Revised Gray Farm Stream Restoration Mitigation Plan

Contract # D05016-2

Iredell County, North Carolina

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Cataloging Unit – Catawba Basin 03050101

Prepared For:

Ecosystem Enhancement PROGRAM

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1.0 EXECUTIVE SUMMARY

The Gray Farm Stream Restoration project is located in the Catawba Basin, Hydrologic Cataloging Unit 03050101. The site consists of two separate reaches (Reach 1 and Reach 2) along unnamed tributaries of Buffalo Shoals Creek, a tributary of the Catawba River. The site is located approximately 10 miles due west of the City of Statesville in western Iredell County, NC.

Reach 1 is located immediately north of Bolick Road (SR 1532) and consisted of approximately 4,340 linear feet of impaired stream channel. Reach 2 is located immediately west of the intersection of New Sterling Road (SR 1525) and Gray House Road and consisted of approximately 1,600 linear feet of impaired stream channel. The watershed areas for Reaches 1 and 2 are estimated at approximately 0.91 square miles (582 acres) and 0.085 square miles (54 acres) respectively. Reach 1 was characterized by severe bank erosion, channel incision, and an over-widening of the stream channel. The reach evidenced overly steep and undercut banks. The reach was down cut and over widened in many sections allowing no floodplain access. Throughout Reach 2, severe bank erosion, channel incision, and an over-widening of the stream channel was evidenced. The reach was characterized by overly steep, sloughing, and undercut banks.

The restoration project objective was to restore the impaired streams to appropriately sized stream channels that are stable and self-maintaining, and will not aggrade or degrade over time. Restoration was accomplished with Rosgen-based natural channel design procedures and techniques. Reach 1 restoration was a combination of a Priority I (reconnection of the channel with its historic floodplain) restoration and a Priority II (construction of a new floodplain at a lower elevation) restoration. Reach 2 was a Priority I restoration. Restoring an appropriate sinuosity lengthened both channels, thereby lowering their bankfull slope.

The buffer of the restored stream channel was planted with native tree and shrub species and seeded with a native grass seed mix. During construction, additional opportunities existed to create vernal pools, oxbows, or pocket wetlands within the riparian zone along the restored reaches.

Restoration construction of the Reach 2 began on March 6th, 2006, and was completed April 14th, 2006. Restoration construction of the Reach 1 began on April 17th, 2006, and was completed on July 27th, 2006. Installation of monitoring devices and As-built surveys for both reaches performed as construction progressed and was completed on July 28th, 2006.

A total of 8,003.97 linear feet of stream channel were restored on site. Reach 1 consists of 5,813.30 linear feet of restored Type C4 channel. Reach 2 consists of 2,190.67 linear feet of restored Type B4 channel. Linear feet of restored stream was measured along the as-built thalweg, and is shown in the stream stationing in Appendix B. Appendix A (Site Photographs) provides photographs of monitored locations along the two restoration

reaches. Appendix B (As-built Conditions Stream Data) includes the As-built Drawings for the Gray Farm Stream Restoration Project.

Stream restoration operations are intended to improve the ecological integrity of the streams and riparian buffer zones. Increased sinuosity of the stream channel and addition of in-stream structures improves bed form diversity, increases oxygenation of the water and provides habitat for aquatic and benthic macroinvertebrates. Restoration of native riparian vegetation combined with suppression of exotic invasive vegetation will improve food supply and habitat for wildlife. See section 2.3.1 for a complete description of the Goals and Objectives of the Gray Farm Stream Restoration Project.

Designed by Soil & Environmental Consultants and constructed by North State Environmental, the project will be monitored for five consecutive years or until the required success criteria have been met as outlined in the Joint Stream Mitigation Guidelines (April 2003). Monitoring activities were initiated immediately following the completion of construction. See Section 3 for a complete description of the Monitoring Plan.

2.0 PROJECT BACKGROUND

2.1 Pre-Existing Site Conditions

This section describes pre-existing site conditions at the Gray Farm Property based on field data recorded by Soil & Environmental Consultants, PA, during the preparation of the approved Restoration Plan (October 2005).

2.1.1 Stream Channels

Both restoration sites drain generally south towards Buffalo Shoals Creek which then flows southeast toward its confluence with the Catawba River, approximately five miles to the southeast. Several smaller tributary ditches have been constructed on the agricultural lands adjacent to Reach 1 to aid in agricultural drainage. These ditches are directed toward the stream. A single mapped tributary joins the restoration reach near the south end of the channel. Reach 2 consists of a single channel with no natural tributaries or constructed ditches.

Reach 1

Reach 1, located immediately north of Bolick Road (SR 1532), consisted of approximately 4,340 linear feet of impaired stream channel. Approximately 800 linear feet of this length was inundated by an existing farm pond. The stream generally flows north to south and is bordered on the west by an existing hardwood and pine forest and in the east by active agricultural land. The topography is generally rolling with moderate slopes.

The small farm pond at the northern end of the reach consisted of an earthen embankment roughly 12 to 14 feet and approximately 150 feet in length. A single riser-barrel spillway structure was located through the embankment generally along the alignment of the existing channel. One additional piped farm road crossing existed approximately 700 feet downstream of the dam. Immediately downstream of the dam for a distance of approximately 1,000 feet, severe bank erosion, channel incision, and an over-widening of the stream channel was evidenced. This degradation appeared in large part due to previous uncontrolled releases from the existing dam spillway.

The lower two thirds of the reach were characterized by overly steep and undercut banks. Significant localized erosion was evidenced along this lower portion. Trees of large diameter lined the banks, many of which were undercut, suspended or had collapsed into the stream. The channel had down cut and over widened in many locations along the reach allowing no access to its floodplain. The last 200 feet (approximately) of

the pre-existing channel was not down cut due to a change in surrounding topography.

Reach 2

The second reach, Reach 2, is located immediately west of the intersection of New Sterling Road (SR 1525) and Gray House Road and consisted of approximately 1,600 linear feet of degraded stream channel.

A small impoundment formerly existed near the lower end of the reach; however, it was drained and removed a number of years prior. A piped farm road crossing existed at roughly the same location (the old dam embankment). This was the only existing crossing along the reach.

Throughout Reach 2, severe bank erosion, channel incision, and an over-widening of the stream channel were evidenced. This impairment appeared in large part due to previous uncontrolled grazing operations. The reach was characterized by overly steep, sloughing, and undercut banks. Significant localized erosion was evidenced along the entire reach. Trees of large diameter lined the banks, many of which were undercut, suspended or collapsed into the stream. The channel had down cut and over widened in many places along the reach allowing no access to its floodplain.

2.1.2 Site Vegetation

Reach 1 was bordered by predominantly bottomland hardwood forest to the west and south. The buffer zone had sporadic woody vegetation and generally opens into active agricultural land. Reach 2 was bordered by predominantly a narrow strip of hardwoods along both its eastern and western banks. The buffer zone along the reach varied from 10 to 50 feet. Both sides of Reach 2 opened to pasture land that was and continues to be actively grazed by cattle. Little to no groundcover or sub-canopy existed likely due to grazing and cattle traffic. Approximately 300 feet of channel near the lower end of the reach had no buffer at all. This location was coincident with the location of the previously drained farm pond.

2.1.3 Stream Geometry & Substrate Material

A physical and visual survey of both restoration reaches was performed for the purpose of quantifying pre-existing channel conditions and stream channel classification.

Reach 1

The existing channel bed had little or no facets due to straightening and significant incision. The channel substrate consists primarily of sands, gravel, and cobble over most of the reach. From survey data, a Level II Classification (Rosgen) was performed on Reach 1 for the existing stream resulting in the stream's classification as a Type F4 Stream Type.

Reach 2

Similar to Reach 1, the existing channel bed had little or no facets due to straightening and incision. The channel substrate consists primarily of sands, gravel, and cobble over most of the reach. From survey data, a Level II Classification (Rosgen) was similarly performed on Reach 2 for the existing stream resulting in the stream's classification of a Type G4 Stream Type.

2.2 Restoration Summary

The channelized and impaired state of the two existing streams, limited floodplain functionality due to channel incision, existing and future erosion and sedimentation potential, and lack of native vegetation along the banks in some areas (adjacent to cropland) indicate that these streams presented viable restoration projects. The remainder of the property consists of a dairy farm operation, with a large portion serving as pasture land or forage crops for cattle.

2.2.1 Mitigation Goals

The goals of the Gray Farm Stream Restoration project were:

1) Improve local water quality within the restored channel reaches as well as the downstream watercourses through;

    a. The reduction of current channel and off site sediment loads by restoring appropriately sized channels with stable beds and banks.

    b. The reduction of nutrient loads (both soil enhancement practices and cattle) from adjacent agricultural fields with a restored riparian buffer.

    c. The reduction of water temperatures provided by shading of the channel from canopy species along with the resultant increase in oxygen content.

2) Improve local aquatic and terrestrial habitat and diversity within the restored channels and their vicinity through;

    a. The formation of varying bed form within the channels to provide for fish, amphibian, and benthic species.

    b. The restoration of a suitable riparian buffer corridor which will provide both vertical and horizontal structure and connectivity with adjacent upland areas.

    c. The restoration of understory and canopy species which will provide forage, cover, and nesting for a variety of mammals, reptiles, and avian species.

3) Improve local watershed conditions through the restoration of two low order streams (one first order, one second order) and the placement of permanent conservation easements.

2.2.2 Mitigation Objectives

Through the restoration process the following objectives were accomplished:

1) Restore approximately 7,610 linear feet of appropriately sized stream channel that is stable and self-maintaining, and will not aggrade or degrade over time. Restoration will be accomplished with Rosgen-based natural channel design procedures and techniques.

2) Develop restored channels with the appropriate morphological characteristics (cross-sectional dimension, pattern, and longitudinal profile) utilizing collected reference reach data as a guide. Allow for no net loss of overall channel length in the process.

3) Create and/or improve bed form diversity (riffles, runs, pools, and glides) and improve aquatic and benthic macroinvertebrate habitat.

4) Construct a floodplain (or local bankfull bench) that is accessible at the proposed bankfull channel elevation.

5) Ensure channel and stream bank stabilization by integrating in-stream structures and native bank vegetation.

6) Establish a native forested and herbaceous riverine buffer plant community within a minimum width of 50 feet from the edge of the restored channel. This new community will be established in conjunction with the eradication of any existing exotic and/or undesirable plant species.

7) Improve water quality within the subject channels and the downstream receiving waters.

8) Supplement the education and conservation efforts for natural resources in Iredell County as indicated in program goals for the local Soil & Water Conservation District and the NC Cooperative Extension Service.

2.3 Restoration Approach

The restoration design for the site streams was based on natural channel design principles and techniques utilizing reference reach data sets and the existing channel conditions survey data. Reference data utilized in our design included the previously described reference reaches in the Gray Farm Project Stream Restoration Plan (Dated October 21, 2005) and the North Carolina Piedmont Regional Curve (SRI 2004).

The proposed restored stream type for Reach 1 was a C4. The proposed restored stream type for Reach 2 was a B4. Reach 1 restoration was a combination of Priority I restoration (reconnection of the channel with its historic floodplain) and Priority II restoration (construction of a new floodplain at a lower elevation). Reach 2 was Priority I restoration. Restoring sinuosity lengthened both channels, thereby lowering their slope. This change in profile provided a more appropriate hydraulic connection of bankfull flow and the historic floodplain (or the newly constructed floodplain / bankfull bench). The restoration design resulted in a riffle-pool system with proper pattern and profile

Rock cross vanes or j-hooks are located at the beginning and end of each reach, and at any straight sections of significant length throughout each reach. The cross-vanes provide grade control for the reach and protect both sides of the stream-banks in straight sections. Rock and log j-hooks are placed along meander bends to assist in the formation of pools and protect the banks. The j-hooks protect the outside meanders from lateral erosion, improve channel facets, and improve sediment transport. The proposed structures are constructed of rock or hardwood logs. Log j-hooks are constructed with logs approximately 12 to 15 inches in diameter. Boulders were utilized in these structures as depicted in the details. Structures maintain grade control and stability throughout the channel.

Erosion control matting (coir fiber matting), temporary seeding, and live stakes were utilized to reduce bank erosion immediately following completion of the channel and provided bank stabilization.

A sediment competency evaluation was performed in the design process for both reaches. An analysis of as-built conditions show that both Reach 1 and Reach 2 were constructed with the appropriate bankfull slopes, channel pattern, and mean bankfull riffle depth necessary to transport natural bedload without aggrading or degrading.

A plan view of the general restoration alignment and As-Built conditions for each reach is provided in Plan Sheets 3 and 8 of Appendix B. Table 1 gives a summary of existing and proposed data as well as mitigation credits based on the As-Built conditions. Plan Sheets 4 through 7 and 9 through 11 show the As-Built conditions compared to proposed conditions discussed in the Gray Farm Project Restoration Plan (October 21, 2005). See attached Overall Site Plan (Sheet 2) and Appendix A – Site Photographs for details of the site.

2.4 Summary Table

The table below gives a restoration summary for Reach 1 and Reach 2. Further As-Built stream data is provided in Appendix B.

Reach	Existing Reach Length (ft.)	Restored Reach Length (ft.)	Mitigation Type	Proposed Credit Ratio	Resultant SMU's
Reach 1	4,340	5,813.30	Restoration	1:1	5,813.30
Reach 2	1,600	2,190.67	Restoration	1:1	2,190.67

TOTAL **8,003.97 feet**

3.0 MONITORING PLAN

The project will be monitored for five consecutive years or until the required success criteria have been met as outlined in the Joint Stream Mitigation Guidelines (April 2003). Monitoring activities were initiated immediately following the completion of construction. As of the date of this report, all necessary monitoring devices have been installed and base-line data collected.

3.1 Stream Restoration Monitoring

The following physical, vegetative, and biological monitoring will be performed on each restoration reach during the five year monitoring period:

3.1.1 Physical Monitoring

An As-built survey of the site has been completed to ensure that site grading work was performed in general accordance with the restoration plan. The As-built survey included the constructed stream channel dimension, pattern, and longitudinal profile. This data (collected by Total Station) will also be utilized as a baseline to compare future monitoring surveys and subsequently to determine annual channel stability and transition.

Cross-section locations to be monitored were established in the As-built survey. Permanently established cross-sections are comprised of a nested riffle and pool segment. Each cross-section was monumented and located for future identification and survey work. A bankfull elevation will be identified in the as-built cross-sections, and this elevation will be the baseline to calculate cross-sectional measurements of future surveys. This as-built bankfull elevation will provide a constant datum to accurately illustrate departure from the as-built cross-sectional area and morphologic characteristics. A total of five (5) nested riffle and pool segments were established along Reach 1, and two (2) nested riffle and pool segments were established along Reach 2 (see Sheets 3 and 8 of Appendix B). All of these cross-sectional surveys were also utilized as photographic points (see Appendix A).

Other stream channel measurements that will be completed during the annual monitoring exercises will include pebble counts, representative stream pattern and profile data, and stream-side plant conditions. Annual inspection of in-stream rock and log vane and j-hook structures will be performed to insure channel stability. The restoration reach will be walked and observed for indications of deterioration or failure of any components of the restoration.

Stream channel monitoring surveys will be completed annually for five consecutive years, starting the in the Fall of this year (2006).

3.1.2 Vegetative Monitoring

Sample vegetation monitoring plots of 10-meter by 10-meter dimensions were established in the riparian zones for vegetative monitoring (representative of community types). Six (6) tree and shrub vegetation plots (four (4) on Reach 1 and two (2) on Reach 2) and four (4) bank vegetation plots (two (2) on Reach 1 and two (2) on Reach 2) were established. All monitoring will occur within these observation plots throughout the monitoring period as long as they continue to be representative of the community. Level 1 of the Carolina Vegetation Survey-Ecosystem Enhancement Program (CVS-EEP) Protocol for Recording Vegetation will be utilized for vegetation sampling.

During monitoring site visits, an evaluation of invasive or undesirable species will be performed and recommendations made regarding necessary removal or treatments.

3.1.3 Biological Monitoring

An initial benthic survey (pre-restoration) was performed during the late fall of 2005 to serve as a baseline for future monitoring events. Five monitoring stations were be established: one immediately upstream of the proposed restoration Reach 1, one within the proposed restoration Reach 1, one immediately downstream of the proposed restoration Reach 1, one within the proposed restoration Reach 2, and one immediately downstream of the proposed restoration Reach 2.

Each monitoring consisted of a riffle-pool sequence (where possible). At each station (or within a station reach), the Qual-4 sampling method was performed. The Qual-4 (according to NCDENR-DWQ standards) sampling method is used for 1st and 2nd order streams and consists of:

1 Kick Net Sample (from riffle)
1 Sweep Net Sample (from bank)
1 Leaf Pack Sample
1 Visual Observation Sample

Sampling was performed by professionals with the necessary DWQ certification credentials. Samples were preserved in-field. Following collection, samples were identified by a certified laboratory. Upon receipt of the identified sample results, several metrics were calculated including, but not limited to Ephemeroptera, Plecoptera, Trichoptera (EPT) number and EPT abundance.

3.2 Monitoring Schedule

As previously described, to ensure a stable restored channel morphology (dimension, pattern, and profile), and vegetative and biological success, monitoring will be conducted

annually on site for a period of five (5) years from the implementation of the restoration plan or until success criteria has been met.

Physical monitoring will occur in the later portion of the monitoring year. In addition to field survey data, this visit will include a walk-through for the general evaluation (by observation) of the site and the collection of record photographs.

A plant survivability survey will be performed during the growing season on each of the tree and shrub vegetation plots and bank vegetation plots.

Benthic macroinvertebrate sampling will be performed during the late fall based on recommendations from Mr. Larry Eaton of DWQ. Annual Benthic macroinvertebrate sampling will be performed for the first three (3) years of the monitoring period. Utilizing the same five monitoring stations that were established in the pre-restoration sample, the Qual-4 sampling method will be performed at each station.

An Annual Monitoring Report will be prepared at the end of each year of monitoring. This report will be submitted to EEP for review not later than 60 days from the end of the monitoring period (December 31 of the monitoring year). The monitoring report will summarize the general site conditions, a channel evaluation, the results of vegetative and biological monitoring, and recommendations for necessary maintenance. The monitoring period for Year One of Five will end December 31, 2006.

3.3 Success Criteria

Success criteria for physical stream stability will be met if, for the five-year period after construction, the stream bed form features and cross-sections remain stable (i.e. the stream retains its restored Rosgen stream-type classification). Bed form (including the overall channel slope), the location of riffles and pools, as well as the general stability, condition, and function of rock and log cross vanes and j-hooks will be evaluated annually. Cross-sections will be measured and quantified for departure from the as-built conditions on characteristics to include but not limited to: mean depth, maximum depth, bankfull width, and cross-sectional area. A qualitative evaluation of general channel condition including the identification of scour, localized erosion, undesirable deposition, etc., will be performed annually. During the monitoring period, no less than two bankfull flow events must be documented. If less than two bankfull events occur during the 5 year monitoring period, monitoring will continue until the second bankfull event is documented. The bankfull events must occur during separate monitoring years.

The success of the adjacent riparian buffer will be based on the combined survival of tree and shrub species for the five-year monitoring period. Survival of woody (tree and shrub) species planted within the restored buffers will be at least 320 stems/acre through year three, 288 stems/acre through year four, 260 stems/acre through year five. The stem count will be based on an average of the stem counts of the evaluated tree and shrub buffer vegetation plots. The success of the bank vegetation plots along the restored channels will be based on the survival of live-stake (or other) bank plantings for the five-

year monitoring period. Survival of bank plantings will be based on a linear average of approximately 50 percent of the planted species within the restoration reaches. Biological monitoring will be used as a general indicator of restoration success, however, no specific biological criteria applies to the success of the restoration reaches.

4.0 MAINTENANCE AND CONTINGENCY PLANS

Should stream stability or vegetation success criteria not be fulfilled, a contingency plan will be developed by Soil & Environmental Consultants, PA (S&EC). In the case that stream stability success criteria are not met, remedial actions may include but are not limited to stream bank stabilization, in stream structure stabilization or re-establishment of stream substrate. In the case that vegetation success criteria are not met, problem areas will be replanted and/or reseeded and monitoring operations will be extended accordingly. All contingency plans will be coordinated and directed by S&EC.

APPENDIX A

SITE PHOTOGRAPHS

Figure 1—Reach 1 Cross-Section 1 (Pool) (All Photos Oriented Downstream)

Figure 2—Reach 1 Cross-Section 1 (Riffle)

Figure 3—Reach 1 Cross-Section 2 (Pool)

Figure 4—Reach 1 Cross-Section 2 (Riffle)

Figure 5—Reach 1 Cross-Section 3 (Pool)

Figure 6—Reach 1 Cross-Section 3 (Riffle)

Figure 7 –Reach 1 Cross-Section 4 (Pool)

Figure 8—Reach 1 Cross-Section 4 (Riffle)

Figure 9—Reach 1 Cross-Section 5 (Pool)

Figure 10—Reach 1 Cross-Section 5 (Riffle)

Figure 11—Reach 1 Cross-Section 6 (Pool)

Figure 12—Reach 1 Cross-Section 6 (Riffle)

Figure 13—Reach 1 Cross-Section 7 (Pool)

Figure 14—Reach 1 Cross-Section 7 (Pool)

Figure 15— Reach 2 Cross-Section 1 (Pool)

Figure 16—Reach 2 Cross-Section 1 (Riffle)

Figure 17—Reach 2 Cross-Section 2 (Pool)

Figure 18—Reach 2 Cross-Section 2 (Riffle)

APPENDIX B

AS-BUILT CONDTITIONS STREAM DATA

TABLE 1 - REACH 1
MORPHOLOGICAL CHARACTERISTICS OF THE ASBUILT AND PROPOSED DATA

C4 STREAM TYPE

DIMENSION SUMMARY						
Values						
	ASBUILT			PROPOSED		
Variable	Min	Avg	Max	Min	Avg	Max
Floodprone Width (ft)	37.49	61.53	89.67	47	52.54	90.34
Riffle Area (Sq ft)	11.01	13.79	17.92	17.84	17.84	17.84
Max Riffle Depth (ft)	1.36	1.61	2.04	1.71	1.71	1.71
Mean Riffle Depth (ft)	0.7	0.86	0.94	1.17	1.17	1.17
Riffle Width (ft)	13.62	16.02	19.48	15.2	15.2	15.2
Pool Area (Sq ft)	26.72	33	42.08	24.84	24.84	24.84
Max Pool Depth (ft)	2.3	2.94	3.47	2.2	2.2	2.2
Mean Pool Depth (ft)	1.25	1.57	1.86	1.17	1.17	1.17
Pool Width (ft)	18.59	20.98	22.66	21.14	21.14	21.14
Dimensionless Ratios						
Variable	Min	Avg	Max	Min	Avg	Max
Wfpa / Wbkf	2.34	3.84	5.60	3.09	2.98	2.98
Pool Area / Abkf	1.94	2.39	3.05	1.39	1.39	1.39
Max Pool Depth / Dbkf	2.67	3.42	4.03	1.88	1.88	1.88
Mean Pool Depth / Dbkf	1.45	1.83	2.16	1.00	1.00	1.00
Pool Width / Wbkf	1.16	1.31	1.41	1.39	1.39	1.39

PATTERN SUMMARY						
Values						
	ASBUILT			PROPOSED		
Variable	Min	Avg	Max	Min	Avg	Max
Sinuosity		1.45			1.3	
Meander Wavelength (ft)	77.08	94.8	117.13	77.08	95.07	117.13
Radius of Curvature (ft)	16.64	25.73	40.88	19.97	28.23	37.85
Belt Width (ft)	59.32	72.85	93.89	26.1	40.75	61.8
Dimensionless Ratios						
Variable	Min	Avg	Max	Min	Avg	Max
Lm / W bkf	4.81	5.92	7.31	5.07	6.25	7.71
Rc / W bkf	1.04	1.61	2.55	1.31	1.86	2.49
Wblt / Wbkf (MWR)	3.70	4.55	5.86	1.72	2.68	4.07

PROFILE SUMMARY						
Values						
	ASBUILT			PROPOSED		
Variable	Min	Avg	Max	Min	Avg	Max
S riffle (ft/ft)	0.00096	0.00544	0.01006		0.0057	
S pool (ft/ft)	0	0.0016	0.0064		0.0013	
P - P (ft)	12.35	70.94	0.12547	51.66	67.79	82.92
P length (ft)	7.41	23.01	244.47	22.9	29.66	33.17
Dmax riffle (ft)	1.36	1.61	2.04	1.71	1.71	1.71
Dmax pool (ft)	2.3	2.94	3.47	2.2	2.2	2.2
Dimesionless Ratios						
Variable	Min	Avg	Max	Min	Avg	Max
S riffle / S bkf (ft/ft)	0.18	1.00	1.85		1.00	
S pool / S bkf (ft/ft)	0.00	0.29	1.18		0.23	
P - P / W bkf (ft)	0.77	4.43	15.26	3.40	4.46	5.46
P length / W bkf (ft)	0.46	1.44	2.16	1.51	1.95	2.18
Dmax riffle / D bkf (ft)	1.58	1.87	2.37	1.46	1.46	1.46
Dmax pool / D bkf (ft)	2.67	3.42	4.03	1.88	1.88	1.88
Bankfull Slope (ft/ft)		0.00544			0.0057	

HYDRAULIC SUMMARY						
	ASBUILT			PROPOSED		
Variable		Avg			Avg	
Discharge (cfs)		83.18			83.18	
Velocity (fps)		6.03			4.96	
Hyd Radius (ft)	0.69	0.83	0.92	1.11	1.11	1.11
Bkf Shear (lb/ sq ft)	0.23	0.28	0.31	0.45	0.45	0.45

TABLE 2 - REACH 2
MORPHOLOGICAL CHARACTERISTICS OF THE ASBUILT AND PROPOSED DATA

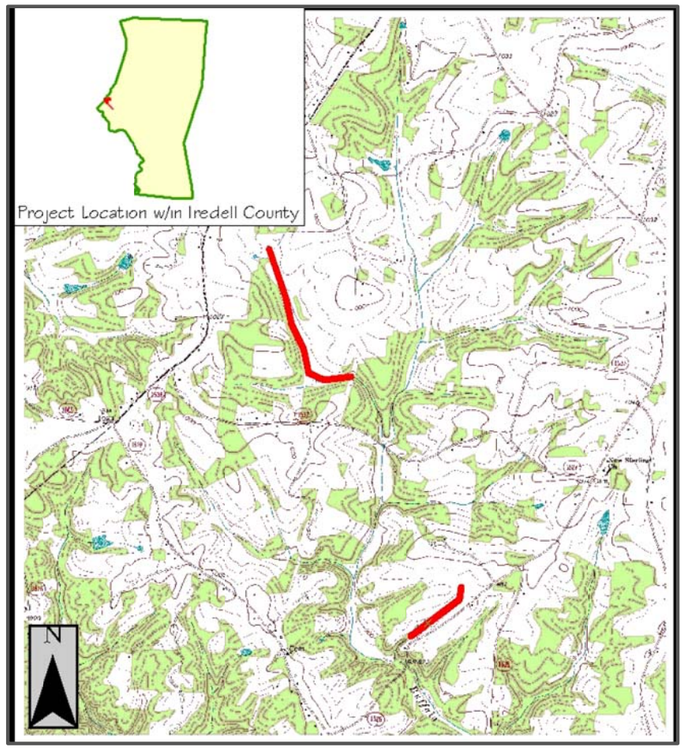
B4 STREAM TYPE

DIMENSION SUMMARY						
Values						
	ASBUILT			PROPOSED		
Variable	Min	Avg	Max	Min	Avg	Max
Floodprone Width (ft)	13.96	26.53	39.05	12.4	12.4	12.4
Riffle Area (Sq ft)	4.14	5.46	6.77	3.96	3.96	3.96
Max Riffle Depth (ft)	0.86	1.08	1.3	0.87	0.87	0.87
Mean Riffle Depth (ft)	0.56	0.69	0.82	0.57	0.57	0.57
Riffle Width (ft)	7.38	7.8	8.21	6.9	6.9	6.9
Pool Area (Sq ft)	17.34	18.56	19.78	9.45	9.45	9.45
Max Pool Depth (ft)	2.6	2.9	3.2	1.67	1.67	1.67
Mean Pool Depth (ft)	1.07	1.44	1.81	1.15	1.15	1.15
Pool Width (ft)	9.59	14.02	18.44	8.24	8.24	8.24
Dimensionless Ratios						
Variable	Min	Avg	Max	Min	Avg	Max
Wfpa / Wbkf	1.79	3.40	5.01	1.80	1.80	1.80
Pool Area / Abkf	3.18	3.40	3.62	2.39	2.39	2.39
Max Pool Depth / Dbkf	3.77	4.20	4.64	2.93	2.93	2.93
Mean Pool Depth / Dbkf	1.55	2.09	2.62	2.02	2.02	2.02
Pool Width / Wbkf	1.23	1.80	2.36	1.19	1.19	1.19

PATTERN SUMMARY						
Values						
	ASBUILT			PROPOSED		
Variable	Min	Avg	Max	Min	Avg	Max
Sinuosity		1.17			1.16	
Meander Wavelength (ft)	27.51	31.75	34.72	31.6	34.08	37.12
Radius of Curvature (ft)	4.63	6.43	9.1	6.71	8.05	9.9
Belt Width (ft)	11.83	16.96	22.05	9.49	12.65	16.5
Dimensionless Ratios						
Variable	Min	Avg	Max	Min	Avg	Max
Lm / W bkf	3.53	4.07	4.45	4.58	4.94	5.38
Rc / W bkf	0.59	0.82	1.17	0.97	1.17	1.43
Wblt / Wbkf (MWR)	1.52	2.17	2.83	1.38	1.83	2.39

PROFILE SUMMARY						
Values						
	ASBUILT			PROPOSED		
Variable	Min	Avg	Max	Min	Avg	Max
S riffle (ft/ft)	0.01919	0.02323	0.02722		0.0246	
S pool (ft/ft)	0	0.00153	0.00916		0.003	
P - P (ft)	9.43	19.51	28.94	15.73	19.22	23.84
P length (ft)	5.2	7.59	10.08	6.25	8.45	10.46
Dmax riffle (ft)	0.86	0.86	1.3	0.87	0.87	0.87
Dmax pool (ft)	2.6	2.9	3.2	1.67	1.67	1.67
Dimesionless Ratios						
Variable	Min	Avg	Max	Min	Avg	Max
S riffle / S bkf (ft/ft)	0.83	1.01	1.18		1.00	
S pool / S bkf (ft/ft)	0.00	0.07	0.40		0.12	
P - P / W bkf (ft)	1.21	2.50	3.71	2.28	2.79	3.46
P length / W bkf (ft)	0.67	0.97	1.29	0.91	1.22	1.52
Dmax riffle / D bkf (ft)	1.25	1.25	1.88	1.53	1.53	1.53
Dmax pool / D bkf (ft)	3.77	4.20	4.64	2.93	2.93	2.93
Bankfull Slope (ft/ft)		0.023			0.0246	

HYDRAULIC SUMMARY						
	ASBUILT			PROPOSED		
Variable		Avg			Avg	
Discharge (cfs)		15.01			15.01	
Velocity (fps)		2.75			3.87	
Hyd Radius (ft)	0.78261	0.95652	1.11594	0.94737	0.94737	0.94737
Bkf Shear (lb/ sq ft)	0.78	0.95	1.11	1.02	1.02	1.02



VICINITY MAP
(STONY POINT, NC QUAD)
NOT TO SCALE

AS-BUILT DRAWINGS FOR:

GRAY FARM

STREAM RESTORATION

IREDELL COUNTY, NC

CONTENTS:

ENVIRONMENTAL DESIGN FIRM:

SOIL & ENVIRONMENTAL
CONSULTANTS, PA
11010 Raven Ridge Road
Raleigh, North Carolina 27614
(919) 846-5900

PREPARED FOR:

RESTORATION SYSTEMS, LLC
1101 Haynes Street Suite 107
Raleigh, North Carolina 27604
(919) 755-9490

File: S:\Jobs\7-9\9365.D1\Drawings\AsBuilt\AsBuilt2.dwg

Project No.: 9365.D1
Proj. Mgr.: PKS
Drawn: RSW
Scales: NO SCALE
Sheet No.: 1 OF 31
Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS
Location: IREDELL CO., NC
Client: ECOSYSTEM ENHANCEMENT PROGRAM
Sheet Title: COVER, CONTENTS, & VICINITY MAP

Soil & Environmental Consultants, PA
11010 Raven Ridge Road • Raleigh, North Carolina 27614 • Phone: (919) 846-5900 • Fax: (919) 846-9467
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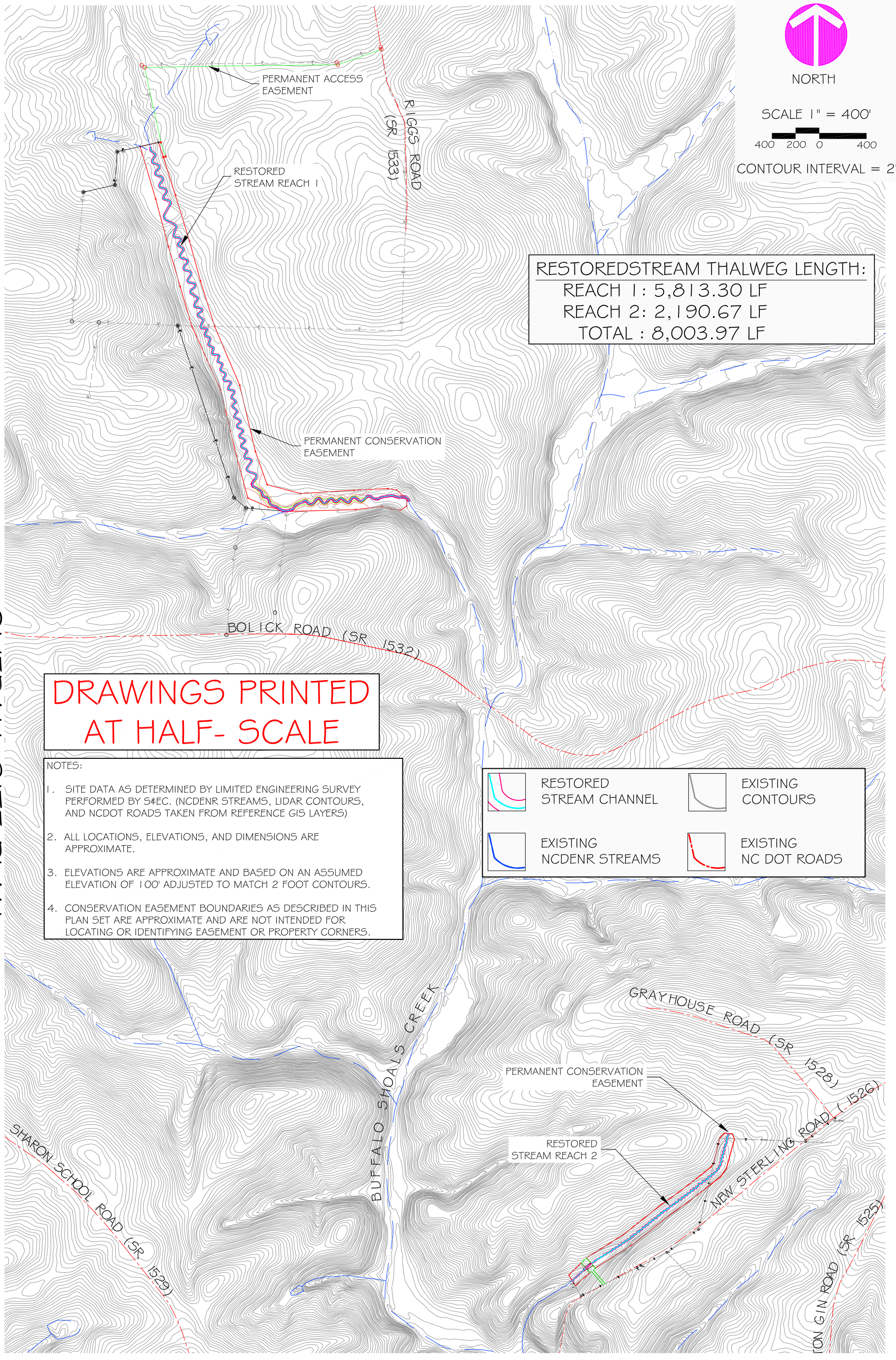
NORTH CAROLINA PROFESSIONAL SEAL 25525 ENGINEER PATRICK K. SMITH

REVISIONS: NO. | DESCRIPTION | DATE | APP'D

File: Sec\Jobs7-9k\9385.D1\Drawings\AsBuilt\AsBuilt2.dwg

OVERALL SITE PLAN



DRAWINGS PRINTED AT HALF- SCALE

NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
2. ALL LOCATIONS, ELEVATIONS, AND DIMENSIONS ARE APPROXIMATE.
3. ELEVATIONS ARE APPROXIMATE AND BASED ON AN ASSUMED ELEVATION OF 100' ADJUSTED TO MATCH 2 FOOT CONTOURS.
4. CONSERVATION EASEMENT BOUNDARIES AS DESCRIBED IN THIS PLAN SET ARE APPROXIMATE AND ARE NOT INTENDED FOR LOCATING OR IDENTIFYING EASEMENT OR PROPERTY CORNERS.

REVISIONS

REV	DESCRIPTION	DATE	APPR

NORTH CAROLINA PROFESSIONAL SEAL 25525 ENGINEER PATRICK K. SMITH

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Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS		Project No.: 9385.D1	
		Proj. Mgr.: PKS	Drawn: RSW
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 400'	
Sheet Title: OVERALL SITE PLAN		Sheet No.: 2 OF 31	

File: Sec\Jobs7-9k\9385.D1\Drawings\AsBuilt\AsBuilt2.dwg

REACH 1 RESTORATION SITE LAYOUT & KEYSHEET

RESTORED STREAM CHANNEL

EXISTING CONTOURS

EXISTING NCDENR STREAMS

EXISTING DOT ROADS

PERMANENT ACCESS EASEMENT

RIGGS ROAD (SR 1533)

A

B

C

D

PERMANENT CONSERVATION EASEMENT

KEY SHEET INDEX

BOLICK ROAD (SR 1532)

NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
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DRAWINGS PRINTED AT HALF- SCALE

NORTH

SCALE 1" = 200'

200 100 0 200

CONTOUR INTERVAL = 2'

REVISIONS

REV.	DESCRIPTION	DATE	APPR.

NORTH CAROLINA PROFESSIONAL SEAL 25525 ENGINEER PATRICK K. SMITH

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www.SandEC.com

Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS		Project No.: 9385.D1
	Proj. Mgr.: PKS	Drawn: RSW
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 200'
Sheet Title: RESTORATION SITE LAYOUT & KEYSHEET		Sheet No.: 3 OF 31

File: Sec\Jobs7-9k\9385.D1\Drawings\AsBuilt\AsBuilt2.dwg

REACH 1 CONSTRUCTED SITE FEATURES & GRADING - A

NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
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NORTH

SCALE 1" = 50'

50 25 0 50

CONTOUR INTERVAL = 2'

DRAWINGS PRINTED AT HALF- SCALE

PERMANENT ACCESS EASEMENT

UPPER LIMITS OF RESTORATION

PERMANENT CONSERVATION EASEMENT BOUNDARY

RESTORED CHANNEL ALIGNMENT

BUFFER 1

XS 1

XS 2

PL

0+00 1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00 9+00 10+00 11+00 12+00 13+00 14+00

LEGEND FOR PROPOSED FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- ROCK CROSS VANE (RCV)

LEGEND FOR ASBUILT FEATURES

- CROSS SECTION LOCATION (RIFFLE/ POOL PAIR)
- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- ROCK VANE (RV)
- ROCK CROSS VANE (RCV)

BUFFER/BANK 1

- VEGETATION PLOTS
- CREATED/RESTORED WETLANDS

A

REVISIONS			
REV.	DESCRIPTION	DATE	APPR.

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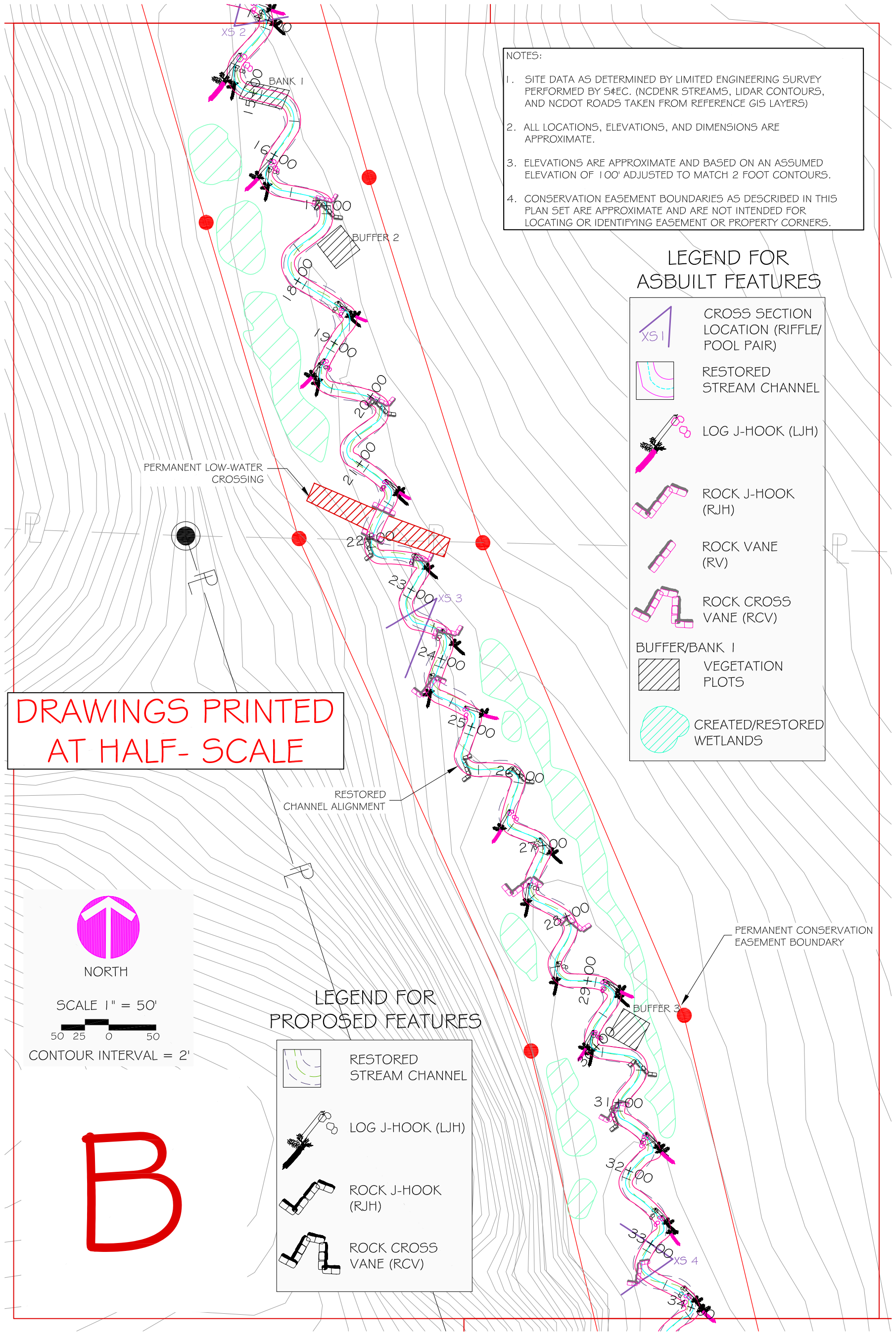
www.SandEC.com

Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS		Project No.: 9385.D1	
		Proj. Mgr.: PKS	Drawn: RSW
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 50'	
Sheet Title: REACH 1 CONSTRUCTED SITE FEATURES & GRADING-A		Sheet No.: 4 OF 31	

File: Sec\Jobs7-9k\9385.D1\Drawings\AsBuilt\AsBuilt2.dwg

REACH 1 CONSTRUCTION SITE FEATURES & GRADING - B



NOTES:

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LEGEND FOR ASBUILT FEATURES

- XS 1 — CROSS SECTION LOCATION (RIFFLE/POOL PAIR)
- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- ROCK VANE (RV)
- ROCK CROSS VANE (RCV)

BUFFER/BANK 1

- VEGETATION PLOTS
- CREATED/RESTORED WETLANDS

DRAWINGS PRINTED AT HALF- SCALE

NORTH

SCALE 1" = 50'

50 25 0 50

CONTOUR INTERVAL = 2'

B

LEGEND FOR PROPOSED FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- ROCK CROSS VANE (RCV)

REVISIONS

REV.	DESCRIPTION	DATE	APPR.

NORTH CAROLINA PROFESSIONAL SEAL 25525 ENGINEER PATRICK K. SMITH

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Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS		Project No.: 9385.D1	
		Proj. Mgr.: PKS	Drawn: RSW
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 50'	
Sheet Title: REACH 1 CONSTRUCTED SITE FEATURES & GRADING - B		Sheet No.: 5 OF 31	

File: Sec\Jobs7-9k\9385.D1\Drawings\AsBuilt\AsBuilt2.dwg

DRAWINGS PRINTED AT HALF- SCALE

NOTES:

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RESTORED CHANNEL ALIGNMENT

TOP OF SLOPE/ EXISTING TERRACE

PERMANENT CONSERVATION EASEMENT BOUNDARY

TOE OF SLOPE/ OUTER EDGE OF BANKFULL BENCH

XS 5

XS 6

BANK 2

BUFFER 4

PL

LEGEND FOR ASBUILT FEATURES

- CROSS SECTION LOCATION (RIFFLE/ POOL PAIR)
- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- ROCK VANE (RV)
- ROCK CROSS VANE (RCV)
- BUFFER/BANK 1 VEGETATION PLOTS
- CREATED/RESTORED WETLANDS

LEGEND FOR PROPOSED FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- ROCK CROSS VANE (RCV)

NORTH

SCALE 1" = 50'

50 25 0 50

CONTOUR INTERVAL = 2'

REACH 1 CONSTRUCTED SITE FEATURES & GRADING - C

C

REVISIONS			
REV.	DESCRIPTION	DATE	APPR.

NORTH CAROLINA PROFESSIONAL SEAL 25525 ENGINEER PATRICK K. SMITH

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Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS	Project No.: 9385.D1
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM
Proj. Mgr.: PKS	Drawn: RSW
Scale: 1" = 50'	
Sheet Title: REACH 1 CONSTRUCTED SITE FEATURES & GRADING - C	Sheet No.: 6 OF 31

File: Sec\Jobs7-9k\9385.D1\Drawings\AsBuilt\AsBuilt2.dwg

REACH 1 CONSTRUCTED SITE FEATURES & GRADING - D

LEGEND FOR ASBUILT FEATURES

- CROSS SECTION LOCATION (RIFFLE/ POOL PAIR) — XS 1
- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- ROCK VANE (RV)
- ROCK CROSS VANE (RCV)

BUFFER/BANK 1

- VEGETATION PLOTS
- CREATED/RESTORED WETLANDS

NORTH

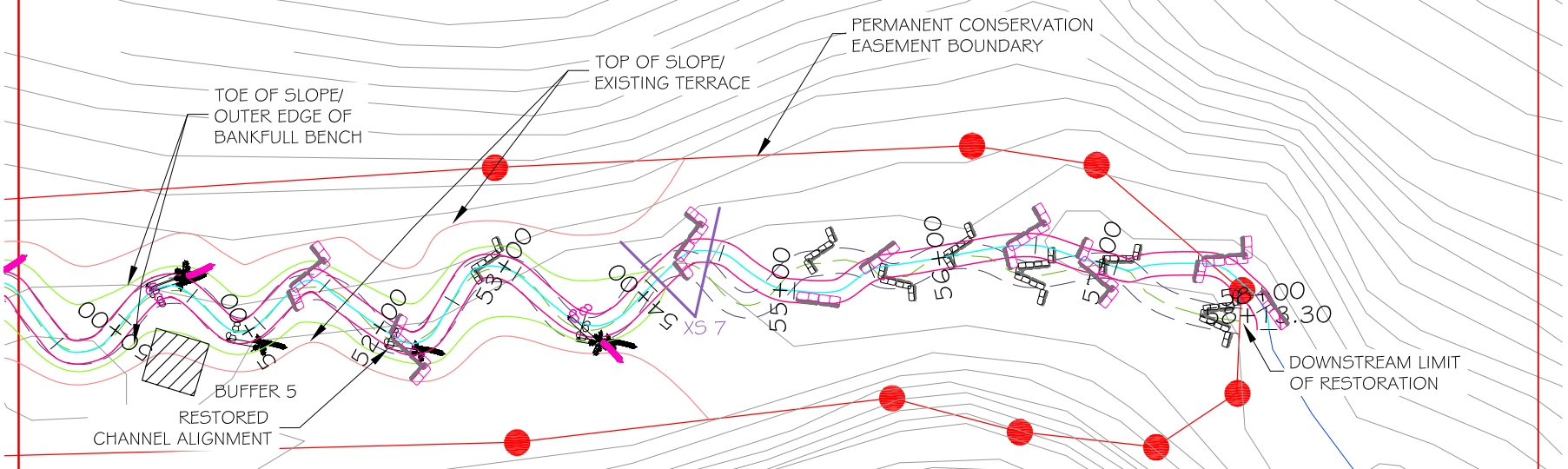
SCALE 1" = 50'

50 25 0 50

CONTOUR INTERVAL = 2'

LEGEND FOR PROPOSED FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- ROCK CROSS VANE (RCV)



DRAWINGS PRINTED AT HALF- SCALE

NOTES:

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REVISIONS

REV.	DESCRIPTION	DATE	APPR.

NORTH CAROLINA PROFESSIONAL SEAL 25525 ENGINEER PATRICK K. SMITH

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www.SandEC.com

Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS		Project No.: 9385.D1
		Proj. Mgr.: PKS / Drawn: RSW
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 50'
Sheet Title: REACH 1 CONSTRUCTED SITE FEATURES & GRADING - D		Sheet No.: 7 OF 31

File: Sec\Jobs7-9k\9385.D1\Drawings\AsBuilt\AsBuilt2.dwg

REACH 2 RESTORATION SITE LAYOUT & KEYSHEET

NOTES:

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DRAWINGS PRINTED AT HALF- SCALE

RESTORED STREAM CHANNEL

EXISTING CONTOURS

EXISTING NCDENR STREAMS

EXISTING DOT ROADS

RESTORED CHANNEL ALIGNMENT

PERMANENT ACCESS EASEMENT

EXISTING CULVERT

PERMANENT CONSERVATION EASEMENT & FENCELINE

KEY SHEET INDEX

E

F

G

PL

PR

CC

PKF

IPF

IPS

NEW STERLING ROAD (SR 1526)

NORTH

SCALE 1" = 100'

100 50 0 100

CONTOUR INTERVAL = 2'

REVISIONS

REV	DESCRIPTION	DATE	APPR

NORTH CAROLINA PROFESSIONAL SEAL 25525 ENGINEER PATRICK K. SMITH

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Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS		Project No.: 9385.D1	
		Proj. Mgr.: PKS	Drawn: RSW
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 100'	
Sheet Title: REACH 2 RESTORATION SITE LAYOUT & KEYSHEET		Sheet No.: 8 OF 31	

File: Sec\Jobs7-9k\9385.D1\Drawings\AsBuilt\AsBuilt2.dwg

NOTES:

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DRAWINGS PRINTED AT HALF- SCALE

NORTH

SCALE 1" = 30'

30 15 0 30

CONTOUR INTERVAL = 2'

LEGEND FOR ASBUILT FEATURES

- CROSS SECTION LOCATION (RIFFLE/ POOL PAIR) — XS 1
- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- ROCK VANE (RV)
- ROCK CROSS VANE (RCV)

BUFFER/BANK 1

- VEGETATION PLOTS
- CREATED/RESTORED WETLANDS

LEGEND FOR PROPOSED FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- ROCK CROSS VANE (RCV)

UPSTREAM LIMIT OF RESTORATION

0+00

1+00

RESTORED CHANNEL ALIGNMENT

2+00

3+00

4+00

5+00

6+00

7+00

8+00

9+00

XS 1

BUFFER 1

PERMANENT CONSERVATION EASEMENT & FENCELINE

PL

E

REACH 2 CONSTRUCTED STE FEATURES & GRADING - E

REVISIONS

REV.	DESCRIPTION	DATE	APPR.

NORTH CAROLINA PROFESSIONAL SEAL 25525 ENGINEER PATRICK K. SMITH

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Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS		Project No.: 9385.D1
		Proj. Mgr.: PKS / Drawn: RSW
Location: REDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 30'
Sheet Title: REACH 2 CONSTRUCTED SITE FEATURES & GRADING - E		Sheet No.: 9 OF 31

File: Sec\Jobs7-9k\9385.D1\Drawings\AsBuilt\AsBuilt2.dwg

REACH 2 CONSTRUCTED SITE FEATURES & GRADING - F

NOTES:

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LEGEND FOR ASBUILT FEATURES

- XS1 — CROSS SECTION LOCATION (RIFFLE/ POOL PAIR)
- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- ROCK VANE (RV)
- ROCK CROSS VANE (RCV)

BUFFER/BANK 1

- VEGETATION PLOTS
- CREATED/RESTORED WETLANDS

NORTH

SCALE 1" = 30'

30 15 0 30

CONTOUR INTERVAL = 2'

LEGEND FOR PROPOSED FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- ROCK CROSS VANE (RCV)

DRAWINGS PRINTED AT HALF- SCALE

10+00

11+00

BANK 1

12+00

RESTORED CHANNEL ALIGNMENT

13+00

14+00

15+00

PERMANENT CONSERVATION EASEMENT & FENCELINE

16+00

BANK 2

17+00

F

REVISIONS

REV.	DESCRIPTION	DATE	APPR.

NORTH CAROLINA PROFESSIONAL SEAL 25525 ENGINEER PATRICK K. SMITH

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11010 Raven Ridge Road • Raleigh, North Carolina 27614 • Phone: (919) 846-5900 • Fax: (919) 846-9467
www.SandEC.com

Project: GRAY FARM
RESTORATION AS-BUILT DRAWINGS

Location: IREDELL CO., NC

Client: NC ECOSYSTEM ENHANCEMENT PROGRAM

Sheet Title: REACH 2 PROPOSED CONDITIONS SHEET F

Project No.: 9385.D1

Proj. Mgr.: PKS

Drawn: RSW

Scale: 1" = 30'

Sheet No.: 10 OF 31

File: Sec\Jobs7-9k\9385.D1\Drawings\AsBuilt\AsBuilt2.dwg

REACH 2 CONSTRUCTED SITE FEATURES & GRADING - G

NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
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NORTH

SCALE 1" = 30'

30 15 0 30

CONTOUR INTERVAL = 2'

LEGEND FOR ASBUILT FEATURES

- XS 1 — CROSS SECTION LOCATION (RIFFLE/ POOL PAIR)
- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- ROCK VANE (RV)
- ROCK CROSS VANE (RCV)

BUFFER/BANK 1

- VEGETATION PLOTS
- CREATED/RESTORED WETLANDS

LEGEND FOR PROPOSED FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- ROCK CROSS VANE (RCV)

BUFFER 2

18+00

XS 2

19+00

RESTORED CHANNEL ALIGNMENT

20+00

20+34.14

20+34.14

PERMANENT ACCESS EASEMENT

EXISTING CULVERT TO REMAIN

21+00

21+90.67

CC

DOWNSTREAM LIMIT OF RESTORATION

IPF

IPS

PERMANENT CONSERVATION EASEMENT & FENCELINE

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DRAWINGS PRINTED AT HALF- SCALE

REVISIONS

REV.	DESCRIPTION	DATE	APPR

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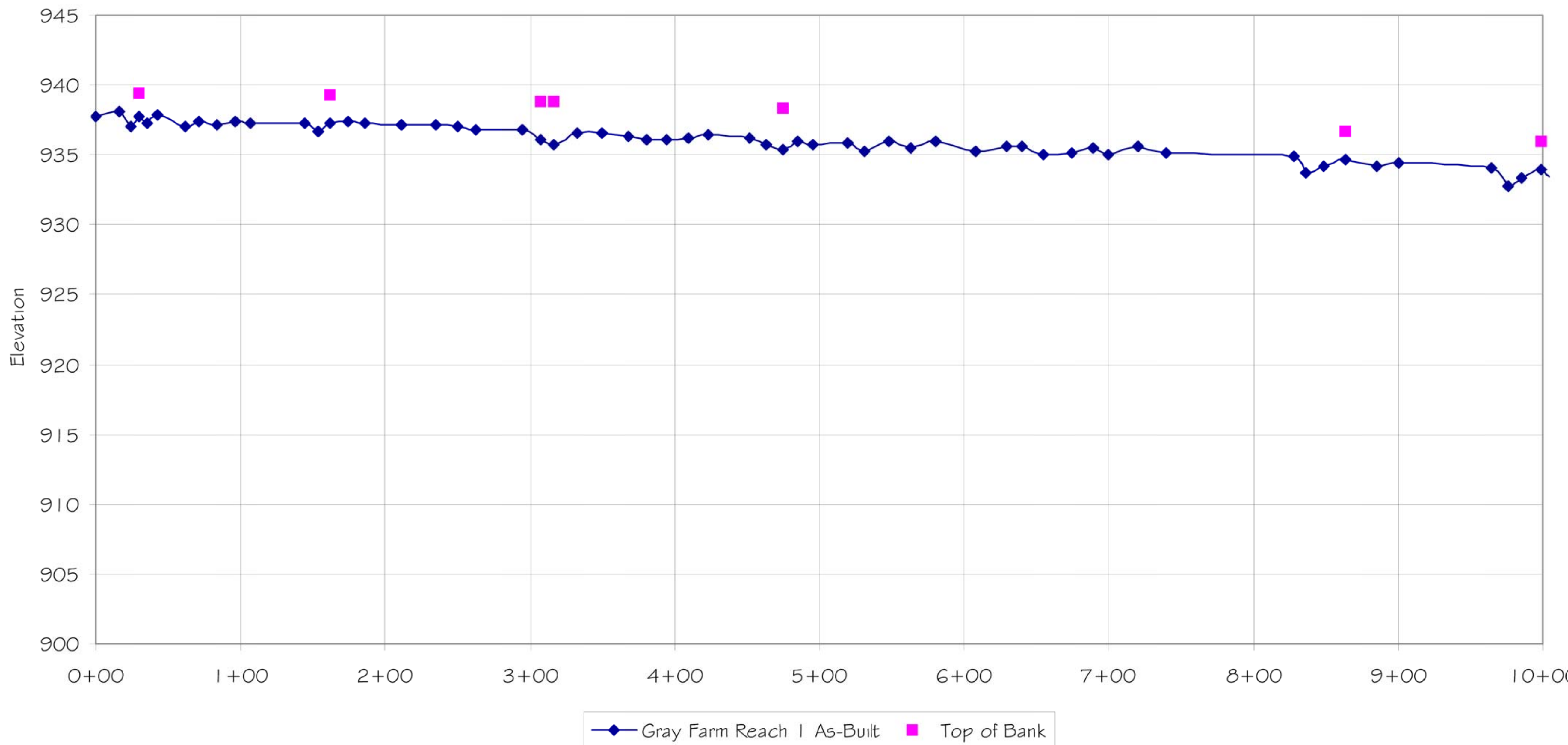
Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS		Project No.: 9385.D1
		Proj. Mgr.: PKS / Drawn: RSW
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 30'
Sheet Title: REACH 2 CONSTRUCTED SITE FEATURES & GRADING - G		Sheet No.: 11 OF 31

GRAY FARM REACH 1 LONGITUDINAL PROFILE (STA. 0+00 TO 10+00)



File: S:\Jobs7-9k\9385.D1\Drawings\AsBuilt\AsBuilt2.dwg

REV.	DESCRIPTION	DATE	APPR.
1	Revisions per EEP comments, 9/11/06	9/15/06	PKS

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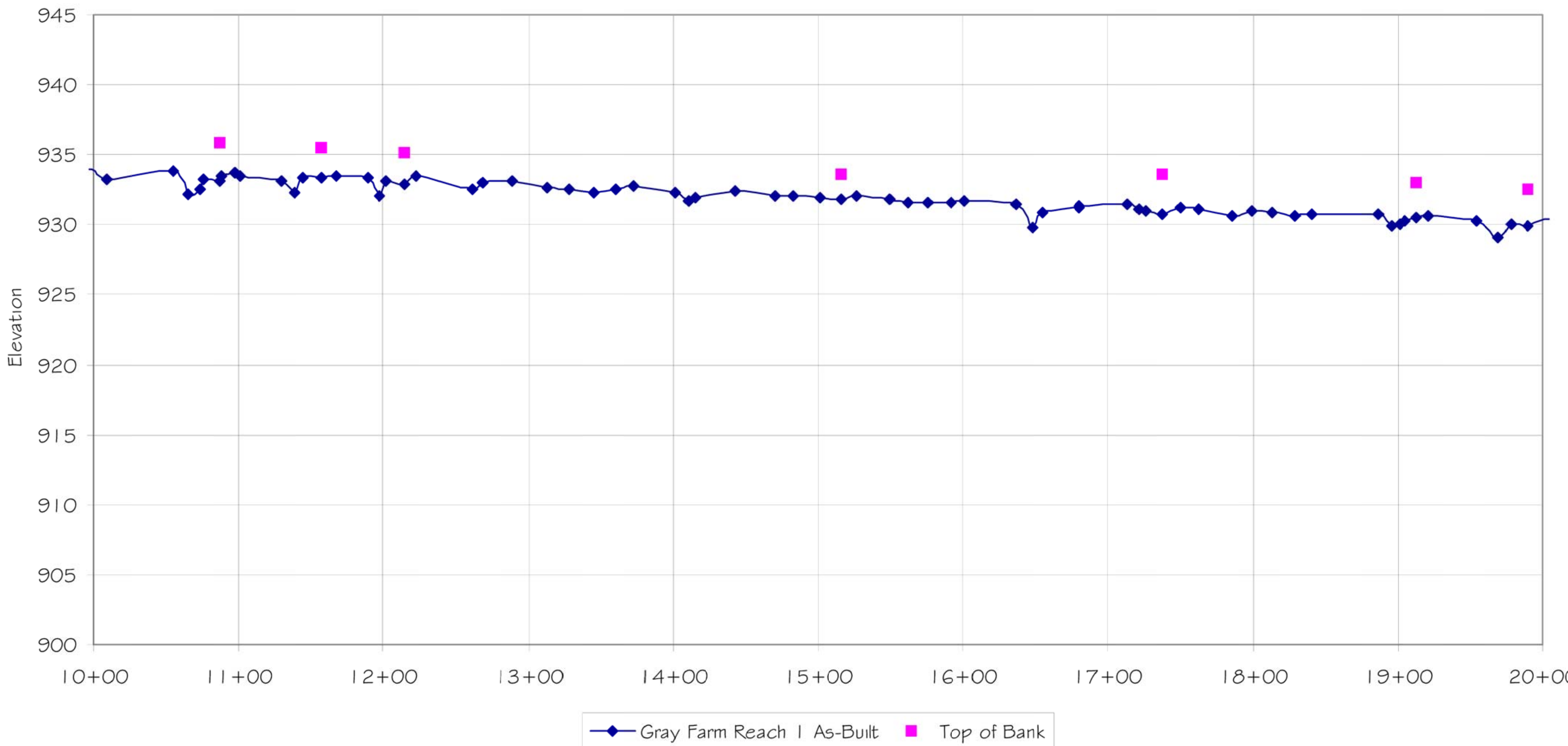
Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS
Location: IREDELL CO., NC
Client: NC ECOSYSTEM ENHANCEMENT PROGRAM
Sheet Title: REACH 1 LONGITUDINAL PROFILE
Project No.: 9385.D1
Proj. Mgr.: PKS
Drawn: RSW
Scale: AS SHOWN
Sheet No.: 12 OF 31

GRAY FARM REACH 1
LONGITUDINAL PROFILE
(STA. 10+00 TO 20+00)



Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS

Project No.: 9385.D1

Proj. Mgr.: PKS

Drawn: RSW

Location: IREDELL CO., NC

Client: NC ECOSYSTEM ENHANCEMENT PROGRAM

Scale: AS SHOWN

Sheet Title: REACH 1 LONGITUDINAL PROFILE

Sheet No.: 13 OF 31

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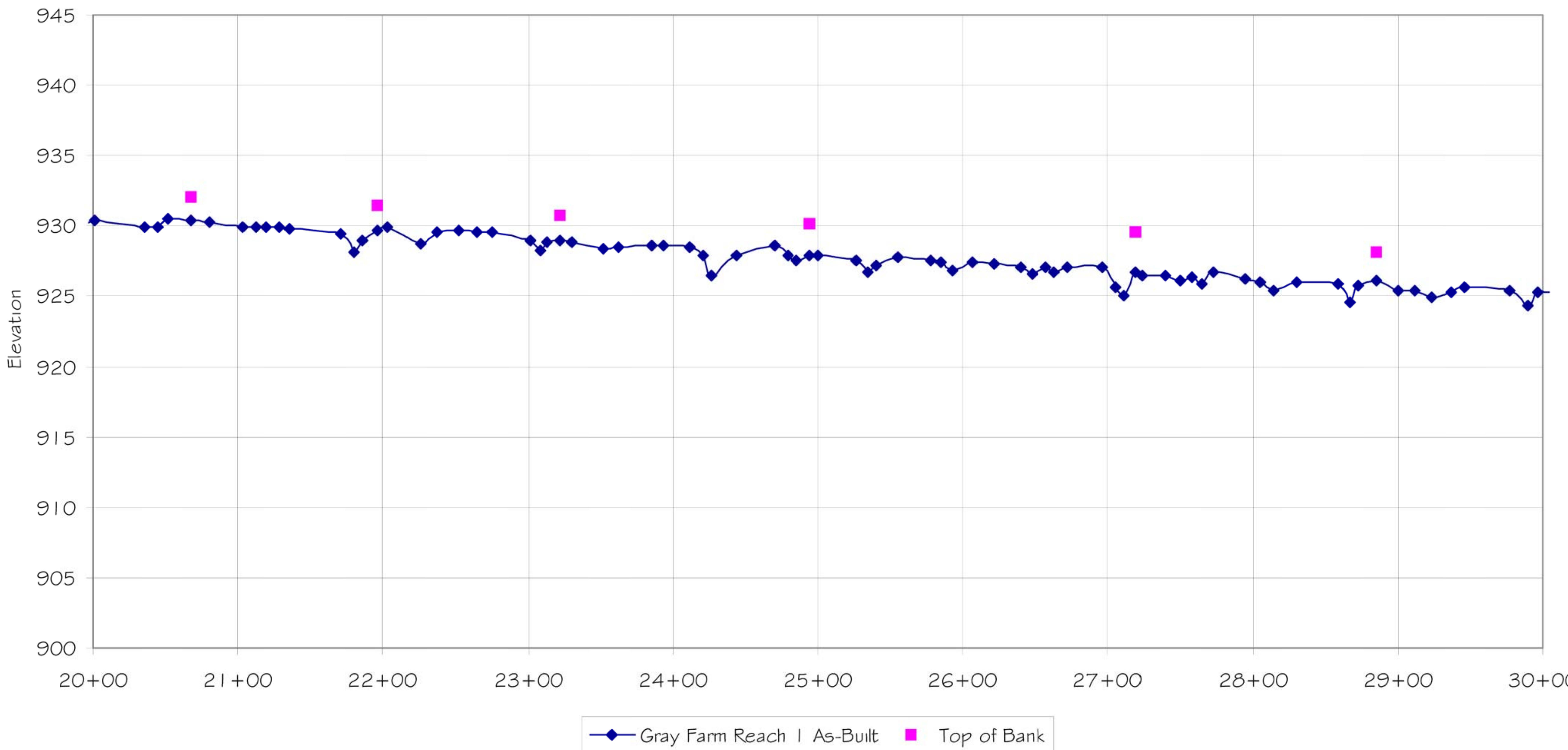
File: Sec\Jobs7-9k\9385.D1\Drawings\AsBuilt\AsBuilt2.dwg

GRAY FARM REACH 1
LONGITUIDNAL PROFILE
(STA. 20+00 TO 30+00)



Project No.: 9385.D1
Proj. Mgr.: PKS
Drawn: RSW
Scale: AS SHOWN
Sheet No.: 14 OF 31

Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS
Client: NC ECOSYSTEM ENHANCEMENT PROGRAM
Location: IREDELL CO., NC
Sheet Title: REACH 1 LONGITUDINAL PROFILE

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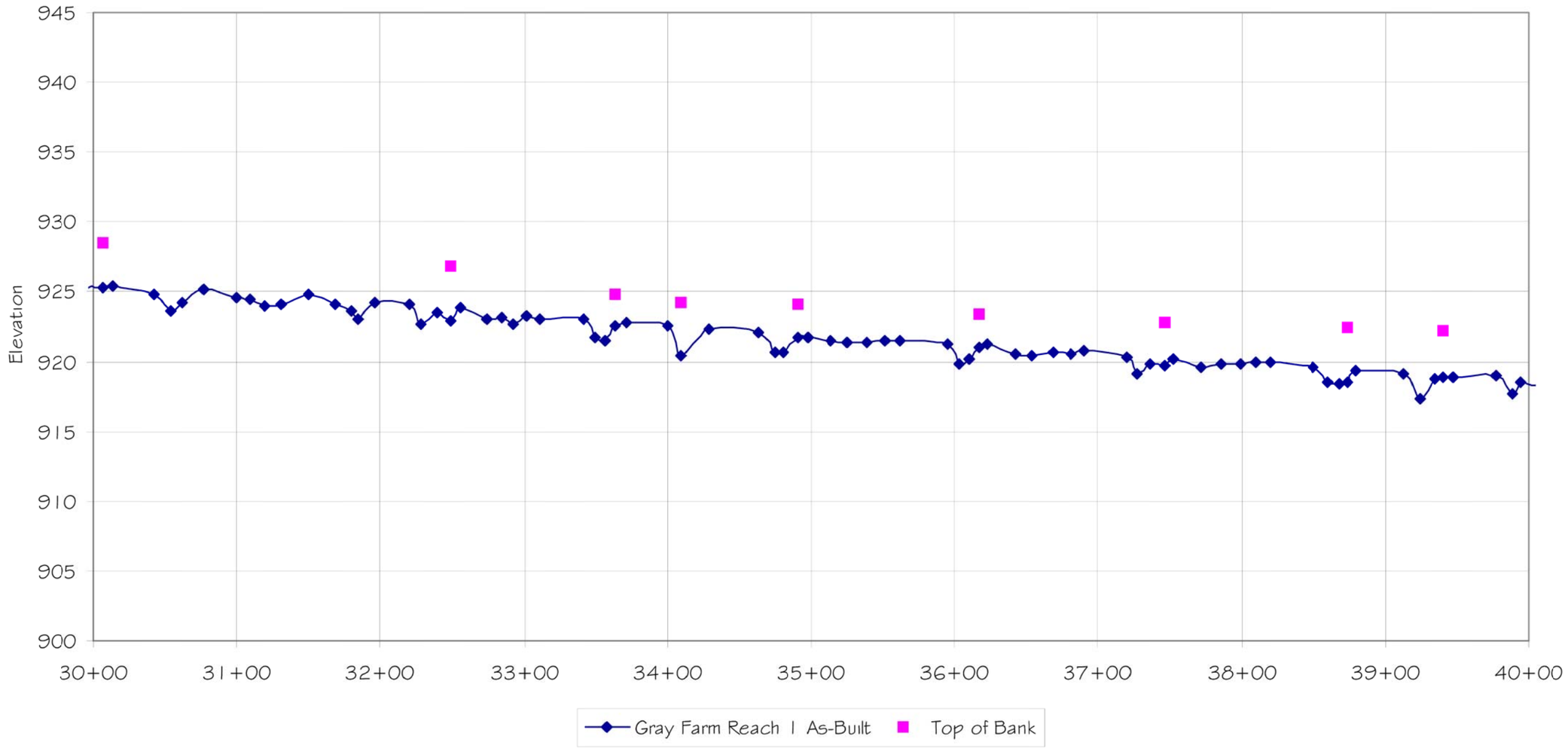
GRAY FARM REACH 1
LONGITUDINAL PROFILE
(STA. 30+00 TO 40+00)



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Project No.: 9365 D1 | Drawn: RSW
Proj. Mgr.: PKS | Scale: AS SHOWN
Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS
Location: REDELL CO., NC | Client: NC ECOSYSTEM ENHANCEMENT PROGRAM
Sheet Title: REACH 1 LONGITUDINAL PROFILE
Sheet No.: 15 OF 31

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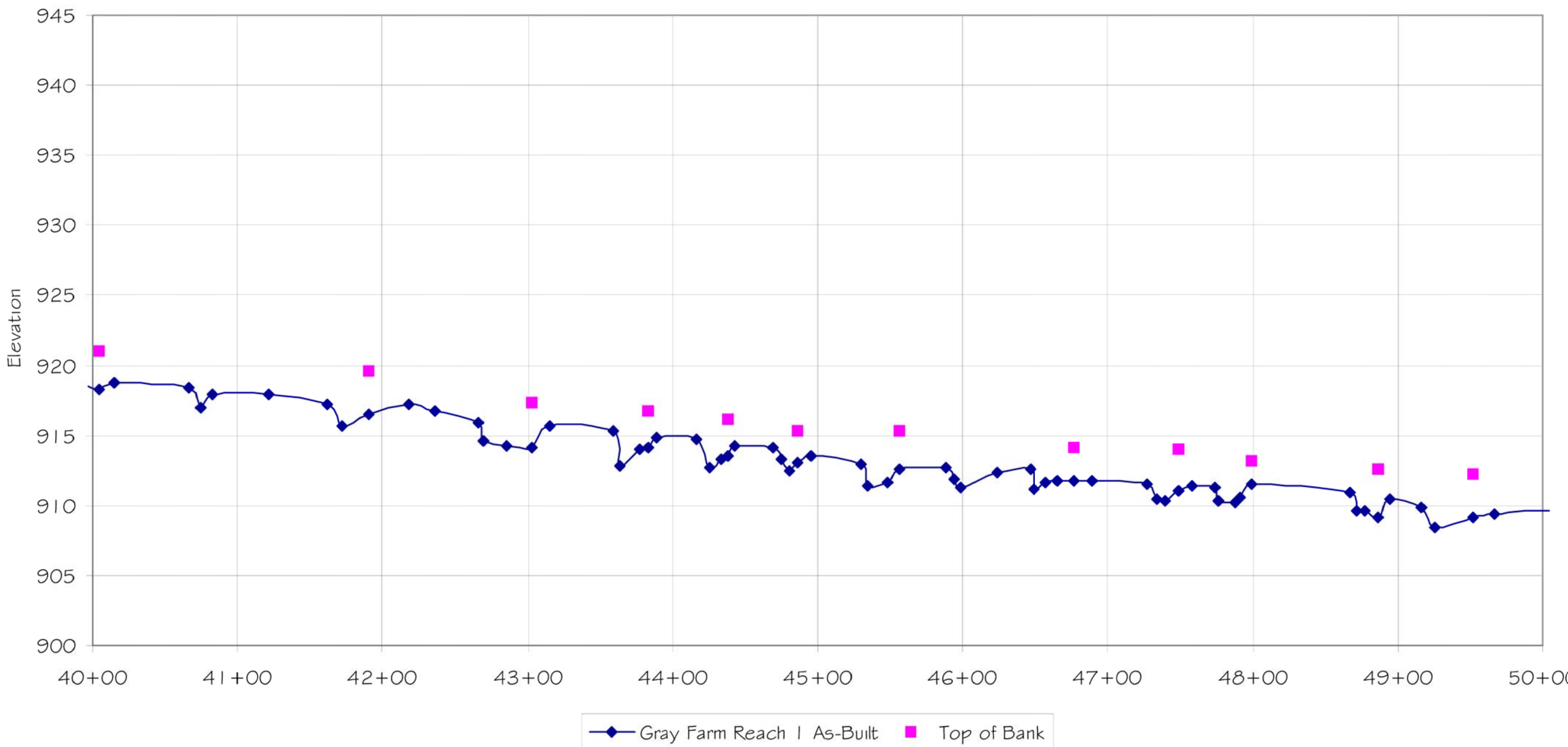
NO.	DESCRIPTION	DATE	APPR.
1	Revised per ESP comments, 3/1/06	3/1/06	PKS

GRAY FARM REACH 1
LONGITDUINAL PROFILE
(STA. 40+00 TO 50+00)



Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS

Project No.: 9385.D1 | Proj. Mgr.: PKS | Drawn: RSW

Location: IREDELL CO., NC | Client: NC ECOSYSTEM ENHANCEMENT PROGRAM | Scale: AS SHOWN

Sheet Title: REACH 1 LONGITUDINAL PROFILE | Sheet No.: 16 OF 31

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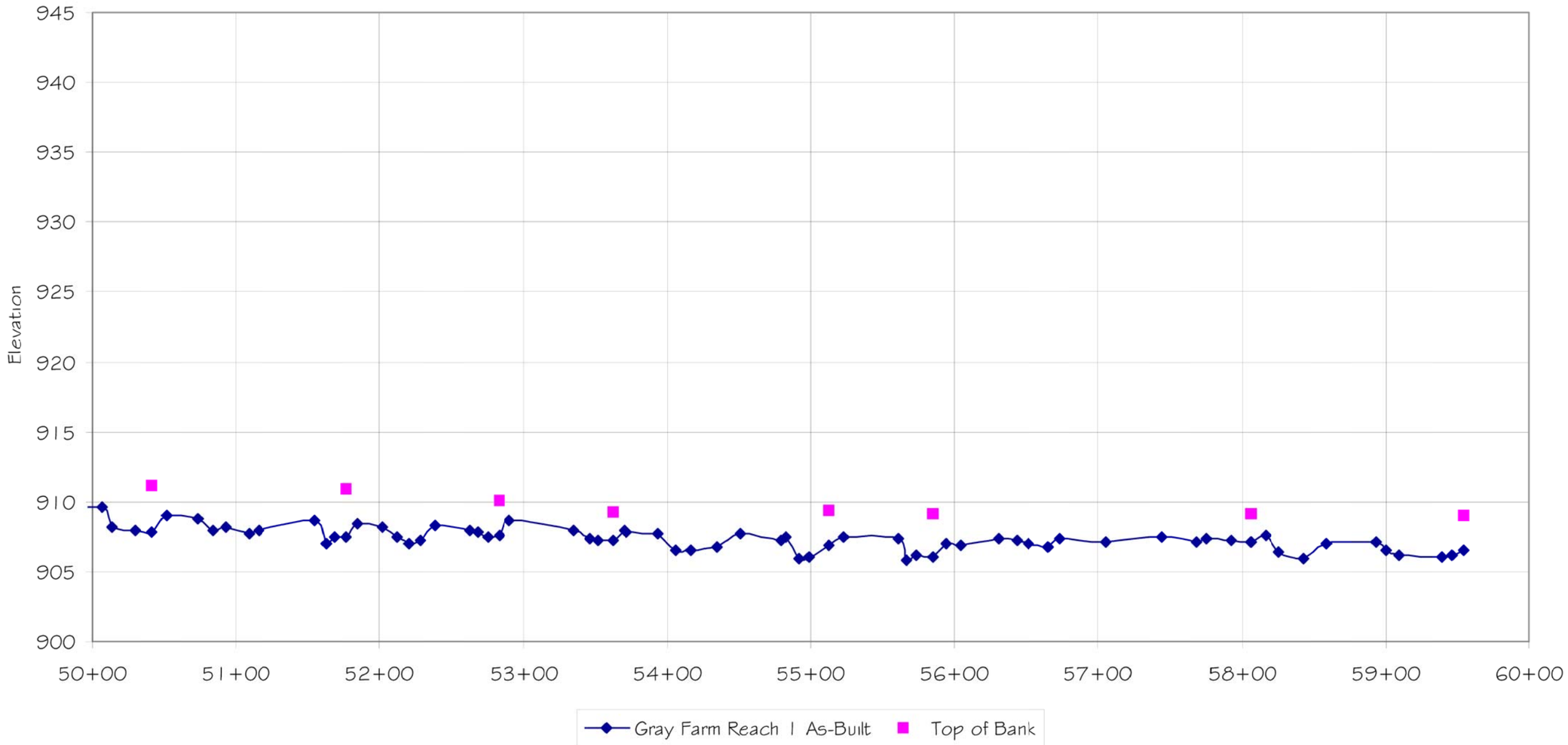
GRAY FARM REACH 1
LONGITUDINAL PROFILE
(STA. 50+00 TO 60+00)



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Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS
Location: REDELL CO., NC
Client: NC ECOSYSTEM ENHANCEMENT PROGRAM
Sheet Title: REACH 1 CROSS-SECTIONS

Project No.: 9365 D1
Proj. Mgr.: PKS
Drawn: RSW
Scale: AS SHOWN
Sheet No.: 17 OF 31

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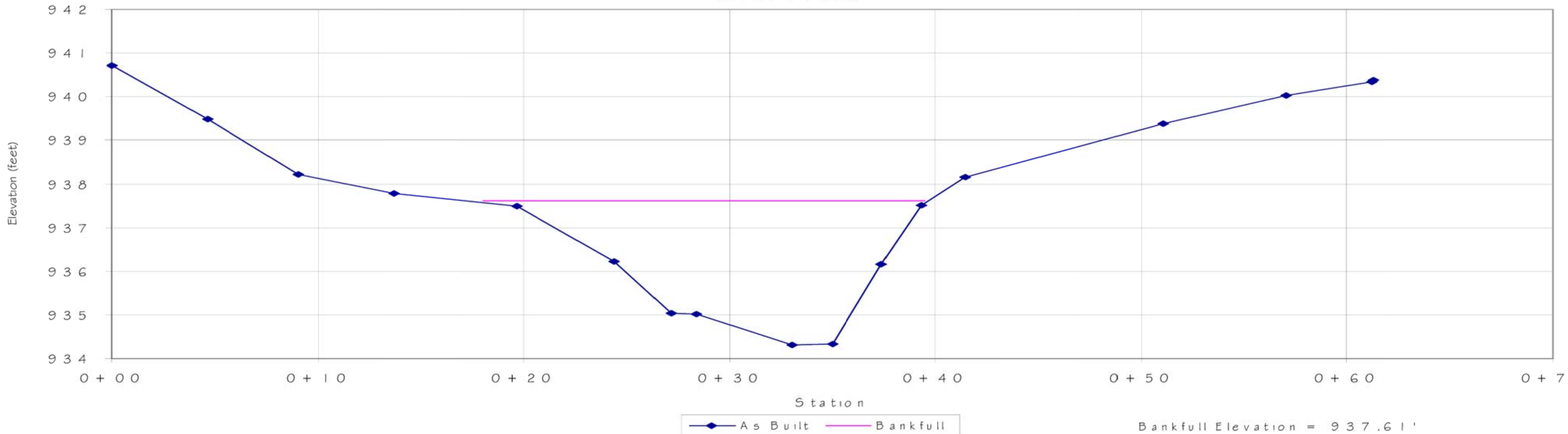
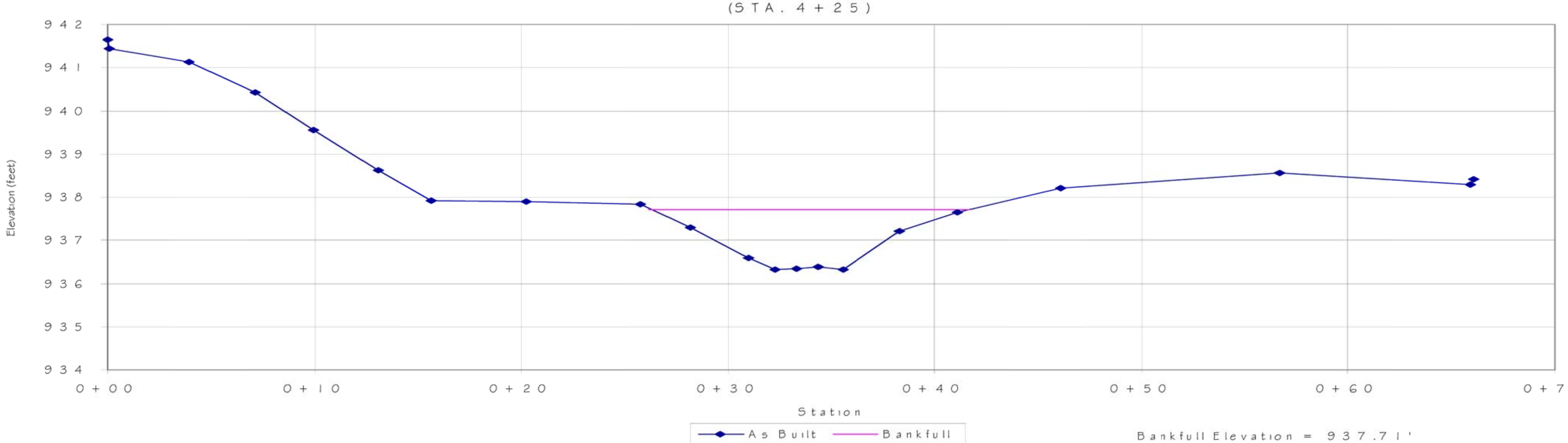
REVISIONS

BY	DESCRIPTION	DATE
1	Revised per DWR comments, 9/1/06	9/1/06

GRAY FARM REACH 1
CROSS-SECTION 1 (POOL)
(STA. 4+65)



GRAY FARM REACH 1
CROSS-SECTION 1 (RIFFLE)
(STA. 4+25)



Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS
Location: IREDELL CO., NC
Client: NC ECOSYSTEM ENHANCEMENT PROGRAM
Sheet Title: REACH 1 CROSS-SECTIONS
Project No.: 9385.D1
Proj. Mgr.: PKS
Drawn: RSW
Scale: AS SHOWN
Sheet No.: 18 OF 31

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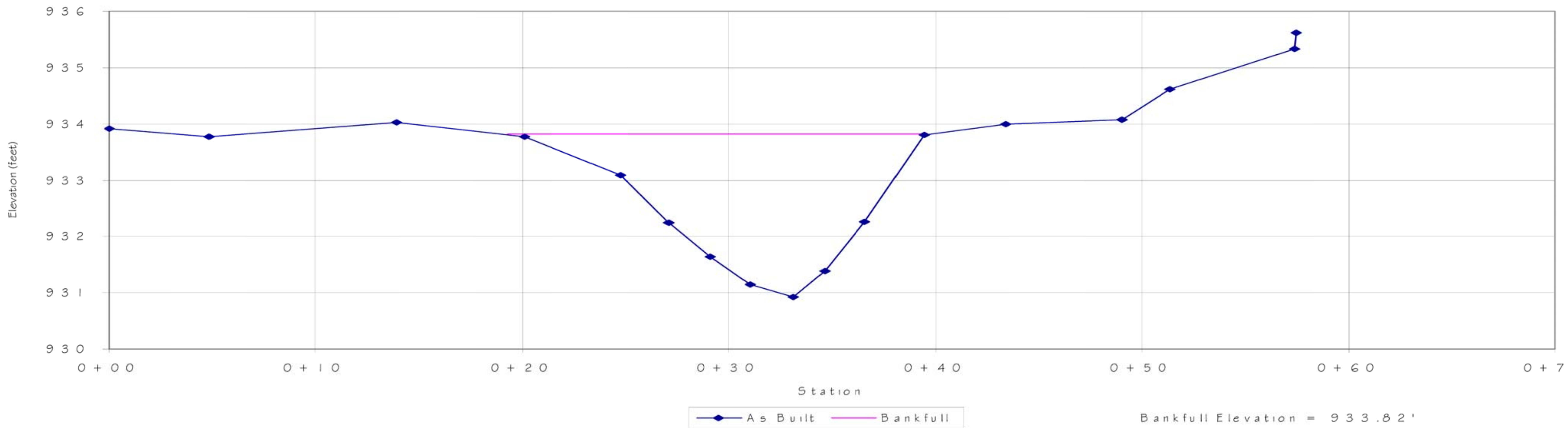
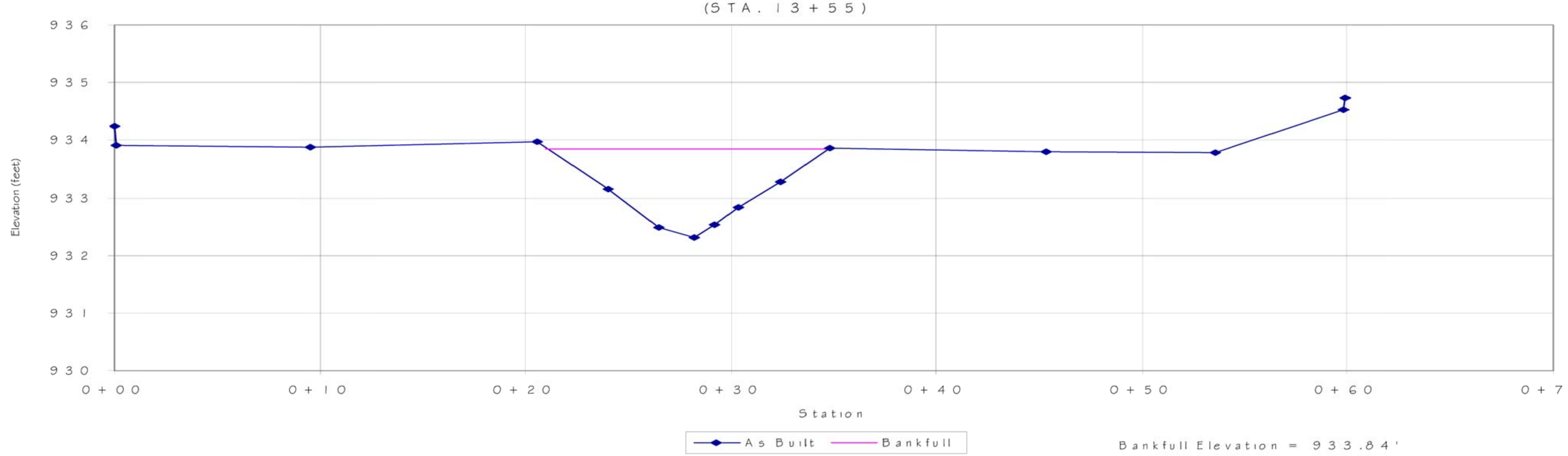
GRAY FARM REACH 1
CROSS-SECTION 2 (POOL)
(STA. 13+90)



GRAY FARM REACH 1
CROSS-SECTION 2 (RIFFLE)
(STA. 13+55)



Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS

Location: IREDELL CO., NC

Client: NC ECOSYSTEM ENHANCEMENT PROGRAM

Sheet Title: REACH 1 CROSS-SECTIONS

Project No.: 9385.D1

Proj. Mgr.: PKS

Drawn: RSW

Scale: AS SHOWN

Sheet No.: 19 OF 31

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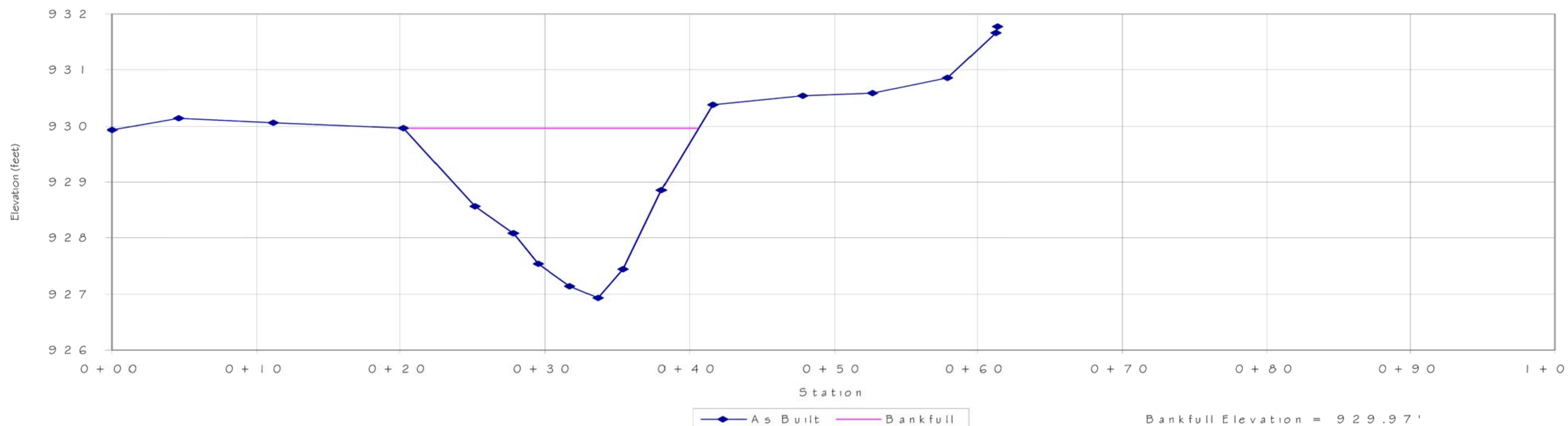
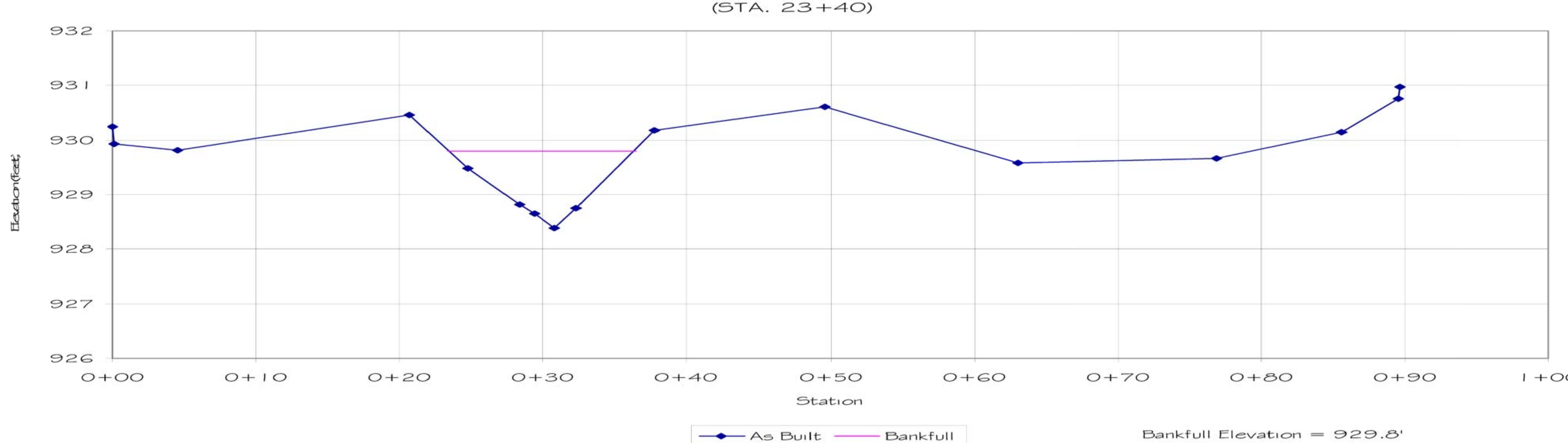
GRAY FARM REACH 1
CROSS-SECTION 3 (POOL)
(STA. 23+20)



GRAY FARM REACH 1
CROSS-SECTION 3 (RIFFLE)
(STA. 23+40)



Project No.: 9385.D1
Proj. Mgr.: PKS
Drawn: RSW
Scale: AS SHOWN
Sheet No.: 20 OF 31

Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS
Location: IREDELL CO., NC
Client: NC ECOSYSTEM ENHANCEMENT PROGRAM
Sheet Title: REACH 1 CROSS-SECTIONS

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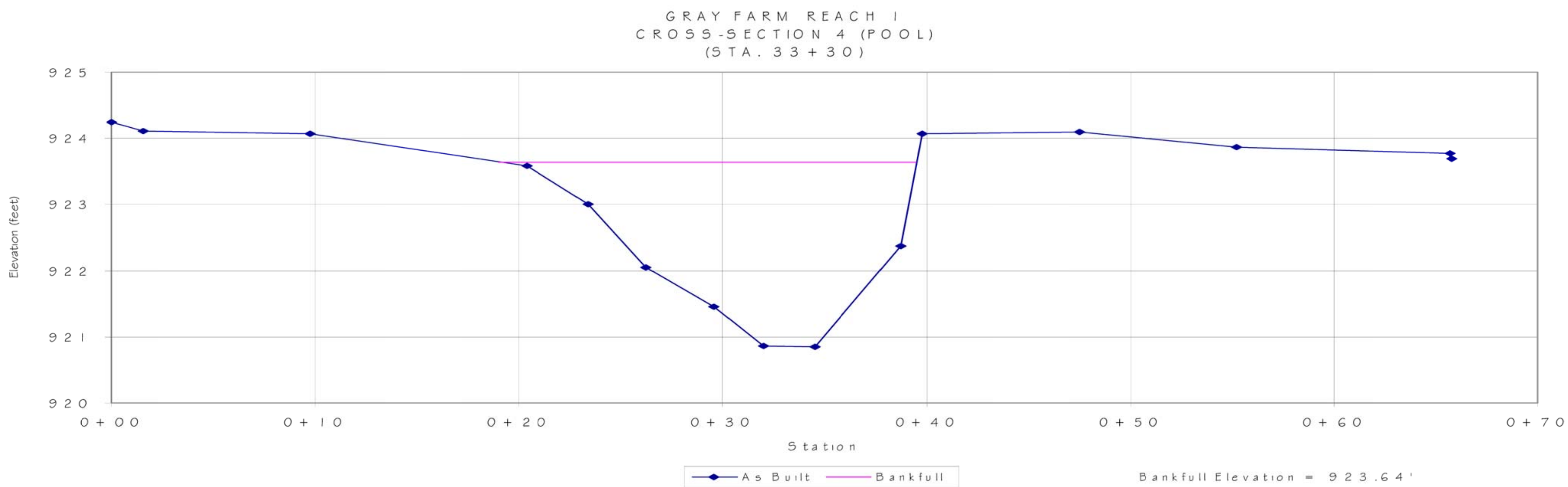

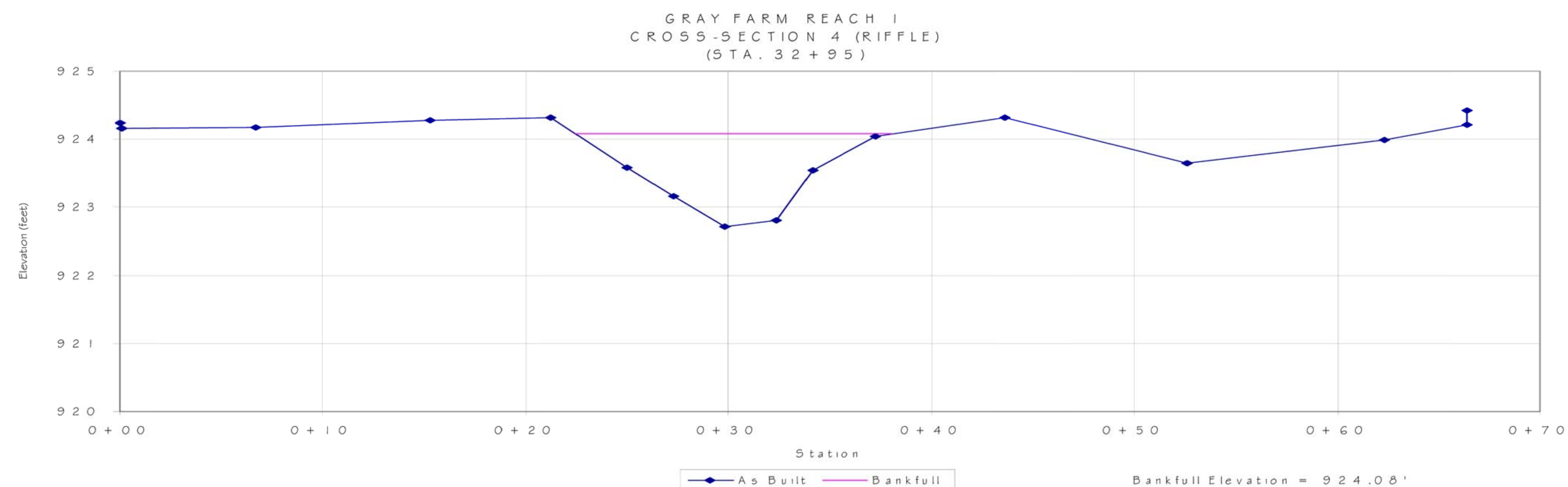

Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS

Location: IREDELL CO., NC

Client: NC ECOSYSTEM ENHANCEMENT PROGRAM

Sheet Title: REACH 1 CROSS-SECTIONS

Project No.: 9385.D1

Proj. Mgr.: PKS

Drawn: RSW

Scale: AS SHOWN

Sheet No.: 21 OF 31

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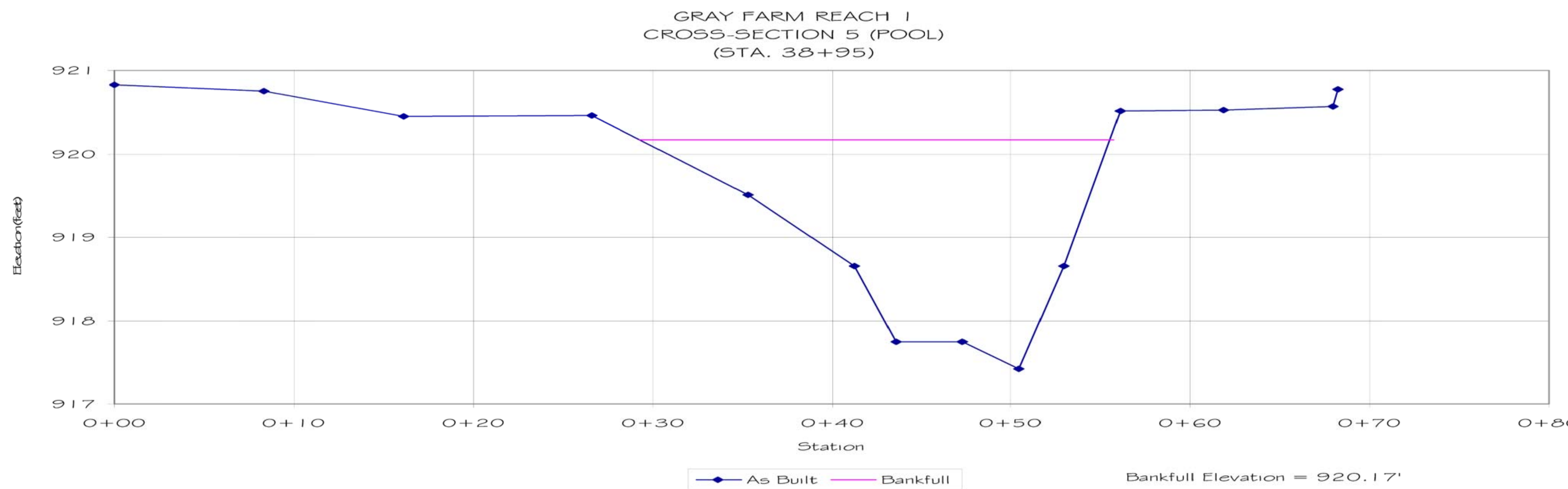
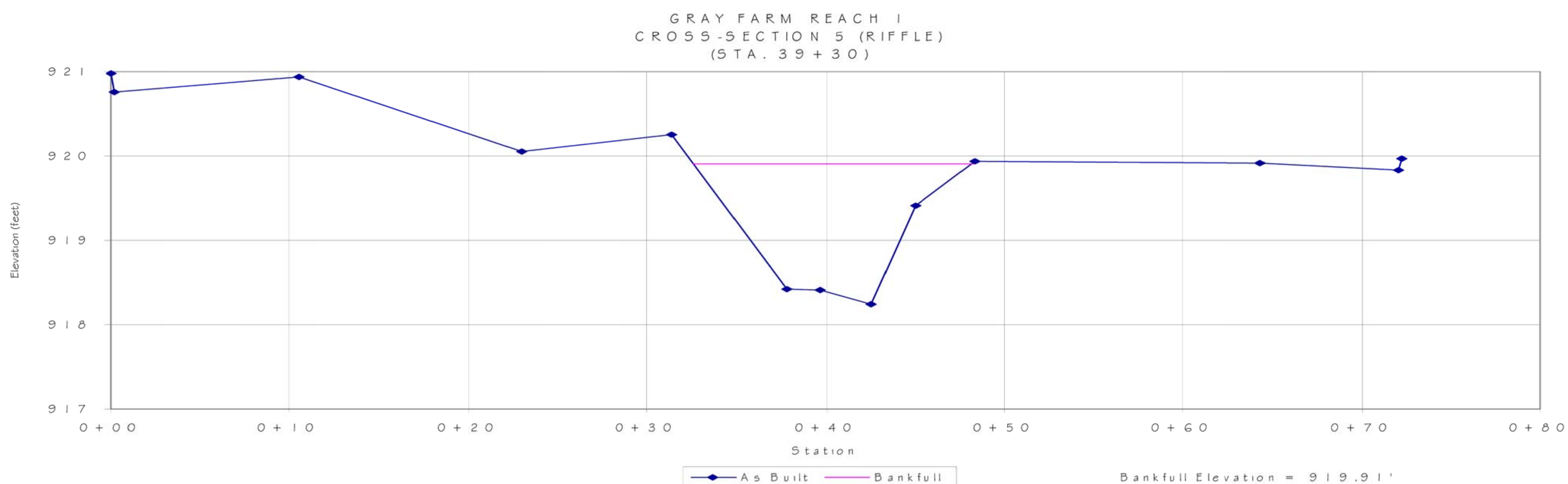
File: SecUobs7-9k9385.D1\Drawings\AsBuilt\AsBuilt2.dwg





Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS

Project No.: 9385.D1

Proj. Mgr.: PKS

Drawn: RSW

Location: IREDELL CO., NC

Client: NC ECOSYSTEM ENHANCEMENT PROGRAM

Scale: AS SHOWN

Sheet Title: REACH 1 CROSS-SECTIONS

Sheet No.: 22 OF 31

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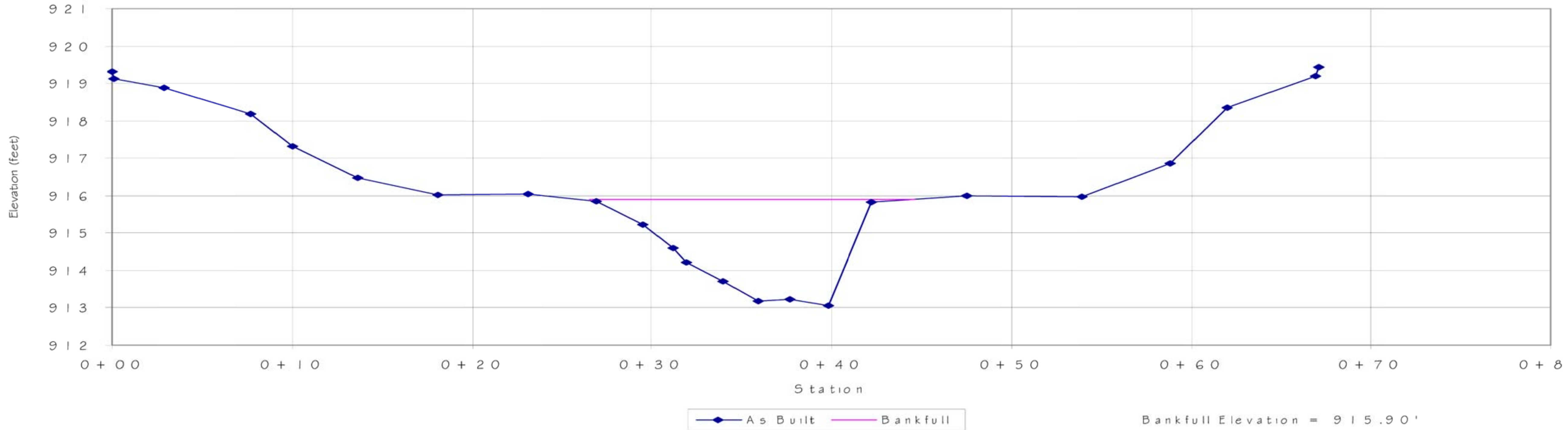
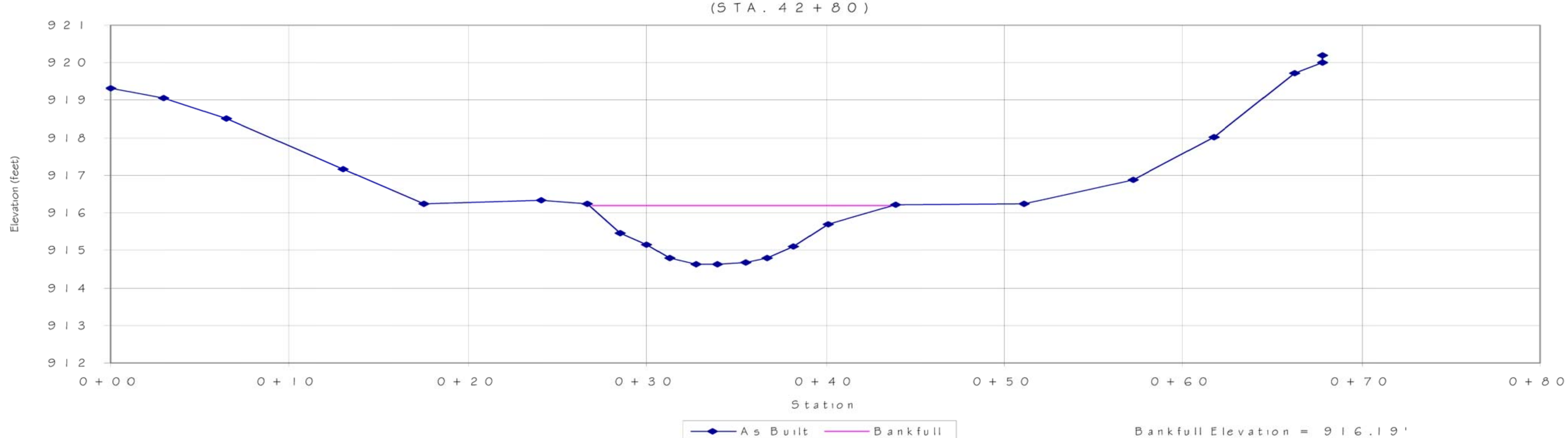
GRAY FARM REACH 1
CROSS-SECTION 6 (POOL)
(STA. 43+10)



GRAY FARM REACH 1
CROSS-SECTION 6 (RIFFLE)
(STA. 42+80)



File: SecUobs7-9k9385.D1\Drawings\AsBuilt\AsBuilt2.dwg

Project No.: 9385.D1
Proj. Mgr.: PKS
Drawn: RSW
Scale: AS SHOWN
Sheet No.: 23 OF 31

Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS
Location: IREDELL CO., NC
Client: NC ECOSYSTEM ENHANCEMENT PROGRAM
Sheet Title: REACH 1 CROSS-SECTIONS

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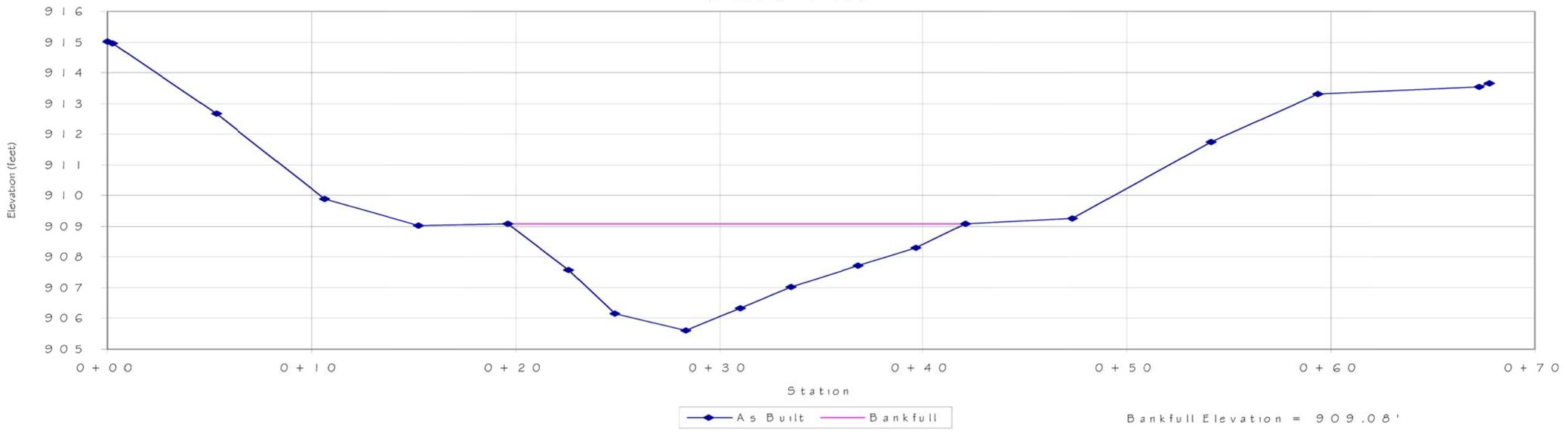
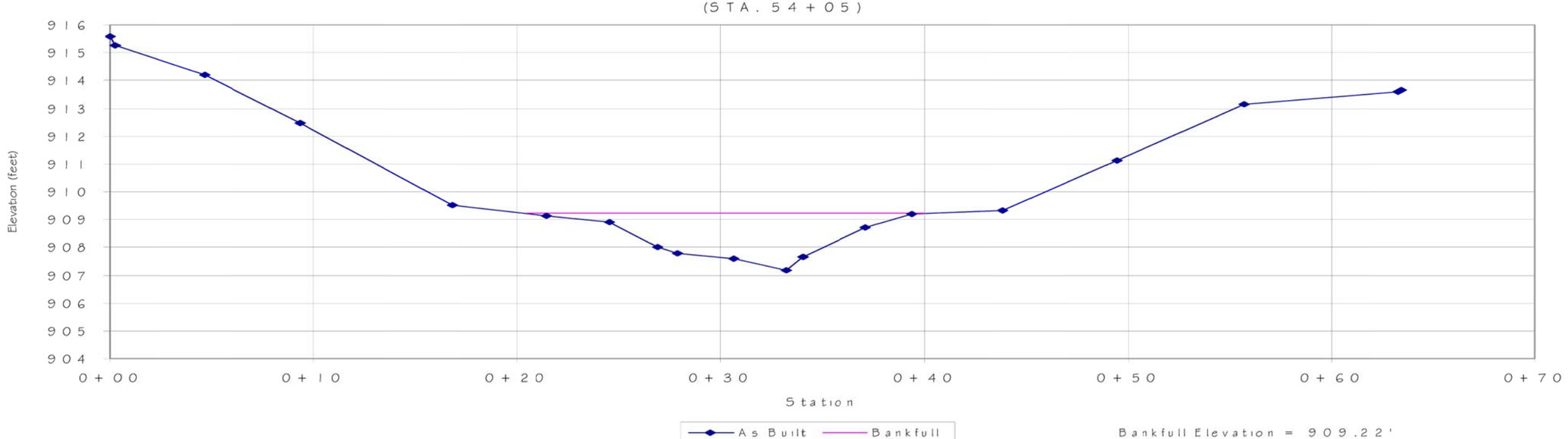
GRAY FARM REACH 1
CROSS-SECTION 7 (POOL)
(STA. 54+45)



Bankfull Elevation = 909.08'

GRAY FARM REACH 1
CROSS-SECTION 7 (RIFFLE)
(STA. 54+05)



Bankfull Elevation = 909.22'

File: SecVols-7 9x9385 D:\Drawings\AsBuilt\AsBuilt2.dwg

Project No.: 9385.D1 | Drawn: RSW
Proj. Mgr.: PKS | Scale: AS SHOWN
Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS
Location: REDELL CO., NC | Client: NC ECOSYSTEM ENHANCEMENT PROGRAM
Sheet Title: REACH 1 CROSS-SECTIONS | Sheet No.: 24 OF 31

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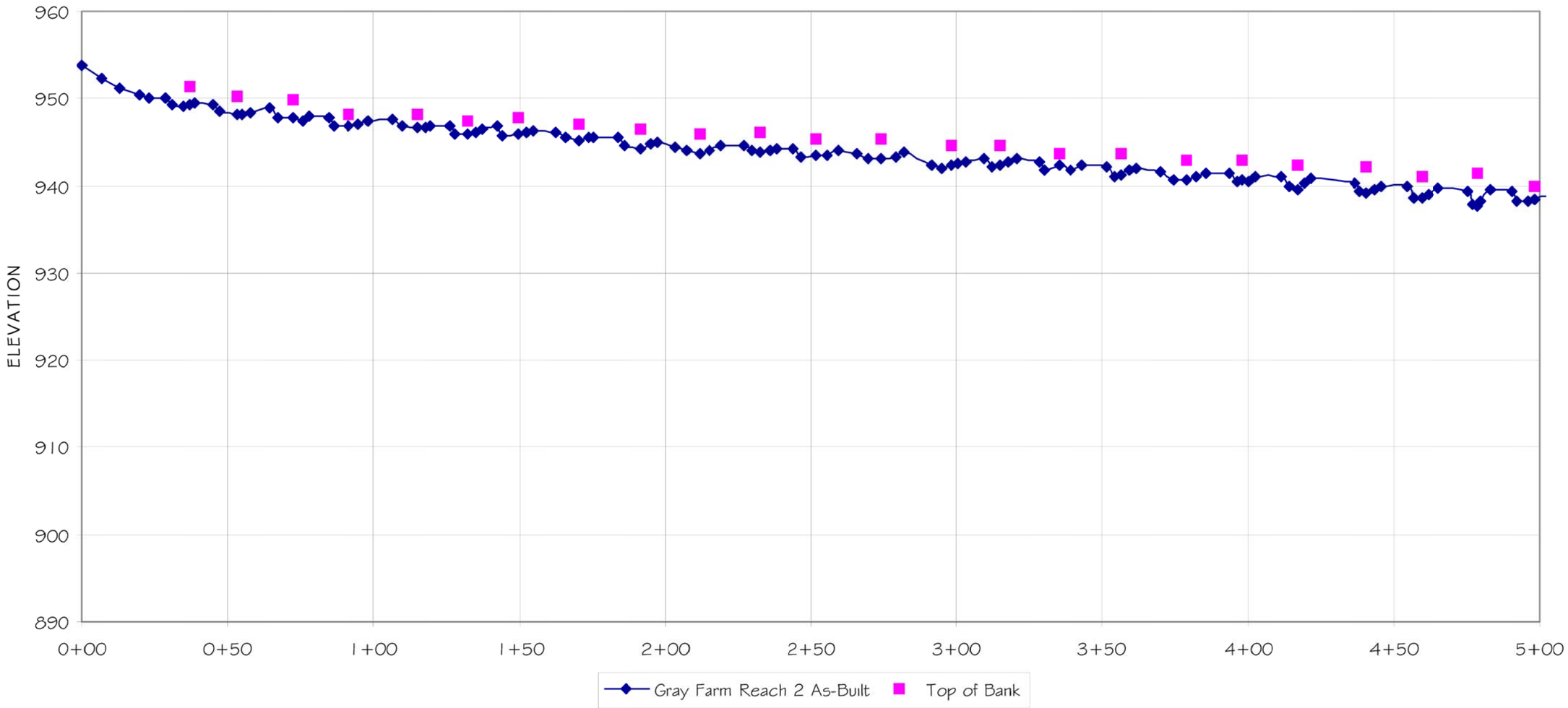
REVISIONS

NO.	DESCRIPTION	DATE	APP'D
1	Revised per comments, 9/1/06	9/1/06	PKS

GRAY FARM REACH 2
LONGITUDINAL PROFILE
(STA. 0+00 TO 5+00)



Project No.: 9385.01
Proj. Mgr.: PKS
Drawn: RSW
Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS
Location: IREDELL CO., NC
Client: NC ECOSYSTEM ENHANCEMENT PROGRAM
Scale: AS SHOWN
Sheet Title: REACH 2 LONGITUDINAL PROFILE- GRAY FARM
Sheet No.: 25 OF 31

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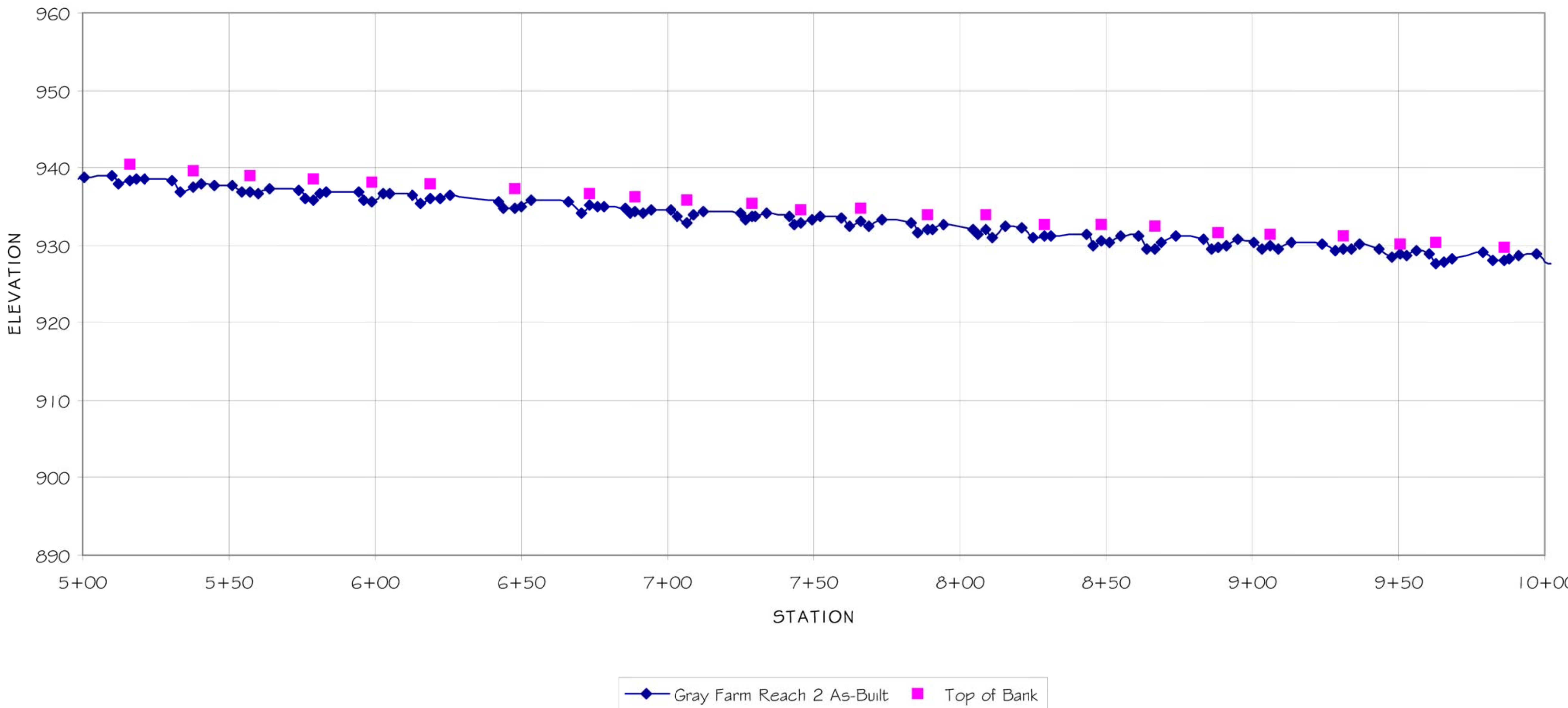
REVISIONS

NO.	DESCRIPTION	DATE	APP.
1	Revisions per DFF comments, 01-06	01-2006	PKS

GRAY FARM REACH 2
LONGITUDINAL PROFILE
(STA. 5+00 TO 10+00)



Project No.: 9385.D1
Proj. Mgr.: PKS
Drawn: RSW
Scale: AS SHOWN
Sheet No.: 26 OF 31

Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS
Location: IREDELL CO., NC
Client: NC ECOSYSTEM ENHANCEMENT PROGRAM
Sheet Title: REACH 2 LONGITUDINAL PROFILE- GRAY FARM

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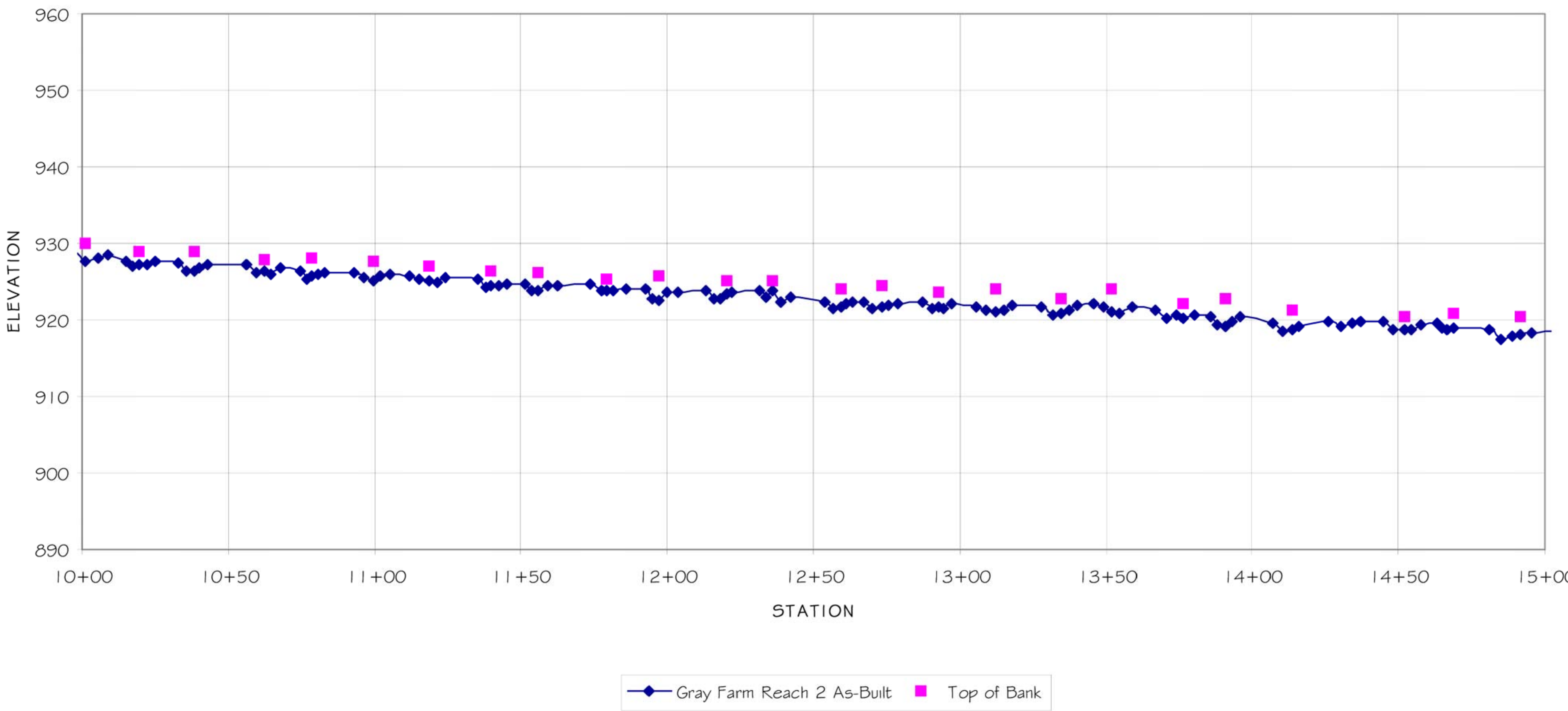
REVISIONS

GRAY FARM REACH 2
LONGITUDINAL PROFILE
(STA. 10+00 TO 15+00)



Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS
Project No.: 9385.D1
Proj. Mgr.: PKS
Drawn: RSW
Location: IREDELL CO., NC
Client: NC ECOSYSTEM ENHANCEMENT PROGRAM
Scale: AS SHOWN
Sheet Title: REACH 2 LONGITUDINAL PROFILE- GRAY FARM
Sheet No.: 27 OF 31

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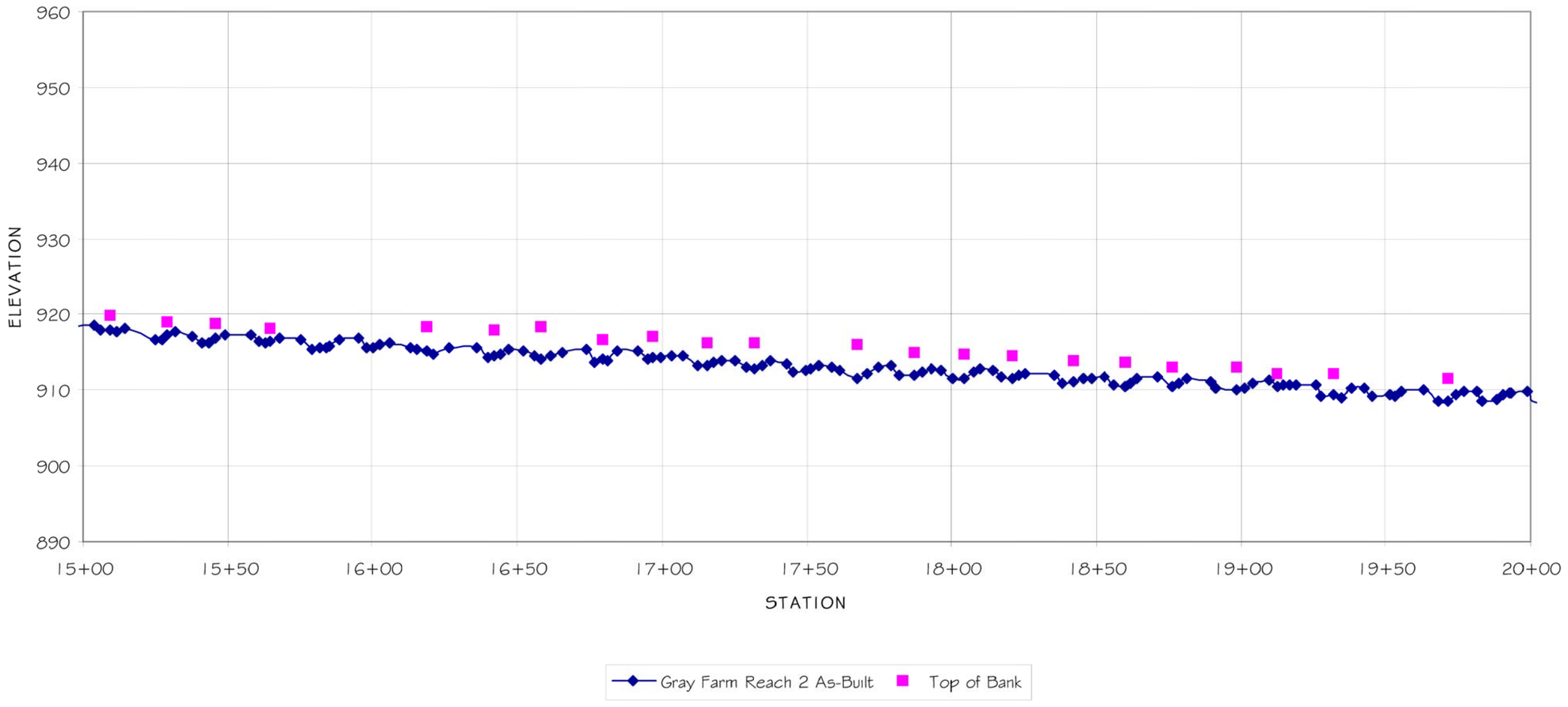
File: S:\EcoJobs\7-9k\9385.D1\Drawings\AsBuilt\AsBuilt2.dwg

GRAY FARM REACH 2
LONGITUDINAL PROFILE
(STA. 15+00 TO 20+00)



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Project No.: 9365 D I
Proj. Mgr.: PKS
Drawn: RSW
Scale: AS SHOWN
Sheet No.: 28 OF 31

Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS
Location: REDELL CO., NC
Client: NC ECOSYSTEM ENHANCEMENT PROGRAM
Sheet Title: REACH 2 LONGITUDINAL PROFILE - GRAY FARM

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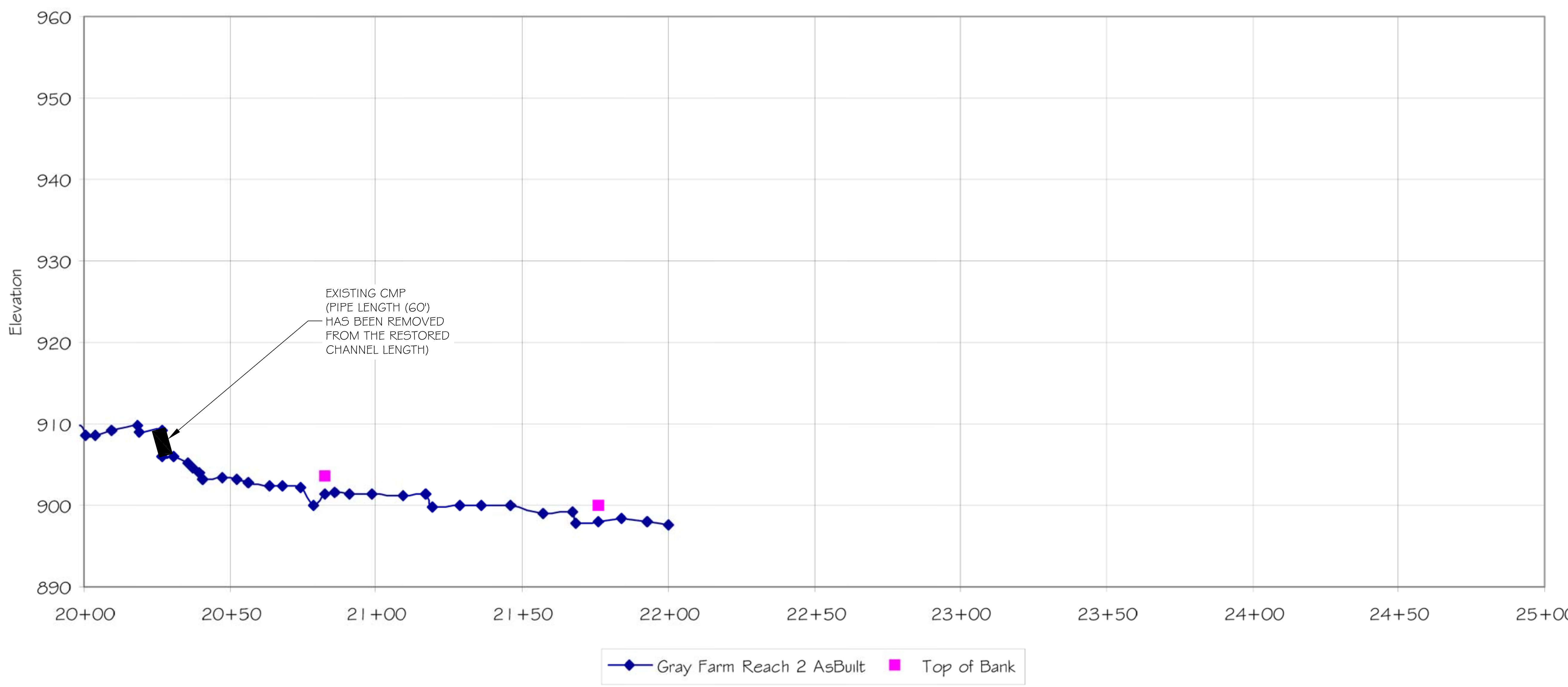
REVISIONS			
NO.	DESCRIPTION	DATE	APPR.
1	Revised per ESP comments, 3/1/06	3/1/06	PKS

GRAY FARM REACH 2
LONGITUDINAL PROFILE
(STA. 20+00 TO 25+00)



Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS

Project No.: 9385.D1 | Proj. Mgr.: PKS | Drawn: RSW

Location: IREDELL CO., NC | Client: NC ECOSYSTEM ENHANCEMENT PROGRAM | Scale: AS SHOWN

Sheet Title: REACH 2 LONGITUDINAL PROFILE- GRAY FARM | Sheet No.: 29 OF 31

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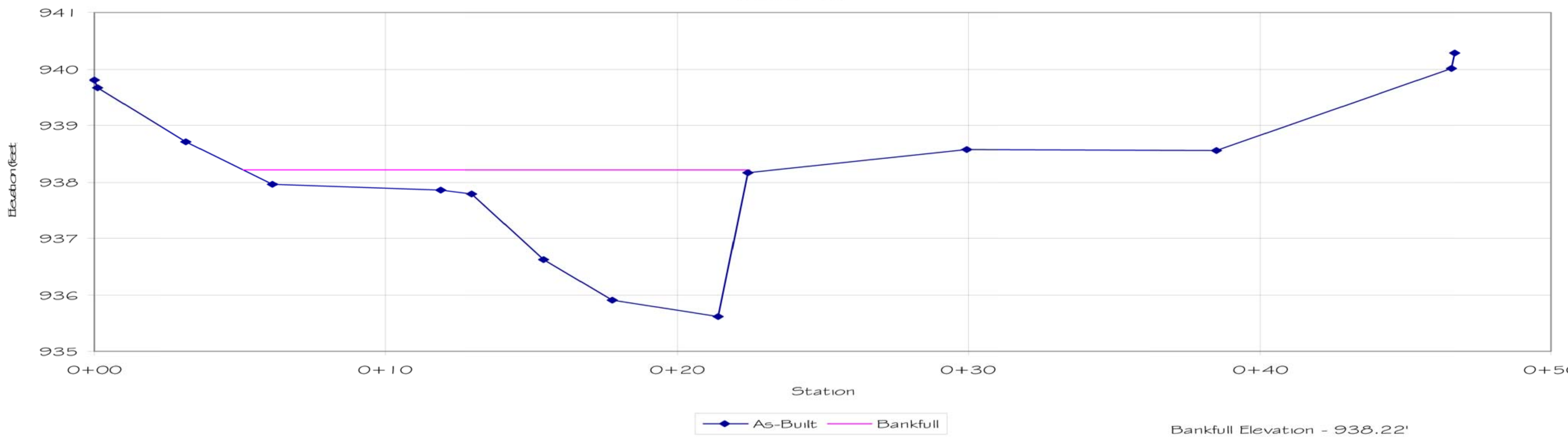
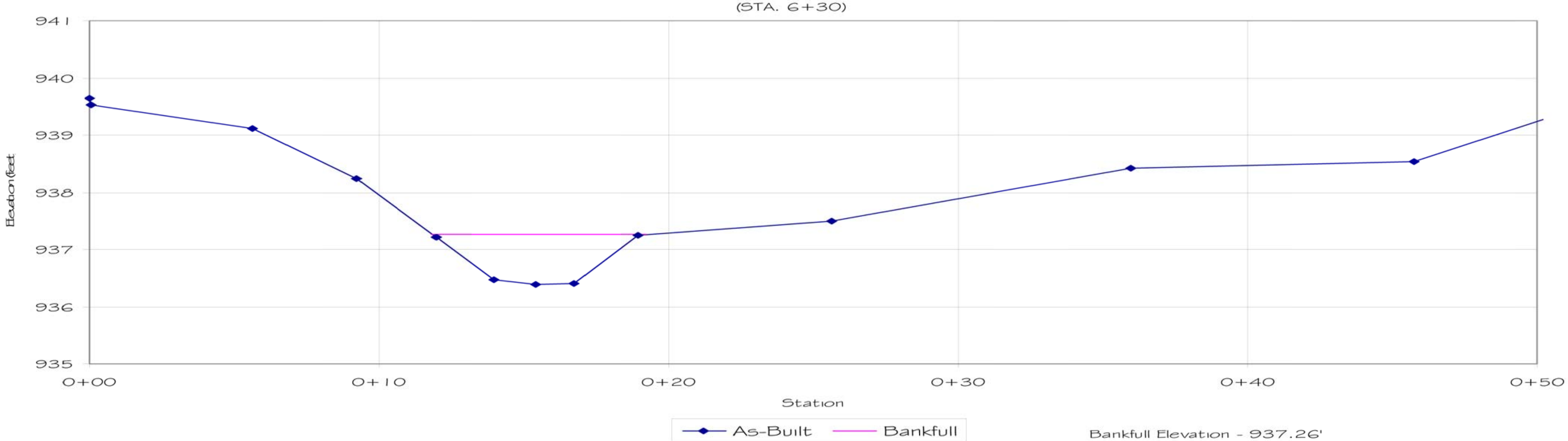
REVISIONS

GRAY FARM REACH 2
CROSS-SECTION 1 (POOL)
(STA. 6+00)



GRAY FARM REACH 2
CROSS-SECTION 1 (RIFFLE)
(STA. 6+30)



Project No.: 9385.D1
Proj. Mgr.: PKS
Drawn: RSW
Scale: AS SHOWN
Sheet No.: 30 OF 31

Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS
Location: IREDELL CO., NC
Client: NC ECOSYSTEM ENHANCEMENT PROGRAM
Sheet Title: REACH 2 CROSS-SECTIONS

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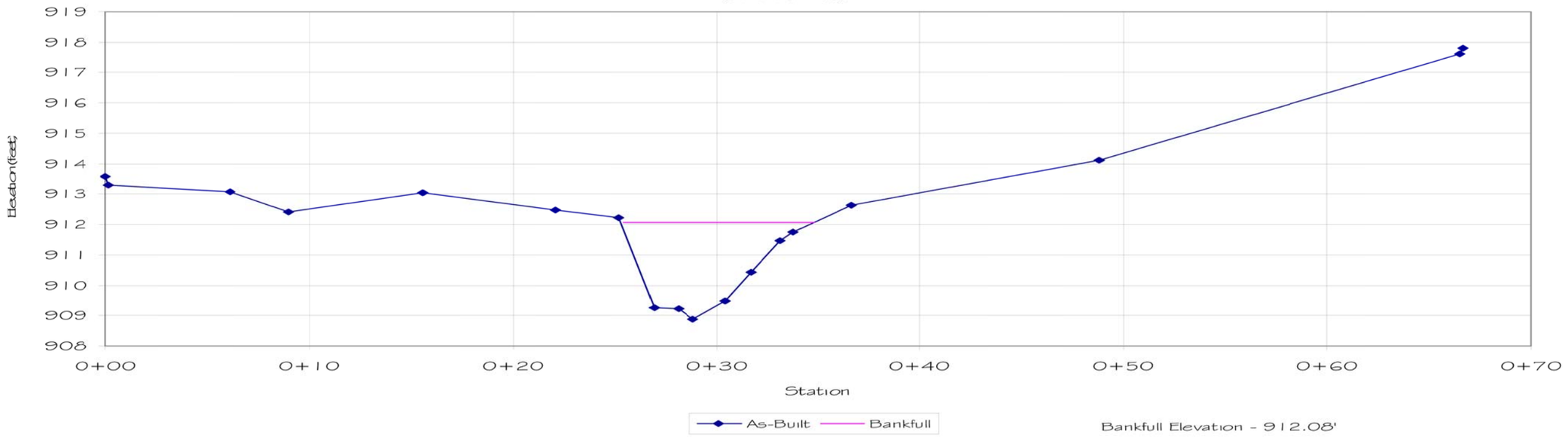

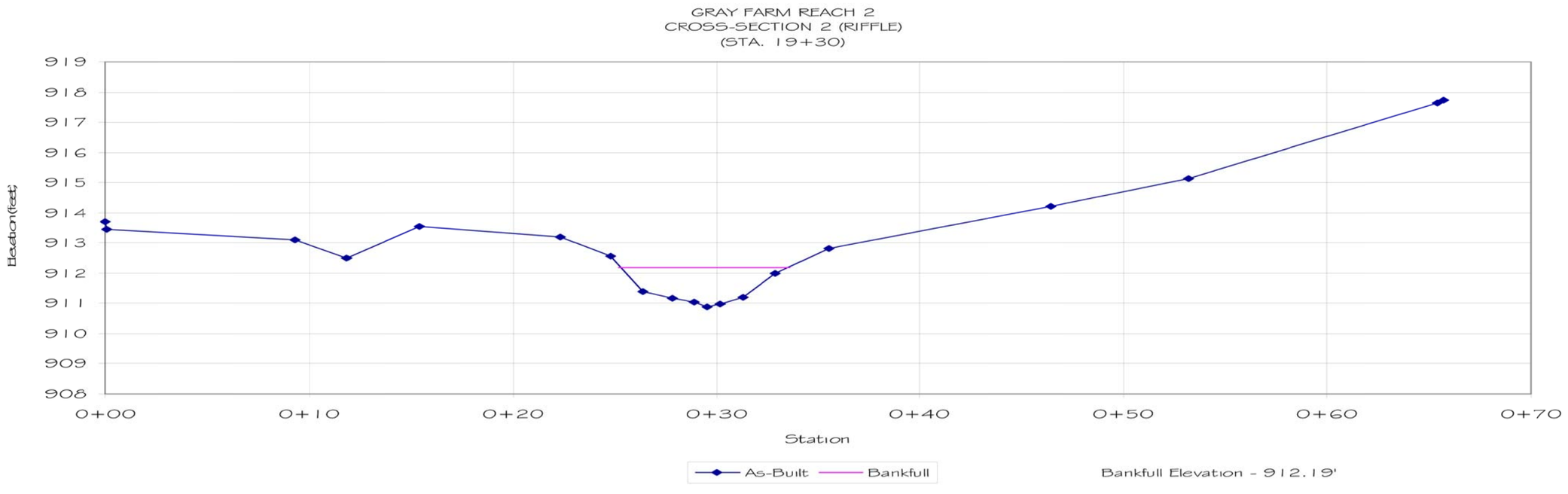

Project: GRAY FARM STREAM RESTORATION AS-BUILT DRAWINGS
Location: REDELL CO., NC
Client: NC ECOSYSTEM ENHANCEMENT PROGRAM
Sheet Title: REACH 2 CROSS-SECTIONS
Project No.: 9385.01
Proj. Mgr.: PKS
Drawn: RSW
Scale: AS SHOWN
Sheet No.: 31 OF 31

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