667.911	
295.15	667.4						
295.58				668.493			
296.16					668.554		
302.51				668.626			
302.51	667.374						
302.51				668.256			
302.59		667.96				667.96	
303.35	667.186						
303.54		667.838				667.838	

304.25				668.502		
304.78				668.49		
312.26			668.108			
314.85	667.154					
314.85				668.166		
314.9		667.691			667.691	
320.33			668.177			
321.96		667.541			667.541	
322.29	667.051					
322.29				667.917		
334.78			668.209			
335.21		667.668			667.668	
335.44				668.295		
335.5	666.776					
347.56			667.915			
348.3	666.72					
348.39		667.575			667.575	
352.38				668.292		
365.1				667.993		
371			667.979			
371	666.355					
381.23			667.933			
382.71		666.973			666.973	
382.77	666.54					
384.28				667.734		
394.84			667.505			
396.11		666.668			666.668	
396.41	666.208					
398.92				667.359		
404.76		666.455			666.455	
404.76				667.096		
404.76	666.053					
407.19			667.187			
412				667.379		
413.42	665.848					
413.42		666.227			666.227	
415.96			667.393			
430.29			667.688			
431.94		666.358			666.358	
432.27	665.857					
433.05				667.299		
442.67	665.618					
442.67			666.87			
443.18		666.336			666.336	
443.93				667.037		
453.64	665.307	666.354	667.075	667.2	666.396	666.312
463.09				666.983		
465.77				666.828		
465.77		666.158			666.158	
465.77	665.777					
475.44			666.741			
477.28		666.162			666.162	
477.32	665.328					
479.22				666.758		
490.57		666.042			666.042	
490.71				666.76		
490.71	665.506					
497.49			666.666			
504.27		665.665			665.665	
504.27	665.066					

504.27				667.028	
507.59			666.627		
520.17				666.531	
520.23		665.706			665.706
520.28	664.971				
523.99				666.424	
525.34			666.584		
525.93		665.923			665.923
527.62	664.924				
527.67			666.667		
532.93			667.262		
534.64		665.769			665.769
535.13	664.882				
536.4				666.377	
543.67			666.964		
543.67	664.834				
544.18		665.652			665.652
546.08				666.431	
555.11	664.682				
555.11			666.304		
556.77		665.591			665.591
557.89				666.304	
570.27			666.036		
570.57		665.437			665.437
570.87	664.811				
573.4				665.954	
585.66			666.25		
587.7		665.049			665.049
588				666.426	
588	663.78				
601.12			665.831		
604.05				666.283	
604.05	664.43				
604.44		665.181			665.181
620.56		664.898			664.898
620.93				665.921	
620.93	664.454				
622.65			665.831		
634.13			665.57		
635.23		664.731			664.731
636.4				665.646	
636.4	664.083				
651.74		664.66			664.66
651.82	664.028				
652.24				665.931	
652.88			665.932		
667.81			666.439		
667.81	663.177				
670.25		664.717			664.717
674.1				665.667	
680.1		664.628			664.628
682.65				665.446	
693.08				665.534	
694.18	664.441				
694.18			665.315		
694.49		664.613			664.613
711.05				665.332	
711.73	663.956				
711.94		663.987			663.987
713.98			665.163		

725.98		663.836			663.836	
726.12	663.559					
726.12				665.194		
728.35				665.037		
742.06	663.208					
742.06				664.966		
742.42		663.759			663.759	
744.14			665.027			
758.1			664.978			
762.37		663.553			663.553	
762.99				664.743		
762.99	663.022					
762.99				664.712		
776.14		663.612			663.612	
776.64	662.686					
776.7			664.397			
777.1				664.725		
790.03			664.388			
790.29	662.545					
790.69		663.359			663.359	
792.22				664.268		
802.17		663.356			663.356	
802.48	662.702					
804.64				664.319		
811.52			663.871			
813.27		663.484			663.484	
813.67	663.006					
815.87				664.067		
831.32	662.675	663.243	664.151	663.947	663.28	663.205
847.08	662.662					
847.08				664.228		
847.44		663.22			663.22	
847.85			663.899			
856.8			663.713			
858.16				664.193		
858.16		663.342			663.342	
858.16	662.727					
866.55		663.214			663.214	
867.12				664.167		
867.12	662.833					
870.68			663.948			
885.8			663.797			
887.03	662.462					
887.07		662.823			662.823	
887.3				664.151		
903.57	662.133					
903.87			663.779			
904.59				663.831		
904.79		662.741			662.741	
913.63				663.68		
915.6			663.566			
915.6	662.325					
916.52		662.71			662.71	
927.93		662.531			662.531	
928.45			663.415			
928.45	662.21					
933.23				663.816		
940.43		662.545			662.545	
940.73	662.079					
940.73			663.398			

943.17				663.835	
956.87				663.644	
956.92	661.811				
957.12		662.247			662.247
958.67			663.417		
970.87		662.188			662.188
971.58	661.784				
971.58				664.056	
974.64			663.419		
985.01	661.807				
985.01				663.628	
985.62		662.053			662.053
987.6			662.926		
1006.33			662.847		
1006.33	661.116				
1006.33		662.272			662.272
1007.31				663.1	
1023.1	661.743				
1023.1			662.735		
1023.1		662.045			662.045
1024.75				663.07	
1038.55	661.591				
1038.55			662.37		
1039.25		661.981			661.981
1043.83				662.751	
1059.94				662.556	
1061.13			662.631		
1062.24	661.388				
1062.62		661.925			661.925
1081.39			662.288		
1081.39		661.989			661.989
1081.39	661.251				
1085.36				662.402	
1099.35	661.657				
1099.35				662.512	
1099.91		661.935			661.935
1101.01				662.372	
1114.07			662.37		
1119.73	661.172				
1120.21		661.786			661.786
1121.07				662.592	
1139.19	661.026				
1139.19				662.274	
1139.58		661.444			661.444
1140.96			662.356		
1161.82			662.164		
1162.92				662.162	
1162.93	660.284				
1163.28		661.319			661.319
1173.26		661.313			661.313
1173.66	660.277				
1173.66				661.778	
1176.21			661.9		
1176.21	660.914				
1176.32		661.304			661.304
1183.3		660.688			660.688
1183.53	660.235				
1187.14	659.944				
1187.47		660.643			660.643
1189.12			661.578		

1192.36					661.762		
1194.81	659.394						
1194.9		660.621				660.621	
1201.28	659.571						
1201.28				661.889			
1202.19		660.605				660.605	
1209.36					661.979		
1210.4	659.484						
1210.51		660.616				660.616	
1212.03				661.69			
1215.44				661.759			
1216.2	660.094						
1216.2				661.534			
1216.39		660.628				660.628	
1217.28	660.096						
1217.49		660.581				660.581	
1219.01					661.852		
1224.53	659.891						
1226.46				661.3			
1229.52	659.172						
1229.55		660.5				660.5	
1234.04	659.401						
1234.98					661.625		
1235.88	658.815						
1237.71		660.505				660.505	
1241.12					661.33		
1241.84				660.959			
1241.98	658.434						
1243.08		660.476				660.476	
1247.33		660.451				660.451	
1247.97	659.312						
1248.04					661.038		
1251.32				661.152			
1257.61		660.556				660.556	
1258	658.946						
1263.03	659.137						
1263.16					660.999		
1263.63		660.466				660.466	
1266.8				661.116			
1269.79	659.868						
1270.09		660.377					
1276.14					660.828		
1276.14	659.142	659.943					
1279.05	658.13						
1279.26		659.979				659.979	
1283.66				660.392			
1285.43		660.007				660.007	
1285.57	659.03						
1292.45					660.597		
1294.16		659.977				659.977	
1294.54	659.054						
1295.75				660.663			
1301.15	659.28						
1301.53		660.004				660.004	
1303.33				660.442			
1311.23	659.675	659.974	660.721	660.695		659.974	659.974
1311.97		659.985				659.985	
1312.83	659.789						
1323.06	659.077						
1323.29		659.831				659.831	

1324.28			660.775		
1326.51				660.389	
1330.22	659.273				
1330.25		659.823			659.823
1333.1				660.433	
1337.97	659.148				
1338.15		659.862			659.862
1340.97				660.149	
1343.93	658.776				
1344.29				660.385	
1344.5		659.712			659.712
1346.67			660.57		
1353.54		659.633			659.633
1353.68	659.212				
1361.2		659.572			659.572
1362			660.734		
1362	659.004				
1364.3				660.554	
1368.31				660.601	
1370.16	658.84				
1370.63		659.148			659.148
1376.47			660.334		
1378.44		658.899			658.899
1378.52	658.313				
1382.09				660.256	
1384.6	658.239				
1385.06		658.918			658.918
1386.82			660.016		
1389.28				660.133	
1391.9		658.905			658.905
1392.18	658.727				
1396.69			660.252		
1396.95	658.329				
1396.97		658.906			658.906
1398.93				660.318	
1401.22	658.603				
1401.41		658.828			658.828
1410.47	657.706				
1411.43		658.82			658.82
1415.5			660.001		
1417.68	657.94				
1417.85		658.812			658.812
1423.43		658.802			658.802
1423.47	658.096				
1423.47				659.454	
1427.49				659.26	
1430.45	658.228				
1430.53		658.786			658.786
1431.13			659.884		
1438.54				659.83	
1440.25		658.745			658.745
1440.37	658.087				
1445.98			659.542		
1452.31				659.715	
1452.31	658.441				
1452.45		658.832			658.832
1459.75				659.824	
1469.29	657.481				
1470.09		658.752			658.752
1471.03			659.531		

1473.06	657.512				
1473.35		658.763			658.763
1481.23				659.338	
1482.29		658.802			658.802
1482.42	657.577				
1482.44			659.308		
1489.46	658.196				
1489.68		659.069			659.069
1496.93	657.779				
1497.08		658.827			658.827
1500.55				659.721	
1501.33			659.08		
1503.55		658.645			658.645
1503.88	658.23				
1504.95				658.975	
1512.75		658.395			658.395
1513.06	657.676				
1514.95			659.257		
1515.43				659.377	
1519.39	657.167				
1519.87		658.384			658.384
1525.09			658.861		
1525.89		658.394			658.394
1526.02	657.613				
1526.02				659.338	
1533.31		658.355			658.355
1534.34	657.712				
1536.81			659.27		
1539.89				658.987	
1539.89	657.518				
1539.9		658.419			658.419
1549.31	658.037				
1549.61		658.292			658.292
1555.84				658.892	
1557.77			658.721		
1561.24	657.766				
1561.31		658.03			658.03
1568.64		657.61			657.61
1568.72	657.385				
1573.19			658.597		
1575.25	657.043				
1575.56		658.007			658.007
1583.35			659.093		
1584.47				658.801	
1587.04		657.481			657.481
1587.27	657.173				
1596.96		657.455			657.455
1597.08	657.066				
1598.51			658.571		
1598.52			658.581		
1601.64	656.783				
1601.74		657.398			657.398
1606.84				658.457	
1607.48		657.389			657.389
1607.59	657.079				
1610.89	656.441				
1611.62		657.389			657.389
1615.15				658.709	
1615.85			658.557		
1616.55		657.378			657.378

1616.67	656.602				
1618.24			657.965		
1624.06		657.584			657.584
1624.06	657.009				
1632.16			658.298		
1635.16				658.3	
1635.5	656.992				
1635.76		657.291			657.291
1641.84			658.392		
1641.88	656.464				
1642.02		657.079			657.079
1647.46		657.012			657.012
1647.56	656.544				
1654.21			658.203		
1654.58				658.052	
1655.75		657.06			657.06
1655.89	656.466				
1665.62			657.615		
1666.54		657.011			657.011
1666.84	656.449				
1667.04				657.943	
1672.96	656.409				
1673.03		657.242			657.242
1675.76			658.033		
1678.24				657.753	
1680.55		657.074			657.074
1681.07	656.277				
1688.57		657.046			657.046
1688.66	656.487				
1694.32				657.288	
1694.57	656.384				
1695.02		656.997			656.997
1696.49			657.98		
1701.49	656.448				
1701.7		656.977			656.977
1704.95				657.782	
1709.02			657.687		
1710.2		656.892			656.892
1710.55	656.134				
1718.56		656.932			656.932
1718.68	656.014				
1718.68				657.448	
1722.3		656.877			656.877
1722.45	656.7				
1726.89			657.37		
1727.2				657.422	
1727.65			657.31		
1727.74		656.362			656.362
1727.82	656.116				
1732.11		655.969			655.969
1732.19	655.788				
1737.21				657.36	
1740.84		655.85			655.85
1740.84	655.511				
1741.31			657.61		
1745.63	655.144				
1745.81		655.64			655.64
1747.07				657.298	
1752.01			657.391		
1752.01	655.414				

1752.24		655.71				655.71	
1757.3					656.974		
1759.98		655.592				655.592	
1760.09	655.387						
1761.01				656.621			
1768.02		655.296				655.296	
1772.12				656.872			
1773.68	654.946						
1774.16		655.228				655.228	
1780.06	654.751						
1781.82		655.449				655.449	
1782.81					656.819		
1789.79				657.067			
1791.22	654.525						
1791.22		655.437				655.437	
1800.34	654.745	655.106	656.82	656.917		655.131	655.081
1802.29	654.75						

Cross Section / Bank Profile Locations

Name	Type	Profile Station
(Year 4) Cross Section 3 - Pool	(R2-3)Pool XS	453.64
(Year 4) Cross Section 4 - Riffle	(R2-3)Riffle XS	831.32
(Year 4) Cross Section 5 - Riffle	(R2-3)Riffle XS	1311.23
(Year 4) Cross Section 6 - Pool	(R2-3)Pool XS	1800.34

Measurements from Graph

Bankfull Slope: 0.00749

Variable	Min	Avg	Max
S riffle	0.00787	0.02639	0.09107
S pool	0	0	0
S run	0	0	0
S glide	0	0	0
P - P	28.47	47.53	82.11
Pool length	15.49	24.9	33.05
Riffle length	10.01	18.33	31.43
Dmax riffle	0.77	1	1.19
Dmax pool	1.71	2.13	2.52
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.

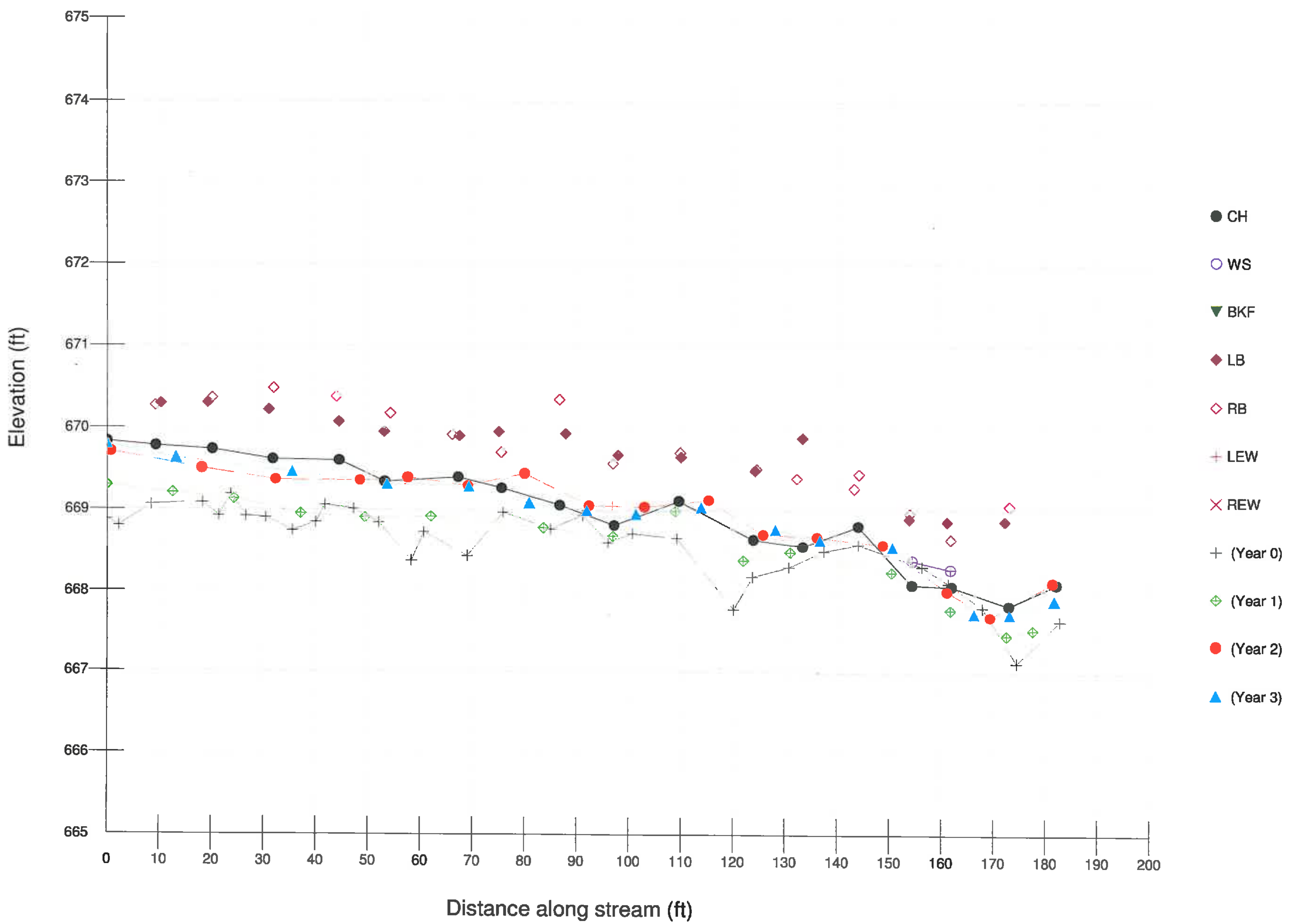
RIVERMORPH PROFILE SUMMARY

Notes

River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-3
Profile Name: (Year 4) R2-3 Longitudinal Profile
Survey Date: 09/26/2011

DIST	Note
453.64	XS3 - TW Intersect @ station 453.64
831.32	XS4 - TW Intersect @ station 831.32
1311.23	XS5 - TW Intersect @ station 1311.23
1800.34	XS6 - TW Intersect @ station 1800.34

(Year 4) R2-4a Longitudinal Profile (Sta 0+00 to 1+82)



RIVERMORPH PROFILE SUMMARY

River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-4a
Profile Name: (Year 4) R2-4a
Survey Date: 09/26/2011

Survey Data

DIST	CH	WS	BKF	LB	RB	LEW	REW
0	669.83						
9.31	669.778						
9.31					670.271		
10.37				670.295			
19.32				670.305			
20.16	669.734						
20.16					670.363		
31.06				670.217			
31.7	669.612						
31.91					670.48		
43.94					670.379		
44.43				670.071			
44.43	669.599						
53.15	669.338						
53.15				669.949			
54.32					670.176		
66.2					669.915		
67.25	669.394						
67.57				669.898			
75.1				669.95			
75.61	669.262						
75.61					669.695		
86.76					670.348		
86.76	669.056						
87.95				669.931			
96.85						669.044	
97					669.563		
97.18	668.812						
97.96				669.664			
109.61	669.108						
109.94					669.698		
110.07				669.645			
123.94	668.64						
124.34				669.476			
124.6					669.496		
132.32					669.385		
133.45				669.878			
133.45	668.554						
143.35					669.267		
144.05	668.805						
144.27					669.44		
153.9				668.893			
154					668.96		
154.42	668.083						
154.54		668.381				668.381	
161.23				668.859			
161.81		668.273				668.273	
161.93					668.646		
162.05	668.062						
172.29				668.867			

173.02	667.824	
173.17		669.051
182.1241	668.09	

Cross Section / Bank Profile Locations

Name	Type	Profile Station

Measurements from Graph

Bankfull Slope: 0.00875

Variable	Min	Avg	Max
S riffle	0.00664	0.01796	0.03175
S pool	0.00213	0.00395	0.00617
S run	0	0	0
S glide	0	0	0
P - P	36.45	40.21	44.24
Pool length	13.13	16.63	20.66
Riffle length	7.99	8.58	9.55
Dmax riffle	0.49	0.58	0.79
Dmax pool	0.69	0.84	1.01
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.
♀

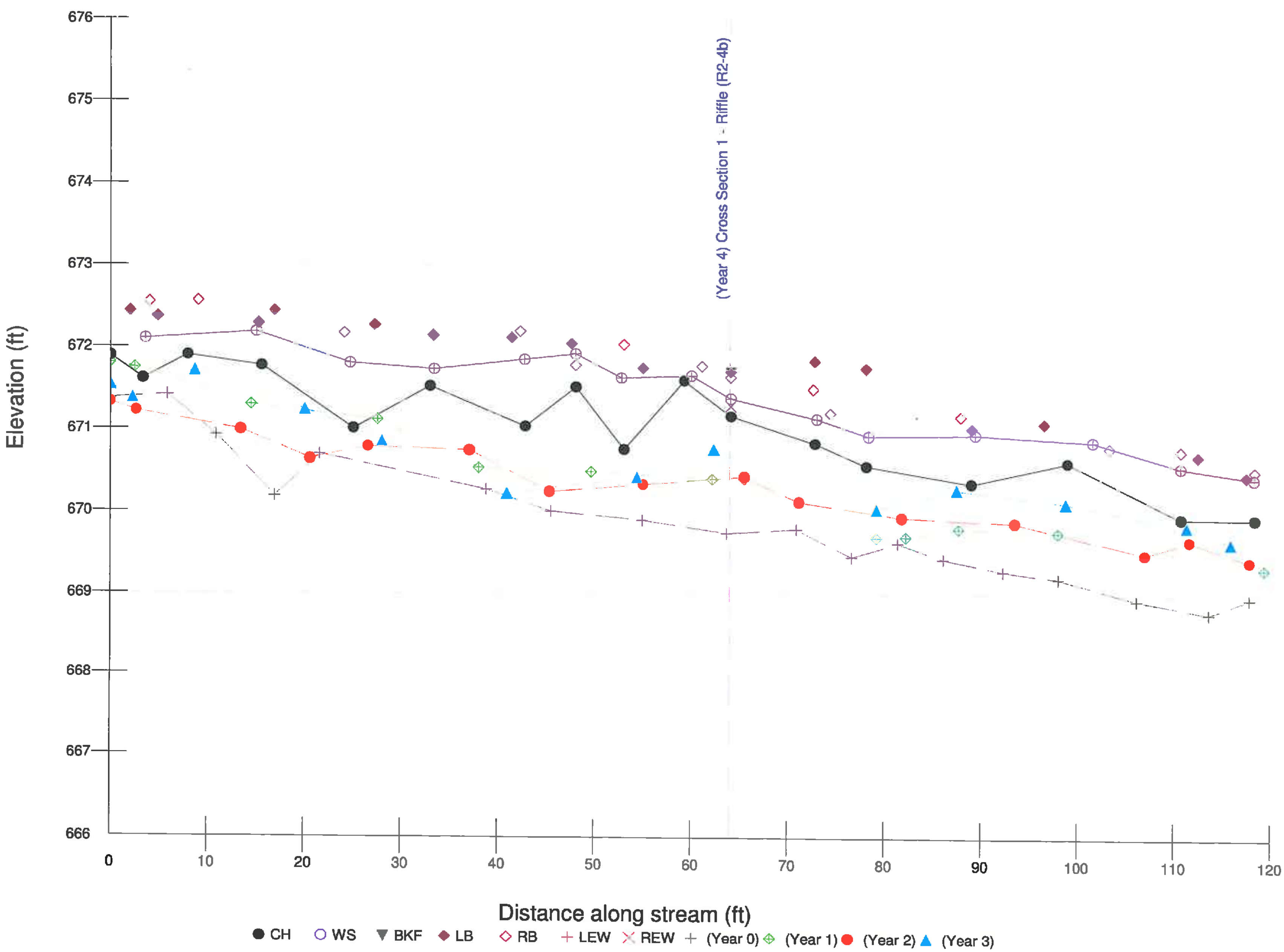
RIVERMORPH PROFILE SUMMARY

Notes

River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-4a
Profile Name: (Year 4) R2-4a
Survey Date: 09/26/2011

DIST	Note

(Year 4) R2-4b Longitudinal Profile (0+00 to 1+20)



RIVERMORPH PROFILE SUMMARY

River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-4b
Profile Name: (Year 4) R2-4b
Survey Date: 09/26/2011

Survey Data

DIST	CH	WS	BKF	LB	RB	LEW	REW
0	671.892						
2.032				672.444			
3.339	671.617						
3.627		672.104				672.104	
4.026					672.554		
4.875				672.378			
7.957	671.909						
9.036					672.569		
15.084		672.188				672.188	
15.315				672.293			
15.586	671.78						
16.954				672.451			
24.172					672.175		
24.755		671.81				671.81	
25.074	671.015						
27.282				672.272			
33.003	671.534						
33.331				672.148			
33.386					672.141		
33.442		671.737				671.737	
41.469				672.12			
42.338					672.198		
42.788		671.856				671.856	
42.836	671.041						
47.651				672.049			
48.058		671.925				671.925	
48.078	671.528						
48.078					671.787		
52.8		671.635				671.635	
53.044					672.045		
53.044	670.76						
55.046				671.756			
59.276	671.609						
60.06		671.665				671.665	
61.137					671.78		
64.12	671.173	671.386	671.71	671.713	671.646	671.386	671.291
72.64					671.506		
72.783				671.847			
72.811	670.838						
73.01		671.136				671.136	
74.426					671.205		
78.118	670.561						
78.118				671.759			
78.392		670.924				670.924	
87.916					671.167		
89.009	670.352						
89.085				671.02			
89.43		670.944				670.944	
96.57				671.084			
98.964	670.607						

101.577		670.861			670.861
103.331				670.783	
110.753		670.547			670.547
110.753	669.932				
110.753				670.748	
112.543			670.685		
117.54			670.443		
118.32		670.412			670.412
118.384				670.505	
118.384	669.928				

Cross Section / Bank Profile Locations

Name	Type	Profile Station
(Year 4) Cross Section 1 - Riffle (R2-4b)	Riffle XS	64.12

Measurements from Graph

Bankfull Slope: 0.01629

Variable	Min	Avg	Max
S riffle	0.01943	0.05387	0.08831
S pool	0.00000	0.00107	0.00252
S run	0	0	0
S glide	0	0	0
P - P	21.75	28.61	36.13
Pool length	10.06	13.36	14.97
Riffle length	5.03	6.43	7.83
Dmax riffle	0.10	0.49	0.78
Dmax pool	0.85	1.03	1.23
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.

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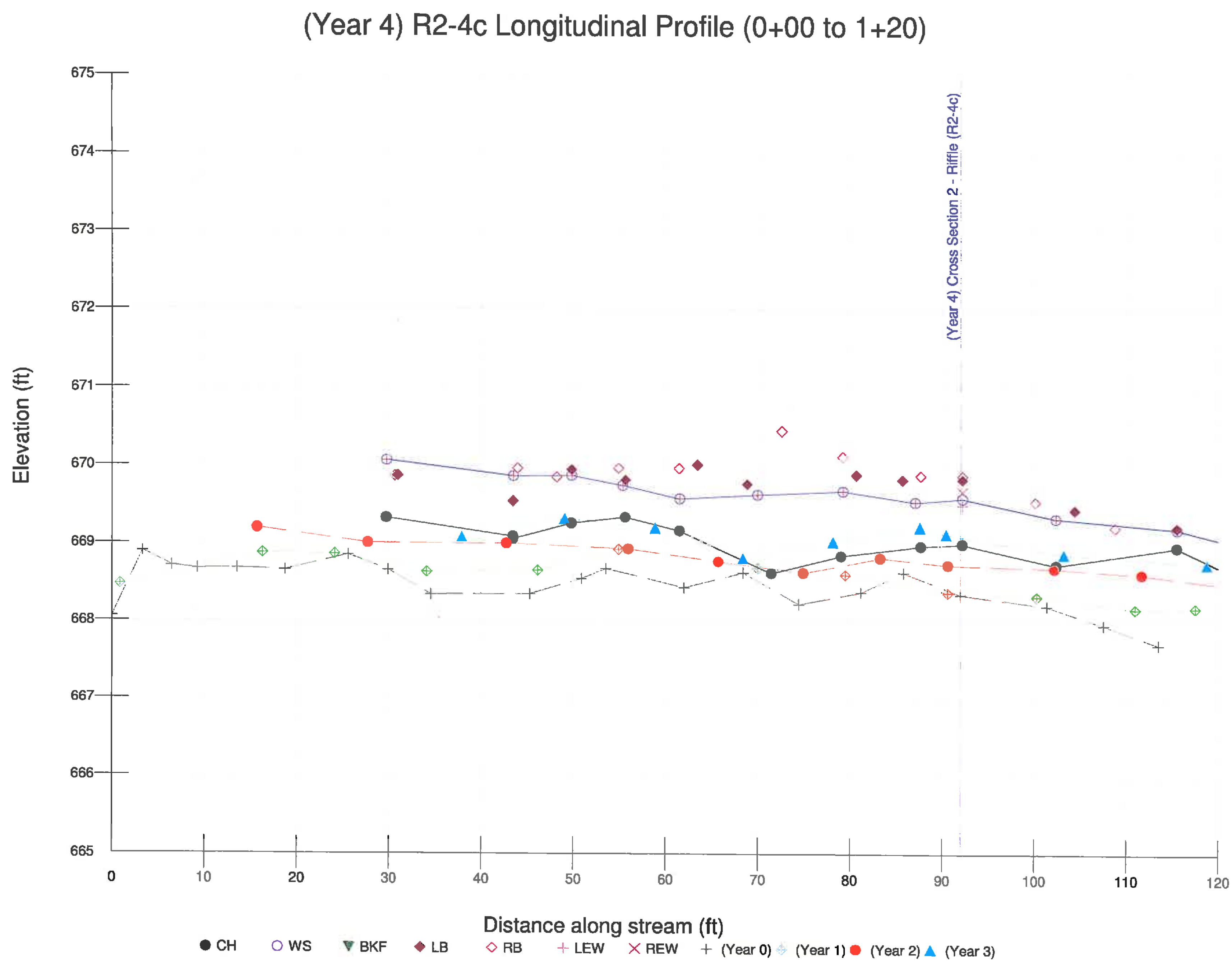
RIVERMORPH PROFILE SUMMARY

Notes

River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-4b
Profile Name: (Year 4) R2-4b
Survey Date: 09/26/2011

DIST	Note
64.12	(Year 4) Cross Section 1 - Riffle (R2-4b)


(Year 4) R2-4c Longitudinal Profile (0+00 to 1+20)
Elevation (ft)
675
674
673
672
671
670
669
668
667
666
665
0
10
20
30
40
50
60
70
80
90
100
110
120
Distance along stream (ft)
(Year 4) Cross Section 2 - Riffle (R2-4c)
CH
WS
BKF
LB
RB
LEW
REW
(Year 0)
(Year 1)
(Year 2)
(Year 3)

River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-4c
Profile Name: (Year 4) R2-4c Longitudinal Profile
Survey Date: 09/26/2011

Survey Data

DIST	CH	WS	BKF	LB	RB	LEW	REW
29.717	669.319						
29.717		670.064				670.064	
30.636					669.863		
30.934				669.867			
43.448	669.085						
43.448				669.534			
43.455	669.049						
43.455		669.863				669.863	
43.929					669.962		
48.155					669.848		
49.778	669.251						
49.778		669.869				669.869	
49.778				669.944			
54.883					669.963		
55.321		669.742				669.742	
55.633	669.327						
55.633				669.812			
61.444					669.96		
61.511	669.158						
61.511		669.576				669.576	
63.473				670.005			
68.82				669.76			
69.953		669.625				669.625	
71.484	668.614						
72.606					670.443		
79.048	668.837						
79.202					670.113		
79.227		669.674				669.674	
80.705				669.88			
85.71				669.815			
87.089		669.535				669.535	
87.692	668.962						
87.692					669.871		
92.222	668.991	669.583		669.823	669.872	669.499	669.666
100.137					669.54		
102.365		669.329				669.329	
102.39	668.721						
104.418				669.438			
108.824					669.218		
115.518	668.953						
115.518				669.215			
115.57		669.192				669.192	
131.951	668.056						
131.951					669.213		
132.02				668.907			
132.02		668.701				668.701	
132.02	668.004						

Cross Section / Bank Profile Locations

(Year 4) Cross Section 2 - Riffle (R2-4c)Riffle XS 92.222

Measurements from Graph

Bankfull Slope: 0.00809

Variable	Min	Avg	Max
S riffle	0.01519	0.02072	0.02486
S pool	0.00214	0.00563	0.00912
S run	0	0	0
S glide	0	0	0
P - P	29.00	30.06	31.11
Pool length	13.92	15.85	17.77
Riffle length	5.61	5.92	6.31
Dmax riffle	0.32	0.71	1.19
Dmax pool	0.76	0.94	1.19
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

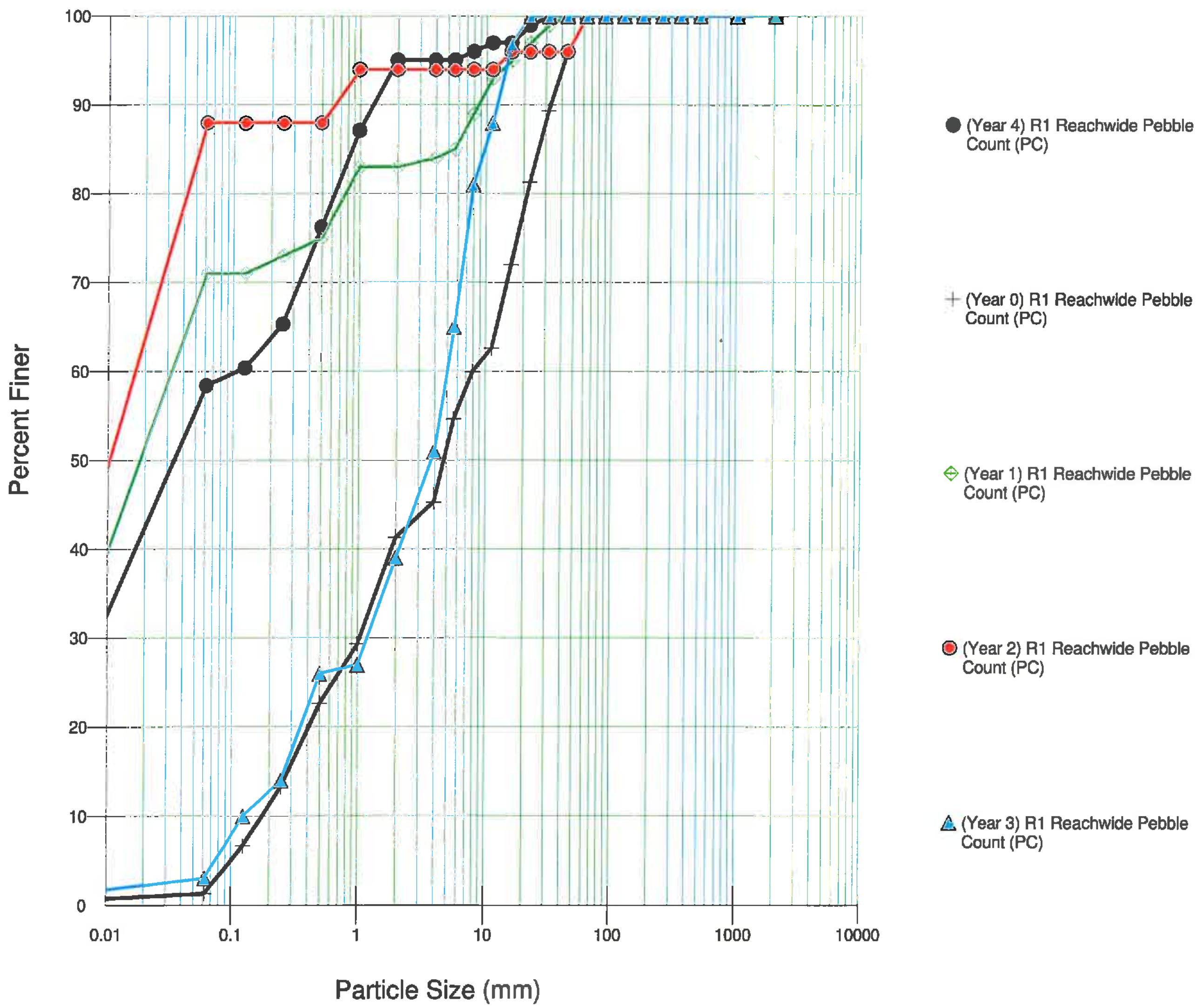
Notes

River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-4c
Profile Name: (Year 4) R2-4c Longitudinal Profile
Survey Date: 09/26/2011

DIST	Note
92.222	XS2 - TW Intersect @ station 92.222

Modified Wolman Pebble Counts

(Year 4) R1 Reachwide Pebble Count



RIVERMORPH PARTICLE SUMMARY

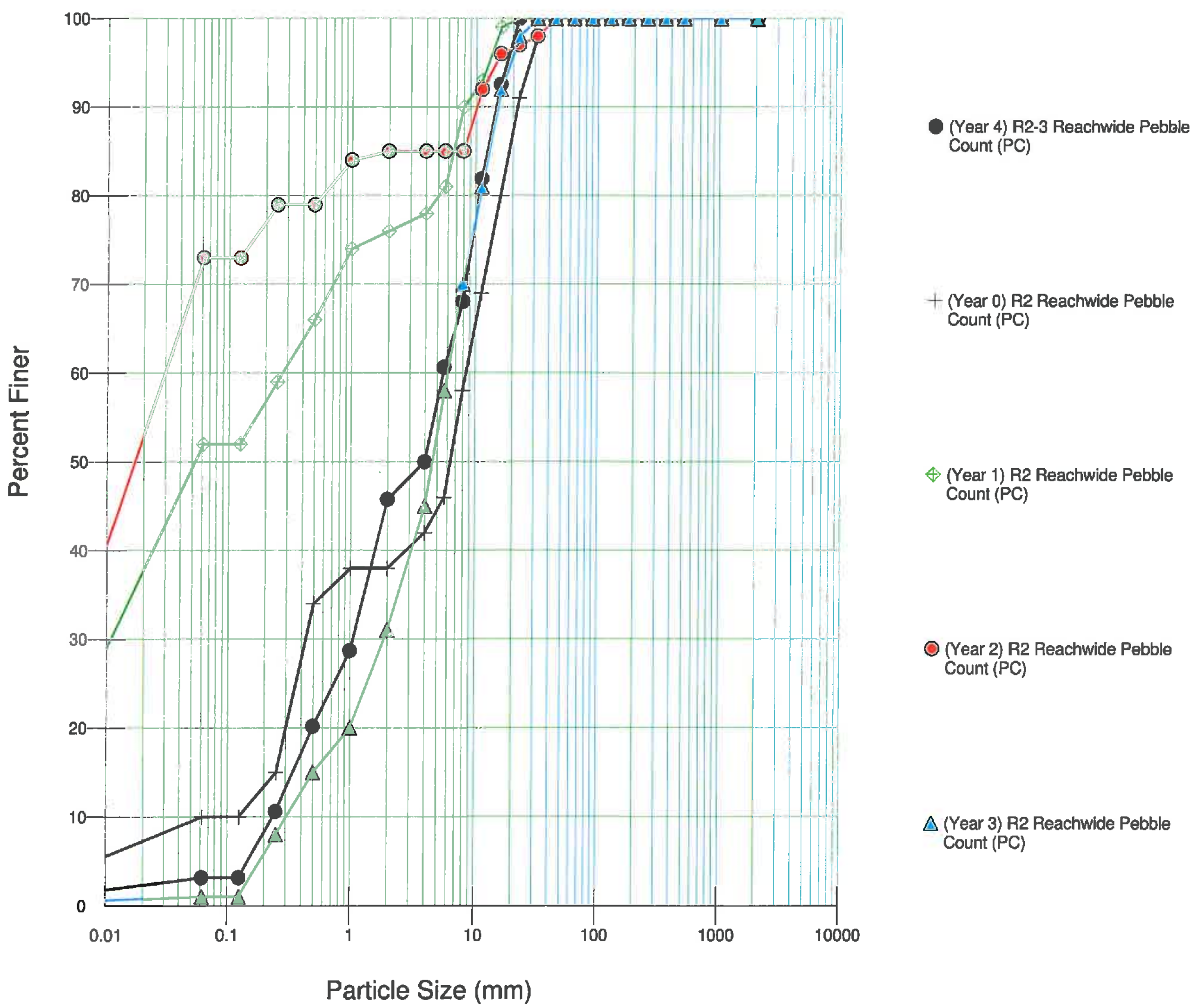
River Name: (Year 4) Reedy Fork Creek
Reach Name: R1
Sample Name: (Year 4) R1 Reachwide Pebble Count
Survey Date: 09/26/2011

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	59	58.42	58.42
0.062 - 0.125	2	1.98	60.40
0.125 - 0.25	5	4.95	65.35
0.25 - 0.50	11	10.89	76.24
0.50 - 1.0	11	10.89	87.13
1.0 - 2.0	8	7.92	95.05
2.0 - 4.0	0	0.00	95.05
4.0 - 5.7	0	0.00	95.05
5.7 - 8.0	1	0.99	96.04
8.0 - 11.3	1	0.99	97.03
11.3 - 16.0	0	0.00	97.03
16.0 - 22.6	2	1.98	99.01
22.6 - 32.0	1	0.99	100.00
32 - 45	0	0.00	100.00
45 - 64	0	0.00	100.00
64 - 90	0	0.00	100.00
90 - 128	0	0.00	100.00
128 - 180	0	0.00	100.00
180 - 256	0	0.00	100.00
256 - 362	0	0.00	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	0.02
D35 (mm)	0.04
D50 (mm)	0.05
D84 (mm)	0.86
D95 (mm)	1.99
D100 (mm)	32
Silt/Clay (%)	58.42
Sand (%)	36.63
Gravel (%)	4.95
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Particles = 101.

(Year 4) R2 Reachwide Pebble Count



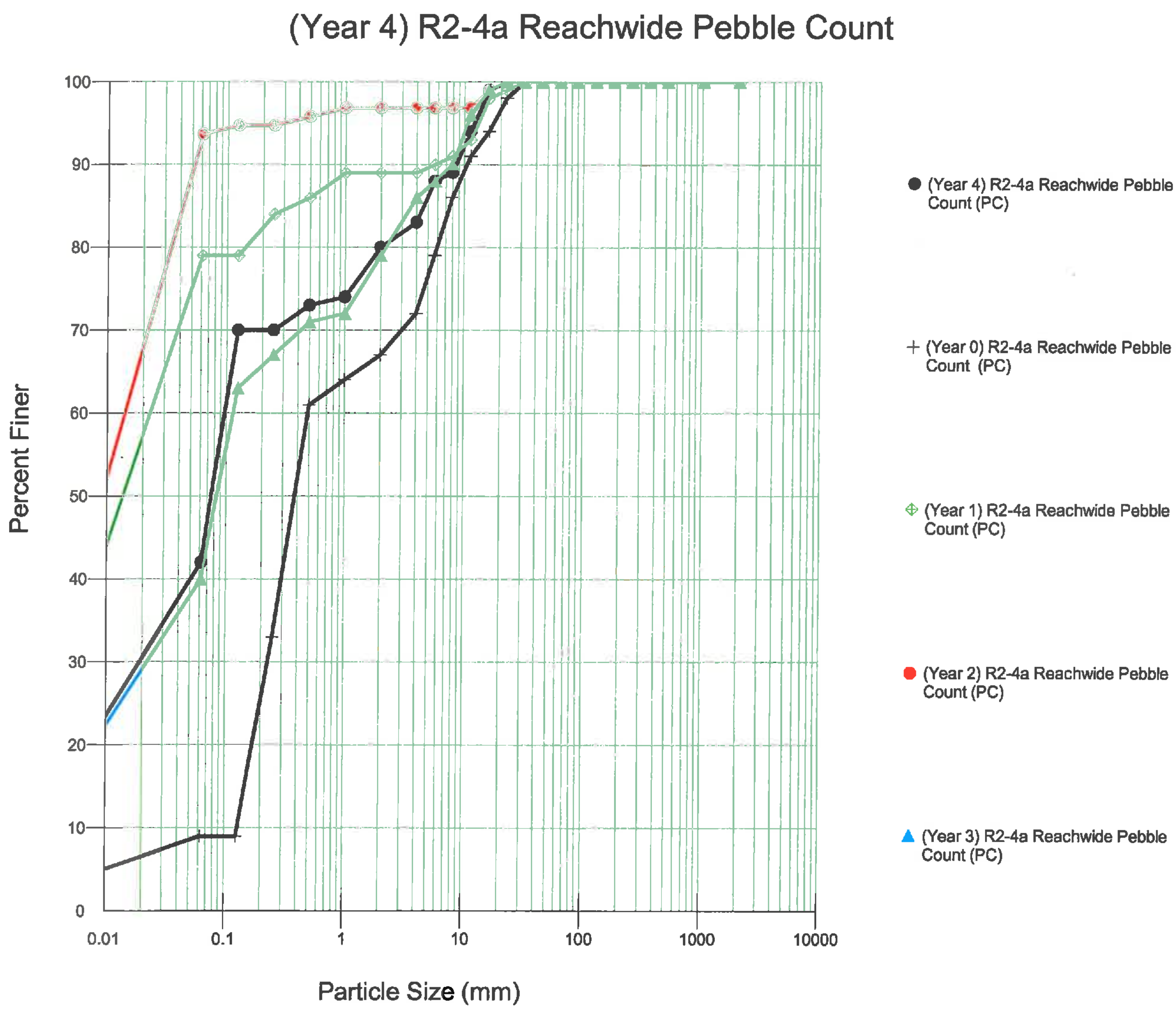
RIVERMORPH PARTICLE SUMMARY

River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-3
Sample Name: (Year 4) R2-3 Reachwide Pebble Count
Survey Date: 09/26/2011

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	3	3.19	3.19
0.062 - 0.125	0	0.00	3.19
0.125 - 0.25	7	7.45	10.64
0.25 - 0.50	9	9.57	20.21
0.50 - 1.0	8	8.51	28.72
1.0 - 2.0	16	17.02	45.74
2.0 - 4.0	4	4.26	50.00
4.0 - 5.7	10	10.64	60.64
5.7 - 8.0	7	7.45	68.09
8.0 - 11.3	13	13.83	81.91
11.3 - 16.0	10	10.64	92.55
16.0 - 22.6	7	7.45	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)	0.39
D35 (mm)	1.37
D50 (mm)	4
D84 (mm)	12.22
D95 (mm)	18.17
D100 (mm)	22.6
Silt/Clay (%)	3.19
Sand (%)	42.55
Gravel (%)	54.26
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Particles = 94.


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

RIVERMORPH PARTICLE SUMMARY

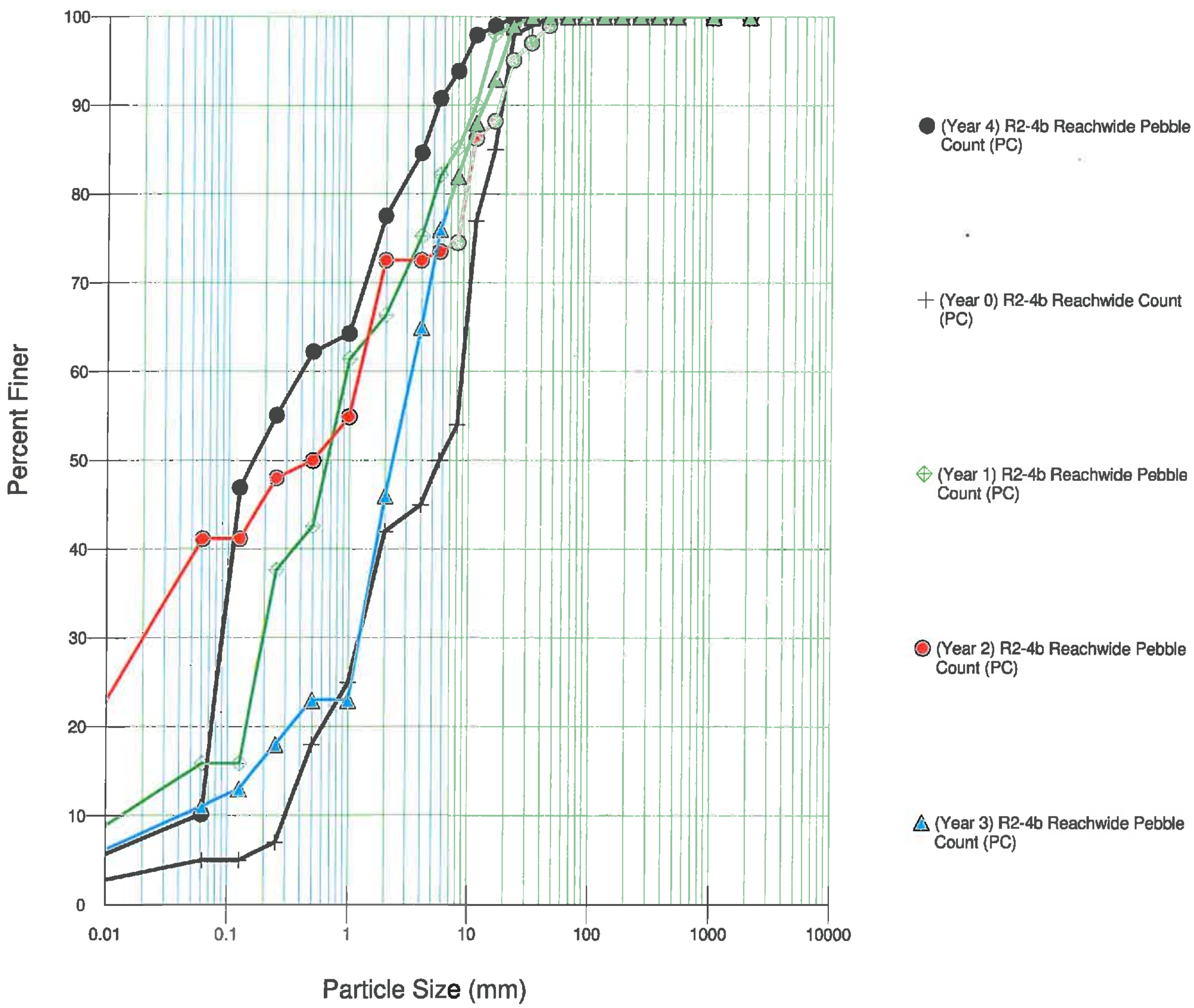
River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-4a
Sample Name: (Year 4) R2-4a Reachwide Pebble Count
Survey Date: 09/26/2011

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	42	42.00	42.00
0.062 - 0.125	28	28.00	70.00
0.125 - 0.25	0	0.00	70.00
0.25 - 0.50	3	3.00	73.00
0.50 - 1.0	1	1.00	74.00
1.0 - 2.0	6	6.00	80.00
2.0 - 4.0	3	3.00	83.00
4.0 - 5.7	5	5.00	88.00
5.7 - 8.0	1	1.00	89.00
8.0 - 11.3	5	5.00	94.00
11.3 - 16.0	5	5.00	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)	0.02
D35 (mm)	0.05
D50 (mm)	0.08
D84 (mm)	4.34
D95 (mm)	12.24
D100 (mm)	22.6
Silt/Clay (%)	42
Sand (%)	38
Gravel (%)	20
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Particles = 100.

(Year 4)R2-4b Reachwide Pebble Count



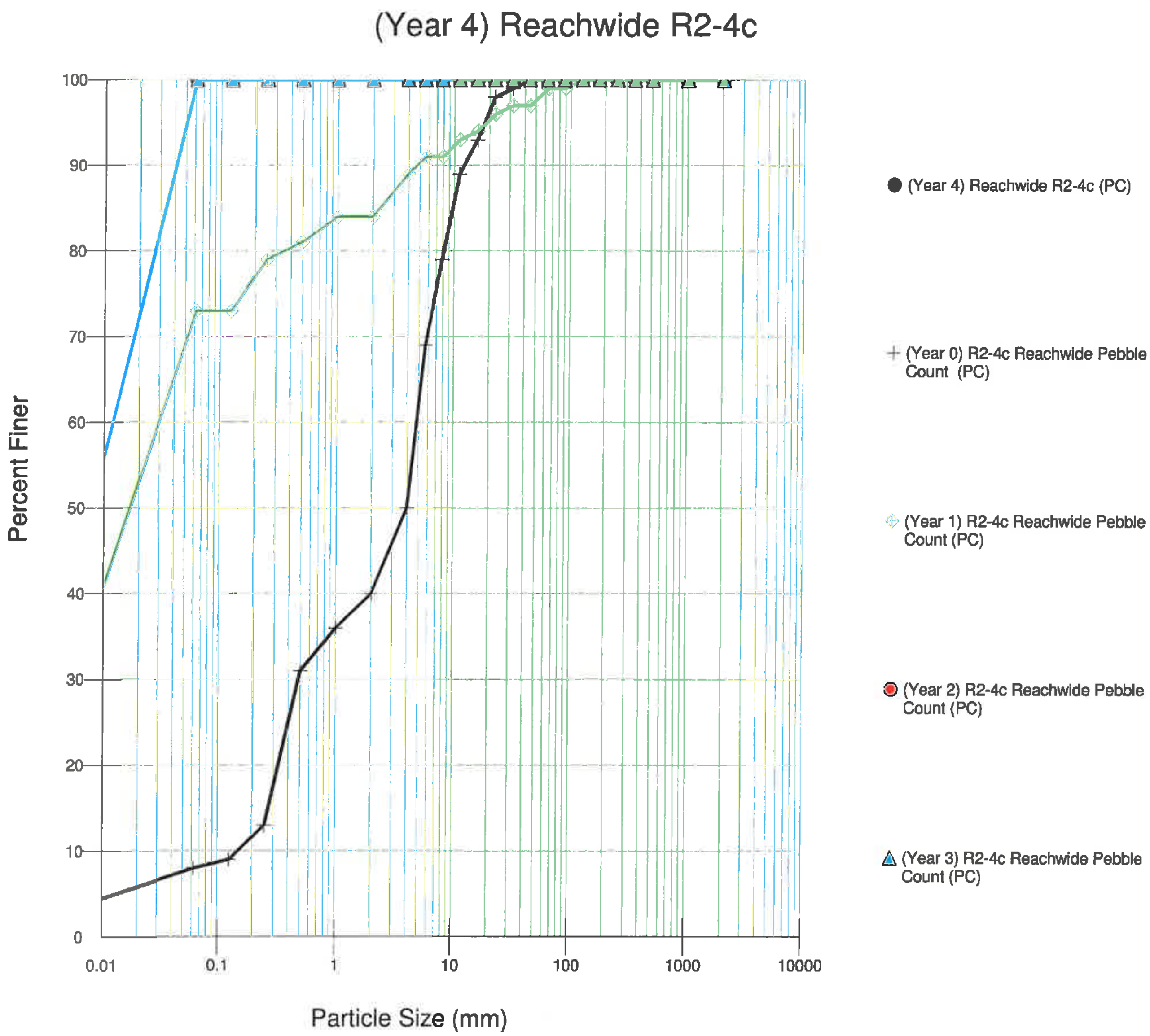
RIVERMORPH PARTICLE SUMMARY

River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-4b
Sample Name: (Year 4) R2-4b Reachwide Pebble Count
Survey Date: 09/26/2011

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	10	10.20	10.20
0.062 - 0.125	36	36.73	46.94
0.125 - 0.25	8	8.16	55.10
0.25 - 0.50	7	7.14	62.24
0.50 - 1.0	2	2.04	64.29
1.0 - 2.0	13	13.27	77.55
2.0 - 4.0	7	7.14	84.69
4.0 - 5.7	6	6.12	90.82
5.7 - 8.0	3	3.06	93.88
8.0 - 11.3	4	4.08	97.96
11.3 - 16.0	1	1.02	98.98
16.0 - 22.6	1	1.02	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)	0.07
D35 (mm)	0.1
D50 (mm)	0.17
D84 (mm)	3.81
D95 (mm)	8.91
D100 (mm)	22.6
Silt/Clay (%)	10.2
Sand (%)	67.35
Gravel (%)	22.45
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Particles = 98.



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

RIVERMORPH PARTICLE SUMMARY

River Name: (Year 4) Reedy Fork Creek
Reach Name: R2-4c
Sample Name: (Year 4) Reachwide R2-4c
Survey Date: 12/06/2011

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.

Bank Erosion Hazard Index

BEHI and Sediment Transport Data was not collected during year 4 monitoring. This sampling method is only required in Year 3 and 5.

Crest
Cage

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