Pinch Gut Creek Tributary Site
EEP ID (IMS) # 92518
FDP CONTRACT NUMBER # D06043-A
USACE ACTION ID # 2007-02849-285
DWQ 401 # 07-1420

CLOSEOUT REPORT

Stream

Project Setting & Classifications

County:	Stokes
General Location:	Pilot Mountain
Basin:	Roanoke
Physiographic Region:	Piedmont
Ecoregion:	Northern Inner Piedmont
USGS Hydro Unit:	03010103170030
NCDWQ Sub-basin:	03-02-01
Wetland Classification:	N/A
Thermal Regime:	Warm
Trout Water:	N/A
Project Performers	
Source Agency:	EEP
Designer:	Michael Baker Engineering, Inc.
Monitoring Firm:	Michael Baker Engineering, Inc.
Channel Remediation:	River Works, Inc.
Plant Remediation:	River Works, Inc.
Property Interest	DENR Stewardship

Overall Project Activities and Timeline

Milestone	**Month-Year**
Project Contracted	June 2006
Permitted	September 2007
Construction Completed	April 2008
Minor Channel Repair	June 2008
As-built survey	July 2008
Monitoring Year-1	December 2008
Monitoring Year-2	December 2009
Minor Channel Repair	April 2009
Invasive Plant Control	August 2010
Minor Channel Repair	December 2010
Monitoring Year 3	December 2010
Supplemental Planting	February 2011
Monitoring Year 4	December 2011
Monitoring Year 5	December 2012
Minor Channel Repair	January 2013
Closeout Submission	January 2013

Project Setting and Background Summary

The Pinch Gut Creek Tributary Site (Site) is located in Stokes County, approximately five miles northeast of the Town of Pilot Mountain, NC. The Site has a recent history of cattle farming and general agricultural usage such as hay production. The cattle had been allowed to actively graze up to the stream banks and access the channels throughout the Site. The streams were channelized and riparian buffer vegetation had been cleared along various reaches of the Site. A majority of the Site had an early successional narrow buffer, which included several vegetative exotic species and many sections were incised and lacked adequate riparian vegetation. As a result, severe channel degradation was observed throughout the Site. After construction, the as-built survey indicated that 10,642 linear feet (LF) of stream were restored.

Goals and Objectives

The specific goals for the Pinch Gut Creek Tributary Site were as follows:

- Restore functional stream channels by providing floodplain connectivity
- Improve native species vegetation composition and woody stem density along streambanks and floodplain areas within the permanent conservation easement

- Improve water quality in the watershed by reducing sediment supply from eroding streambanks and nutrient inputs by permanently fencing cattle out of the stream
- Improve aquatic and riparian habitat by creating deeper pools and areas of re-aeration using in-stream structures.

Success Criteria

Cross-sections: Two permanent cross-sections were installed per 1,000 LF of stream restoration work, with one of the locations being a riffle cross-section and one location being a pool cross-section. A total of twenty-two permanent cross-sections were established across the Site. Each cross-section was marked on both banks with permanent pins in concrete to establish the exact transect used. The permanent cross-section pins are surveyed and located relative to a common benchmark to facilitate easy comparison of year-to-year data. The annual cross-section surveys include points measured at all breaks in slope, including top of bank, bankfull, inner berm, edge of water, and thalweg.

The approved Restoration Plan required the following criteria be met to achieve stream restoration success:

There should be little change in as-built cross-sections. If changes do take place, they will be evaluated to determine if they represent a movement toward a more unstable condition (e.g., down-cutting or erosion) or a movement toward increased stability (e.g., settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio). Cross-sections will be classified using the Rosgen Stream Classification System, and all monitored cross-sections should fall within the quantitative parameters defined for channels of the designed stream type.

Longitudinal Profiles: A longitudinal profile survey will be completed annually during each year of the monitoring period. The profile will be conducted for at least 3,000 LF of restored stream reaches where pattern has been adjusted. Measurements will include thalweg, water surface, inner berm, bankfull, and top of low bank. Each of these measurements will be taken at the head of each feature (e.g., riffle, run, pool, glide) and at the maximum pool depth. The survey will be tied to a permanent benchmark. The longitudinal profiles should show that the bedform features are remaining stable (i.e., they are not aggrading or degrading). The pools should remain deep, with flat water surface slopes, and the riffles should remain steeper and shallower than the pools. Bedforms observed should be consistent with those observed for channels of the design stream type.

Vegetation: To characterize vegetation success criteria objectively, specific goals for woody vegetation density have been defined. Data from vegetation monitoring plots should display a surviving tree density of at least 320 trees per acre at the end of the third year of monitoring, and a surviving tree density of at least 260 five-year-old trees per acre at the end of the five-year monitoring period.

Hydrologic Criteria: Two crest gauges were installed at the Site to document bankfull events. The gauges are checked regularly and record the highest out-of-bank flows between site visits. The gauges are located on the downstream portion of reach UT1 Reach 4 and UT5 Reach 2. The approved Restoration Plan requires that two bankfull flow events must be documented within the five-year

monitoring period. The two bankfull events must occur in separate years, otherwise, the stream monitoring will continue until two bankfull events have been documented in separate years.

Site Details

A total of 21 monitoring plots, 100 square meters (m^2), (10m x 10m) in size, were used to predict survivability of the native woody vegetation planted on the Site. Data from the Year 5 monitoring event for the 21 vegetation plots showed a range of 202 to 809 stems per acre. Following Year 5, the Site exhibited an average survivability of 511 stems per acre, which exceeds the final vegetation success criteria of 260 stems per acre stated in the Site's Restoration Plan.

According to the cross-section surveys, stream channel dimensions for all reaches remained stable throughout the five-year monitoring period. The longitudinal profile surveys following Year 5 for UT1_R2 and UT1_R4 demonstrate that the in-stream structures and channel bedform features have experienced minor adjustments throughout the five-year monitoring period. However, these minor adjustments do not seem to present a movement towards unstable conditions.

The on-site crest gauges documented the occurrence of at least one bankfull flow event each year during the five-year monitoring period, with the exception of Year 1, during the post-construction monitoring period. The documentation of these events meets and exceeds the success criteria of two bankfull events that must occur in separate years as stated in the Site's Restoration Plan.

During the five-year monitoring period, routine maintenance and repair activities were performed across the Site. These remedial actions were implemented to stabilize excessive bank erosion occurring in localized areas of the restored stream channel, and/or to repair damage from significant storm events within or adjacent to the restored stream channel. The stream maintenance and repair activities completed during the five-year monitoring period are summarized below:

> *2008 repairs:* The planting of native species bare-root and live stake vegetation were completed in April 2008. In early May, a significant storm event resulted in a thalweg adjustment in various reaches on the Site. This movement of bed material caused some minor bank and toe erosion before vegetation was established. These areas were addressed in June 2008 and repair work, primarily along UT1_R4, occurred within the stream channel and along the stream banks. This work was completed in June 2008 and included: repaired piping of multiple in-stream structures, installed additional Class A/B stone to constructed riffles and/or problem areas, re-graded channel bottoms and banks, re-centered the thalweg, re-built and re-sealed structures, matted and seeded areas of disturbance.
>
> *2009 repairs:* Two step-pools located along UT1_R3 at Stations 55+00 and 55+50 had experienced minor piping around the step structures. Repair work was necessary in order to correct these problems. Repairs to these areas were completed in spring of 2009. In addition to in-stream repairs, Class I/B stone was added to the UT5_R2 stream crossing. Class A/B stone was added the left bank and floodplain near Station 66+00 to a create drainage swale and redirect hillside runoff into the restored channel. Repair work of easement fencing at Station 78+00 on the UT1_R4 stream crossing was also completed in 2009.

2010 repairs: During Year 3 monitoring, pools located on UT1_R2, UT1_R4, UT5_R1, and UT5_R2 experienced localized bank erosion along the outer meander bends. Most of the problems that occurred during Year 3 monitoring were due to extensive damage from three large storm events in the winter/spring of 2010. The damages incurred were primarily due to a 15-25 year storm event, and damages were exacerbated by saturated soil conditions and slower vegetation establishment in some areas. In-stream repairs were mostly concentrated within the pool areas. The work completed between August and December 2010 included installing geolifts to protect the outside of meander bends, adding in-stream structures such as a cross vane, log j-hook, and grade control j-hook structures for increased bed and bank stability, and adding larger Class I and B stone to constructed riffles and/or problem areas.

Other repairs in the UT1_R4 area included re-grading channel bottoms/banks and re-centering of the thalweg. The areas of disturbance were matted and seeded following the repairs. Repair work to these problem areas were necessary in order to correct the damage incurred from the storm. Repairs to the concerned areas were completed between August and December of 2010. Visual observations of the repaired areas for did not reveal any other issues.

During 2010, in-stream repairs on UT5_R1 and UT5_R2 were also completed. On UT5_R1, a brush mattress was installed along the right bank to increase bank stability near Station 12+00. In-stream repairs on UT5_R1 w also completed on a J-Hook structure that experienced minor piping at Station 18+25.

2013 repairs: During Year 5 monitoring, a grade control J-hook located at Station 16+50 on UT5_R1 experienced localized bank erosion along the log arm and had become unstable. Repairs to this area were completed in early January 2013. This area will be closely observed until project closeout occurs.

The planting of 3-year old containerized trees and shrubs, and live stakes occurred winter/spring of 2011 in areas that were repaired and/or areas of the floodplain that experienced erosional scour from a large storm event. During this re-planting event, approximately 348 stems were installed within the repaired areas.

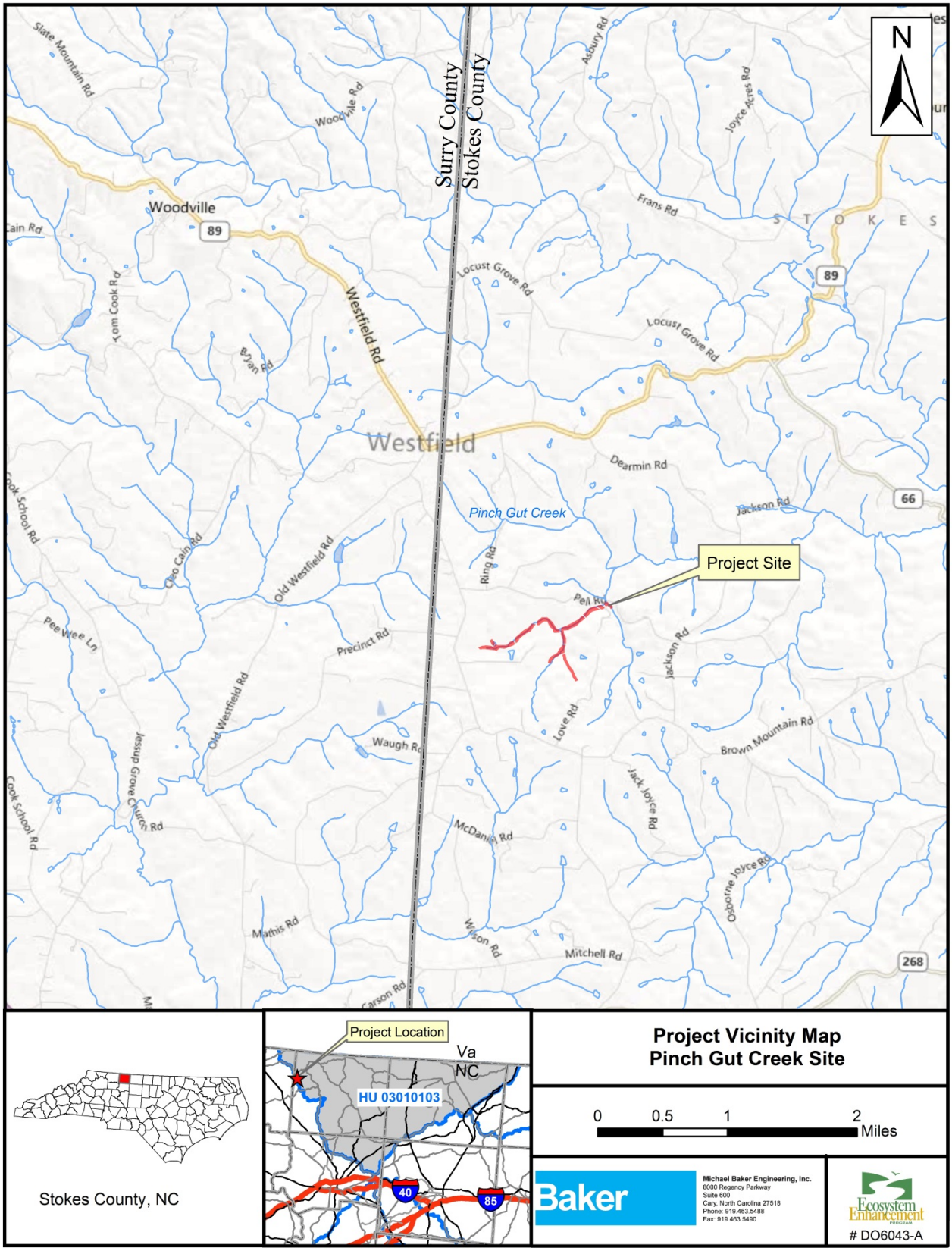
According to the visual stability assessment following Year 5 monitoring, and after visual inspection and evaluation of the August 2009 and fall 2010 repairs, all features on the Site are currently performing as designed. Maintenance and repair areas are shown on the Problem Area Plan View Figure in this report.

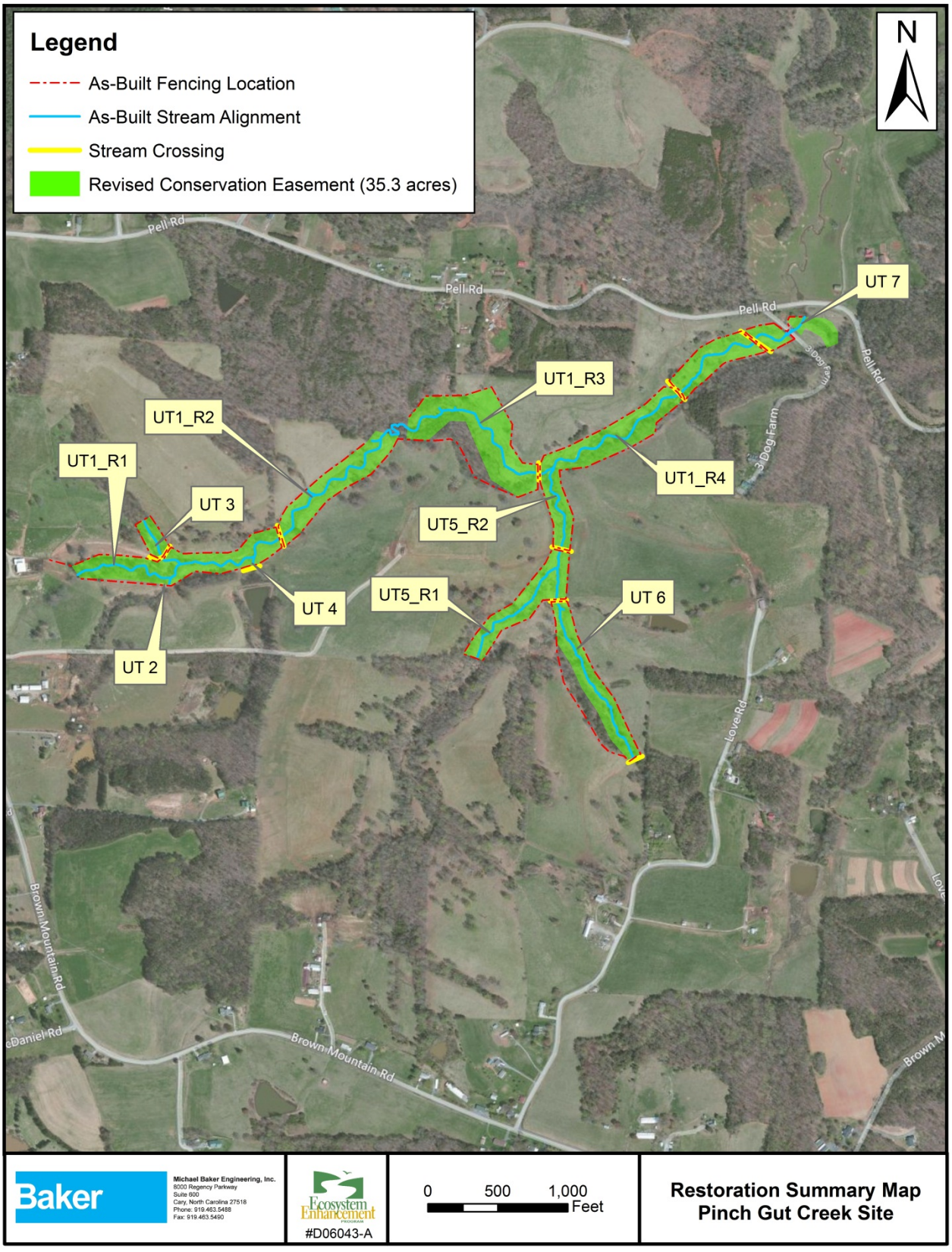
PROJECT DESIGN APPROACH

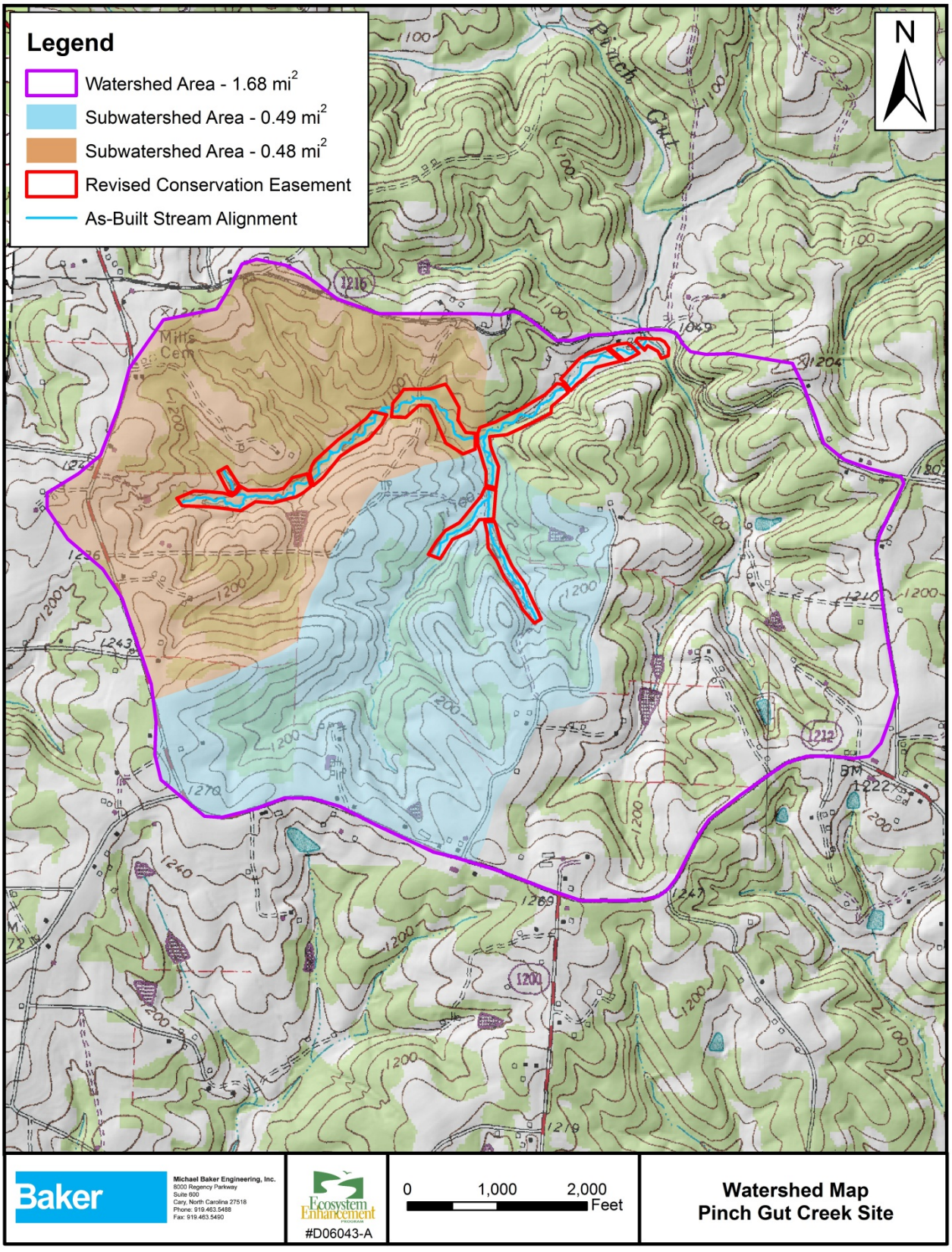
Restoration Segment/Reach	Pre-Construction (linear feet)	Mitigation Approach	Watershed Acreage (mi^2)	As-Built (linear feet)	Mitigation Ratio	Mitigation Units (SMU)
UT1_R1	1,484	R	0.15	1,489	1:1	1,489
UT1_R2	1,952	R	0.41	1,476	1:1	1,476
UT1_R3	1,647	R	0.48	1,427	1:1	1,427
UT1_R4	2,677	R	1.19	2,297	1:1	2,297
UT2	54	R	0.02	45	1:1	45
UT3	256	R	0.02	416	1:1	416
UT4	96	R	0.10	58	1:1	58
UT5_R1	969	R	0.34	951	1:1	951
UT5_R2	842	R	0.49	791	1:1	791
UT6	1,648	R	0.12	1,575	1:1	1,575
UT7	299	E	0.61	292	1:1	117

MITIGATION UNIT TOTALS

Stream Mitigation Units (SMU)	Riparian Wetland Units	Non-riparian Wetland Units	Total Wetland (WMU)	Riparian Buffer	Nutrient Offset
10,642	0	0	0	0	0


N
Surry County
Stokes County
Woodville
89
Westfield
Westfield Rd
Locust Grove Rd
Frans Rd
Dearmin Rd
Pinch Gut Creek
Project Site
Peil Rd
Jackson Rd
66
Old Westfield Rd
Precinct Rd
Waugh Rd
Love Rd
Brown Mountain Rd
McDaniel Rd
Mathis Rd
Wilson Rd
Mitchell Rd
268
Project Location
Va
NC
HU 03010103
40
85
Stokes County, NC
Project Vicinity Map
Pinch Gut Creek Site
0 0.5 1 2
Miles
Baker
Michael Baker Engineering, Inc.
8000 Regency Parkway
Suite 600
Cary, North Carolina 27518
Phone: 919.463.5488
Fax: 919.463.5490
Ecosystem Enhancement Program
DO6043-A


Legend
As-Built Fencing Location
As-Built Stream Alignment
Stream Crossing
Revised Conservation Easement (35.3 acres)
N
UT 7
UT1_R3
UT1_R2
UT1_R1
UT1_R4
UT 3
UT5_R2
UT 4
UT5_R1
UT 6
UT 2
Pell Rd
3 Dog Farm
Love Rd
Brown Mountain Rd
Daniel Rd
Baker
Michael Baker Engineering, Inc.
8000 Regency Parkway
Suite 600
Cary, North Carolina 27518
Phone: 919.463.5488
Fax: 919.463.5490
Ecosystem Enhancement Program
#D06043-A
0 500 1,000 Feet
Restoration Summary Map
Pinch Gut Creek Site


Legend
Watershed Area - 1.68 mi2
Subwatershed Area - 0.49 mi2
Subwatershed Area - 0.48 mi2
Revised Conservation Easement
As-Built Stream Alignment
N
Pinch Gut
Mills Cem
Baker
Michael Baker Engineering, Inc.
8000 Regency Parkway
Suite 600
Cary, North Carolina 27518
Phone: 919.463.5488
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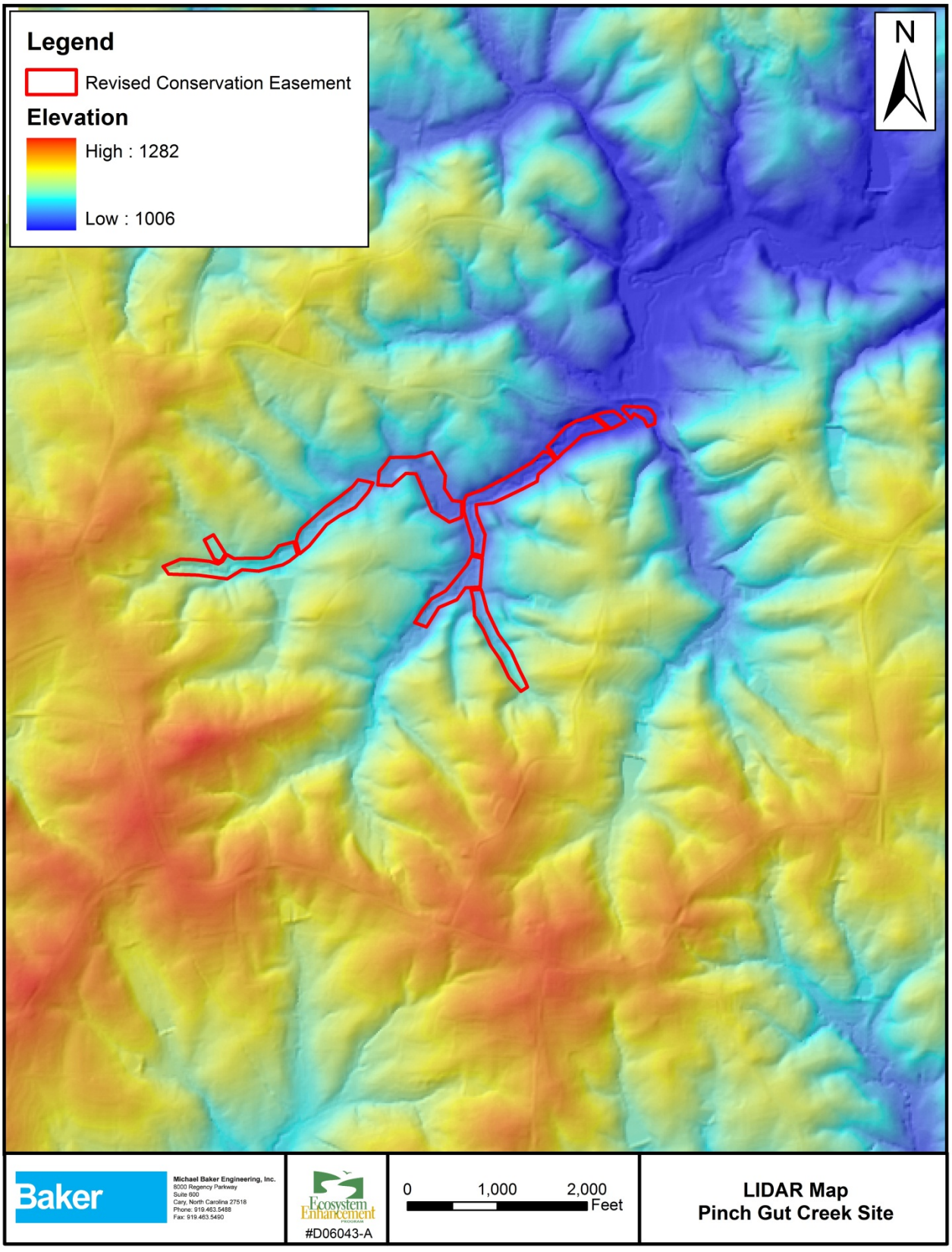
Ecosystem Enhancement Program
#D06043-A
0
1,000
2,000
Feet
Watershed Map
Pinch Gut Creek Site


Legend
Revised Conservation Easement
Elevation
High : 1282
Low : 1006
N
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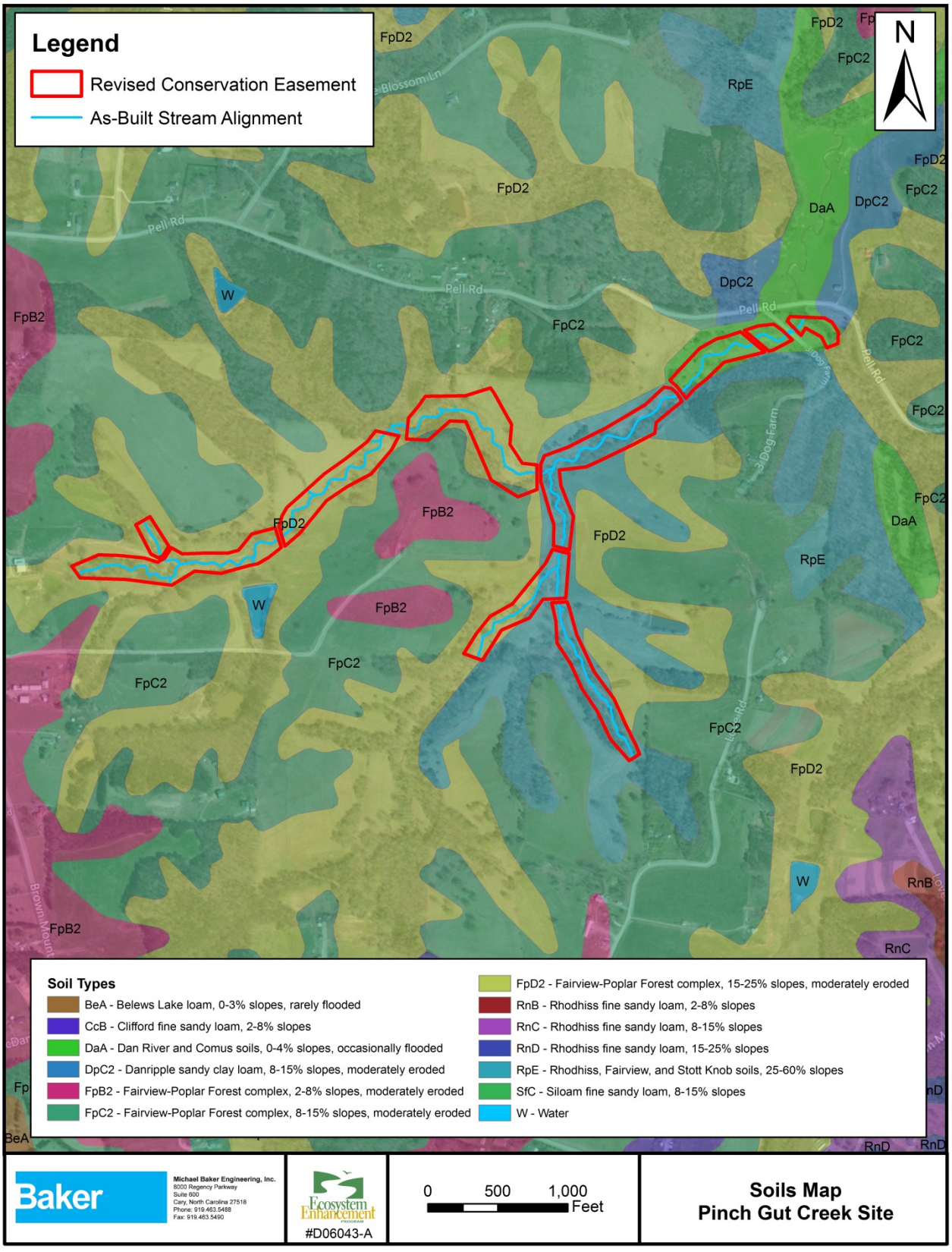
8000 Regency Parkway
Suite 600
Cary, North Carolina 27518
Phone: 919.463.5488
Fax: 919.463.5490
Ecosystem Enhancement Program
#D06043-A
0
1,000
2,000
Feet
LIDAR Map
Pinch Gut Creek Site


Legend
Revised Conservation Easement
As-Built Stream Alignment
N
Soil Types
BeA - Belews Lake loam, 0-3% slopes, rarely flooded
CcB - Clifford fine sandy loam, 2-8% slopes
DaA - Dan River and Comus soils, 0-4% slopes, occasionally flooded
DpC2 - Danripple sandy clay loam, 8-15% slopes, moderately eroded
FpB2 - Fairview-Poplar Forest complex, 2-8% slopes, moderately eroded
FpC2 - Fairview-Poplar Forest complex, 8-15% slopes, moderately eroded
FpD2 - Fairview-Poplar Forest complex, 15-25% slopes, moderately eroded
RnB - Rhodhiss fine sandy loam, 2-8% slopes
RnC - Rhodhiss fine sandy loam, 8-15% slopes
RnD - Rhodhiss fine sandy loam, 15-25% slopes
RpE - Rhodhiss, Fairview, and Stott Knob soils, 25-60% slopes
SfC - Siloam fine sandy loam, 8-15% slopes
W - Water
Pell Rd
Blossom Ln
Brown Mount
Dog Farm
Baker
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Ecosystem Enhancement Program
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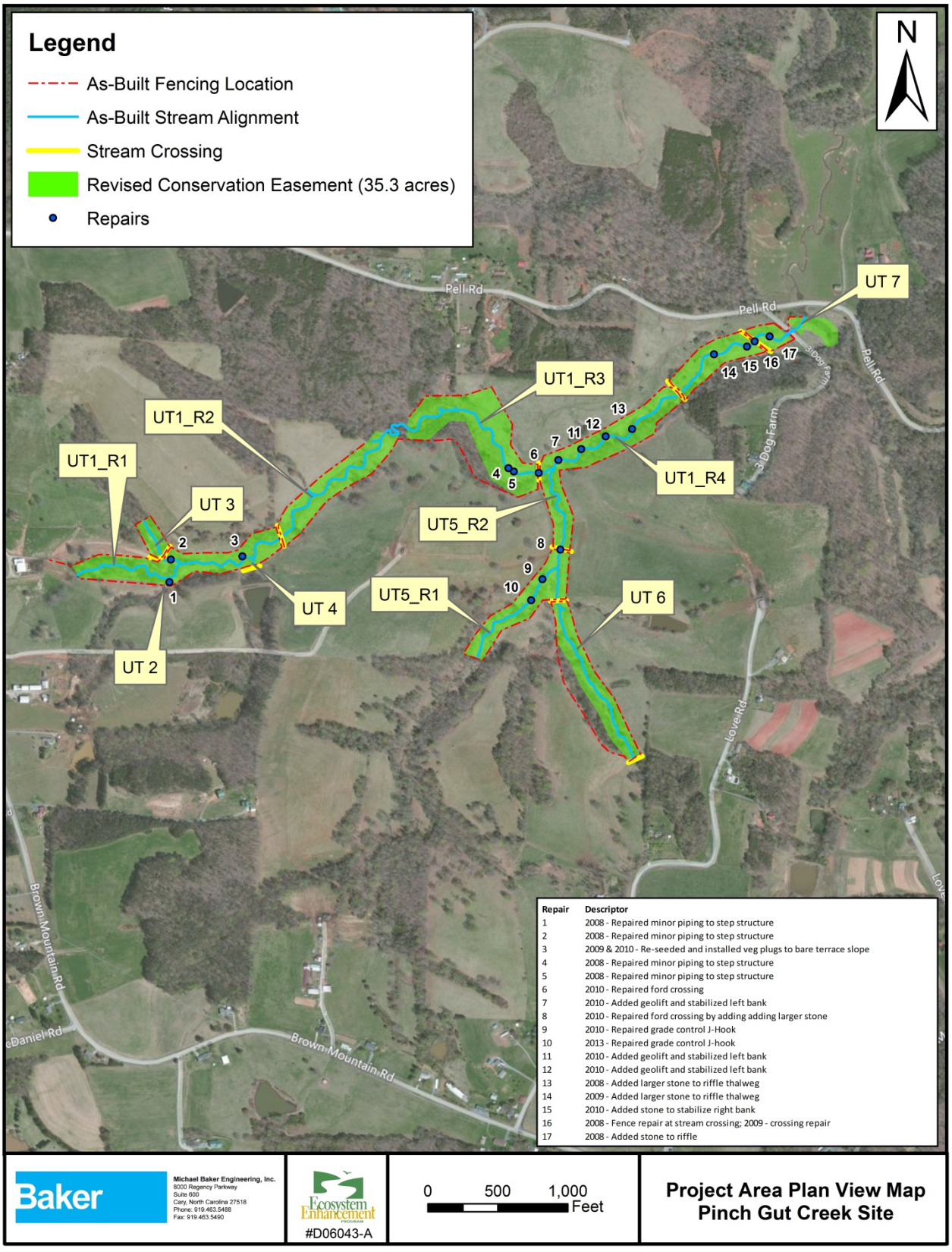
0 500 1,000 Feet
Soils Map
Pinch Gut Creek Site


Legend
As-Built Fencing Location
As-Built Stream Alignment
Stream Crossing
Revised Conservation Easement (35.3 acres)
Repairs
N
UT 7
UT1_R3
UT1_R2
UT1_R1
UT1_R4
UT 3
UT5_R2
UT 4
UT5_R1
UT 6
UT 2
Pell Rd
Brown Mountain Rd
Daniel Rd
Love Rd
3 Dog Farm
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Repair Descriptor
1 2008 - Repaired minor piping to step structure
2 2008 - Repaired minor piping to step structure
3 2009 & 2010 - Re-seeded and installed veg plugs to bare terrace slope
4 2008 - Repaired minor piping to step structure
5 2008 - Repaired minor piping to step structure
6 2010 - Repaired ford crossing
7 2010 - Added geolift and stabilized left bank
8 2010 - Repaired ford crossing by adding larger stone
9 2010 - Repaired grade control J-Hook
10 2013 - Repaired grade control J-hook
11 2010 - Added geolift and stabilized left bank
12 2010 - Added geolift and stabilized left bank
13 2008 - Added larger stone to riffle thalweg
14 2009 - Added larger stone to riffle thalweg
15 2010 - Added stone to stabilize right bank
16 2008 - Fence repair at stream crossing; 2009 - crossing repair
17 2008 - Added stone to riffle
Baker
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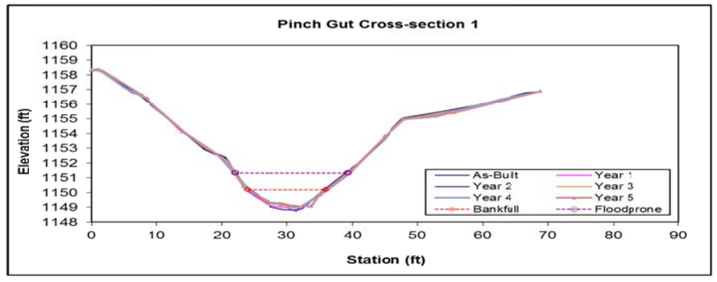
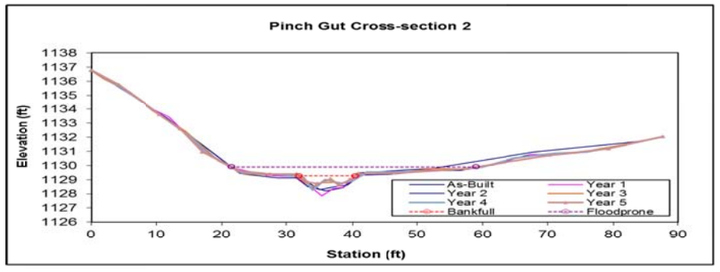
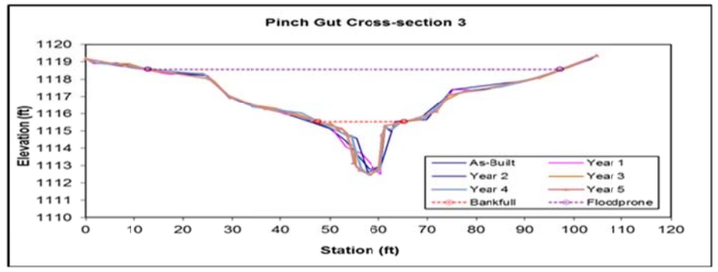
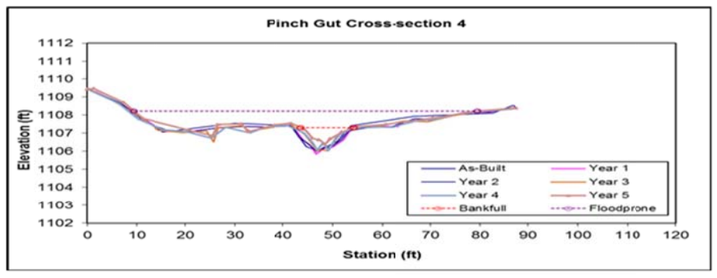
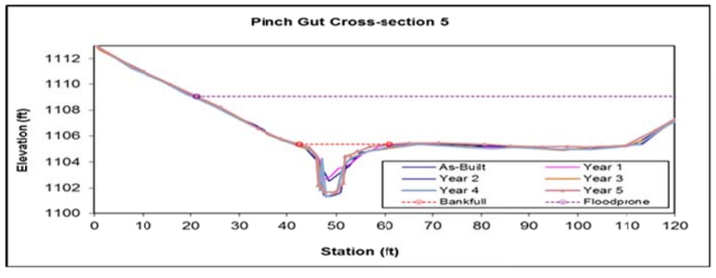
Phone: 919.463.5488
Fax: 919.463.5490
Ecosystem Enhancement Program
#D06043-A
0 500 1,000 Feet
Project Area Plan View Map
Pinch Gut Creek Site

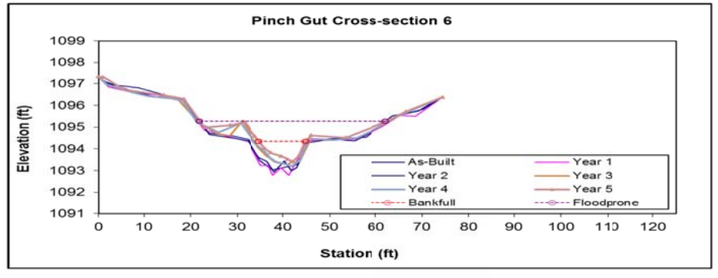

Pinch Gut Cross-section 1
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

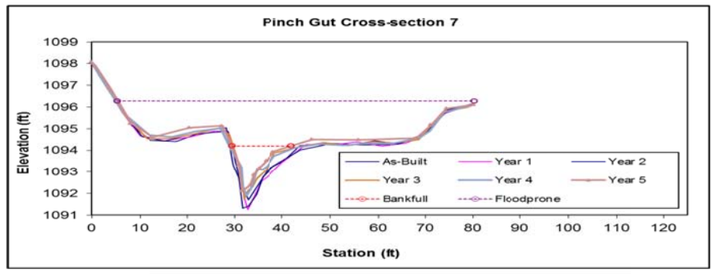

Pinch Gut Cross-section 2
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

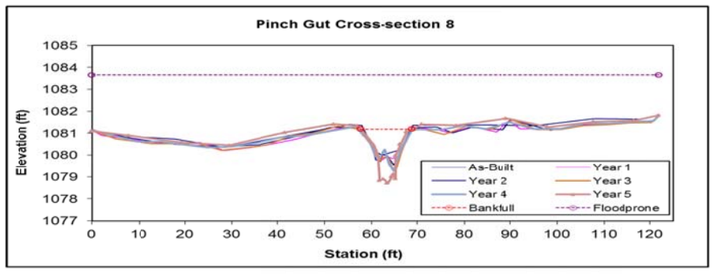

Pinch Gut Cross-section 3
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

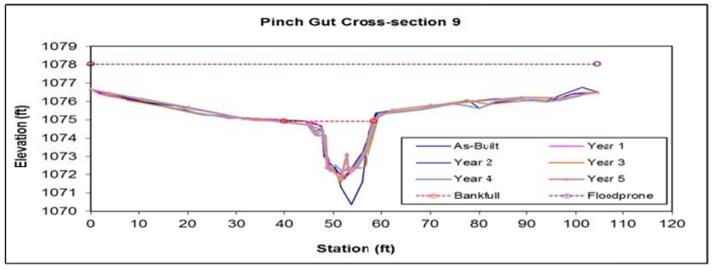

Pinch Gut Cross-section 4
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

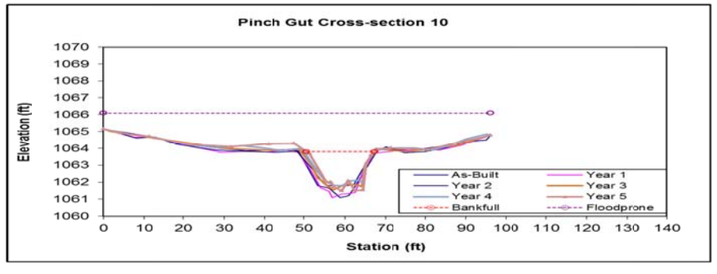

Pinch Gut Cross-section 5
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

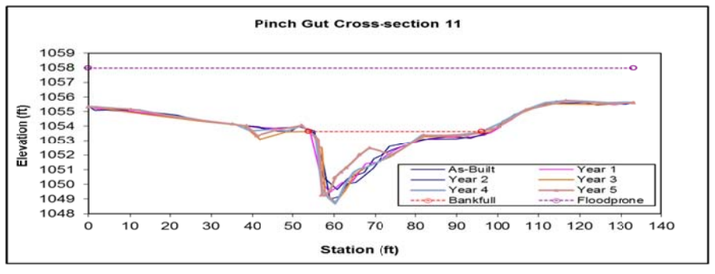

Pinch Gut Cross-section 6
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

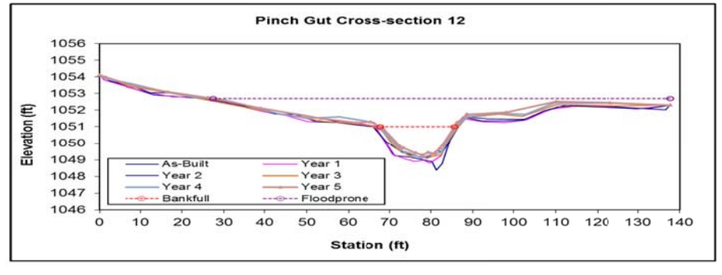

Pinch Gut Cross-section 7
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

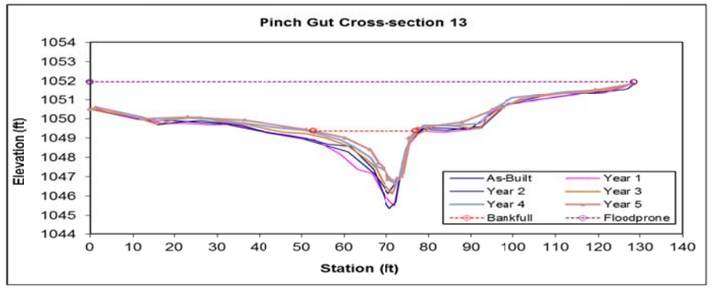

Pinch Gut Cross-section 8
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

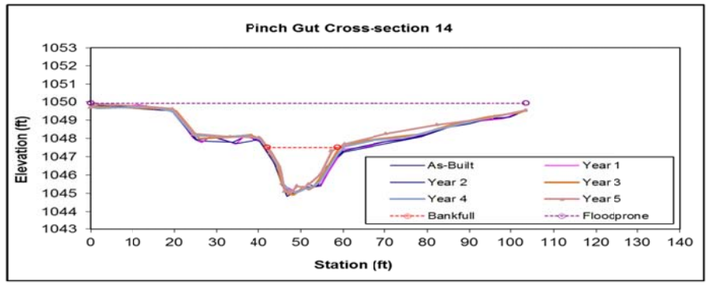

Pinch Gut Cross-section 9
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

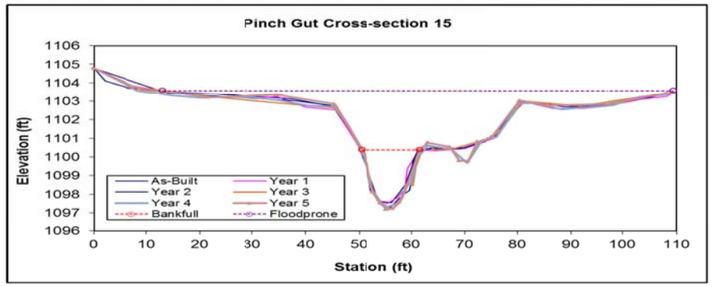

Pinch Gut Cross-section 10
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

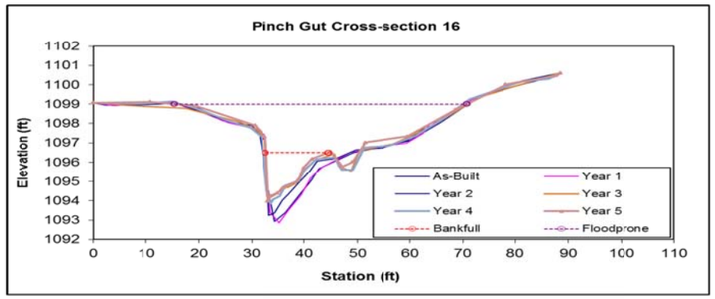

Pinch Gut Cross-section 11
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

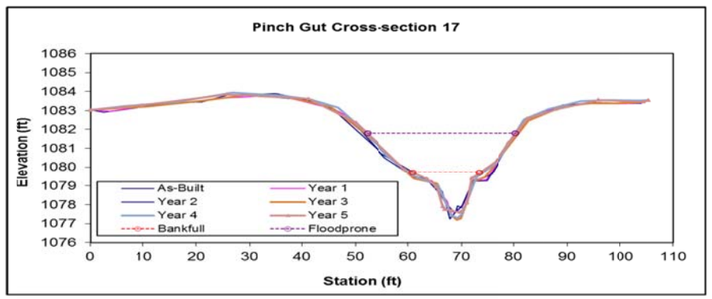

Pinch Gut Cross-section 12
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

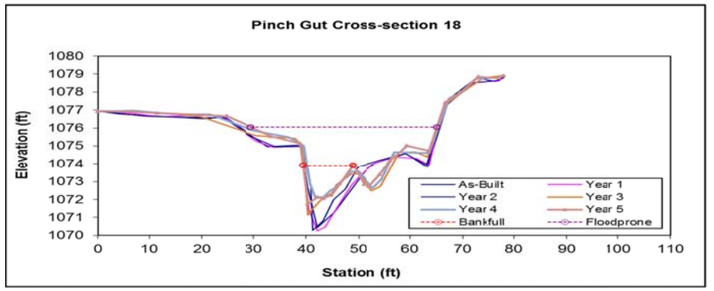

Pinch Gut Cross-section 13
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

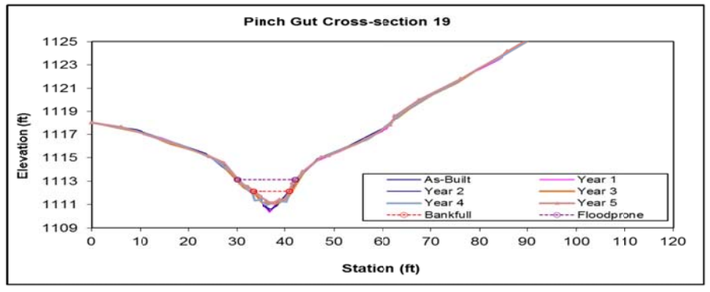

Pinch Gut Cross-section 14
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

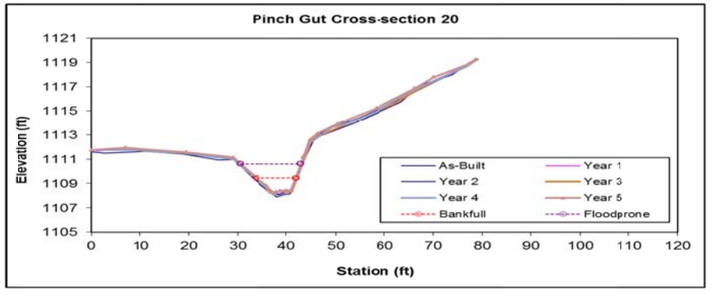

Pinch Gut Cross-section 15
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

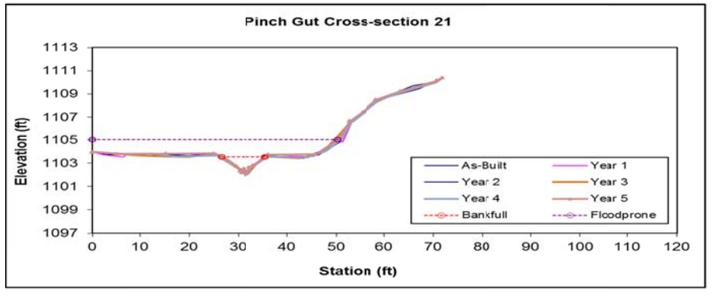

Pinch Gut Cross-section 16
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

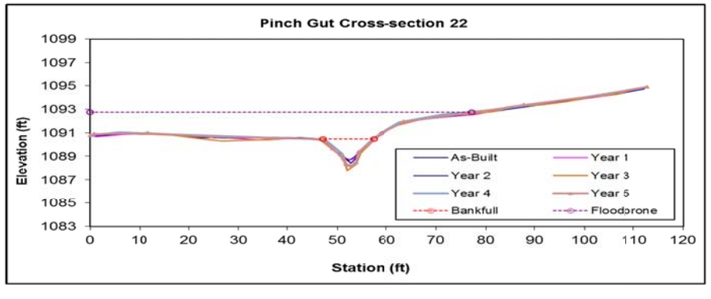

Pinch Gut Cross-section 17
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

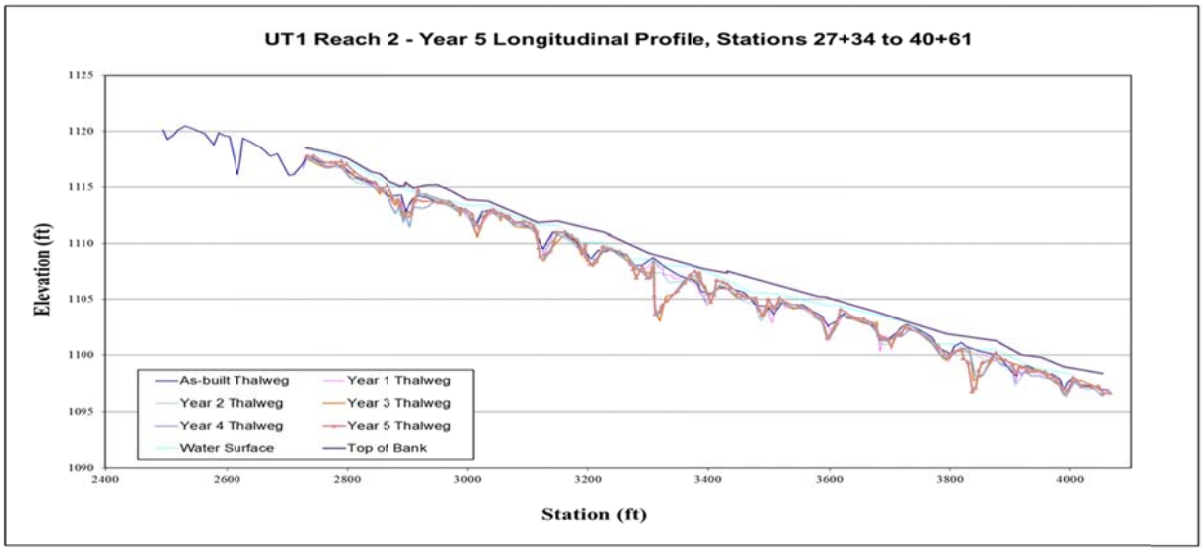

Pinch Gut Cross-section 18
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

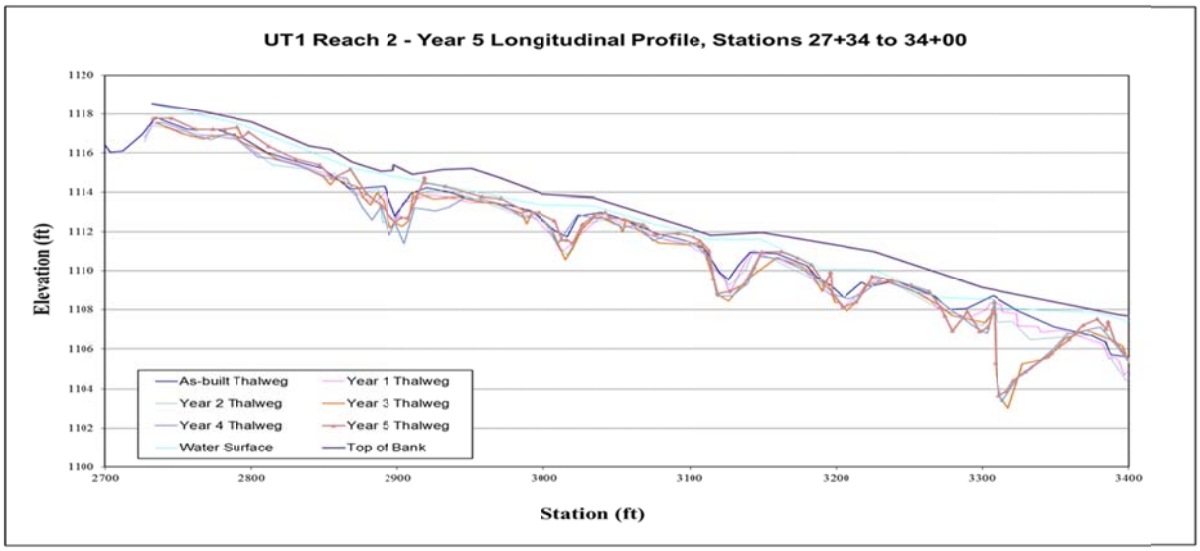

Pinch Gut Cross-section 19
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

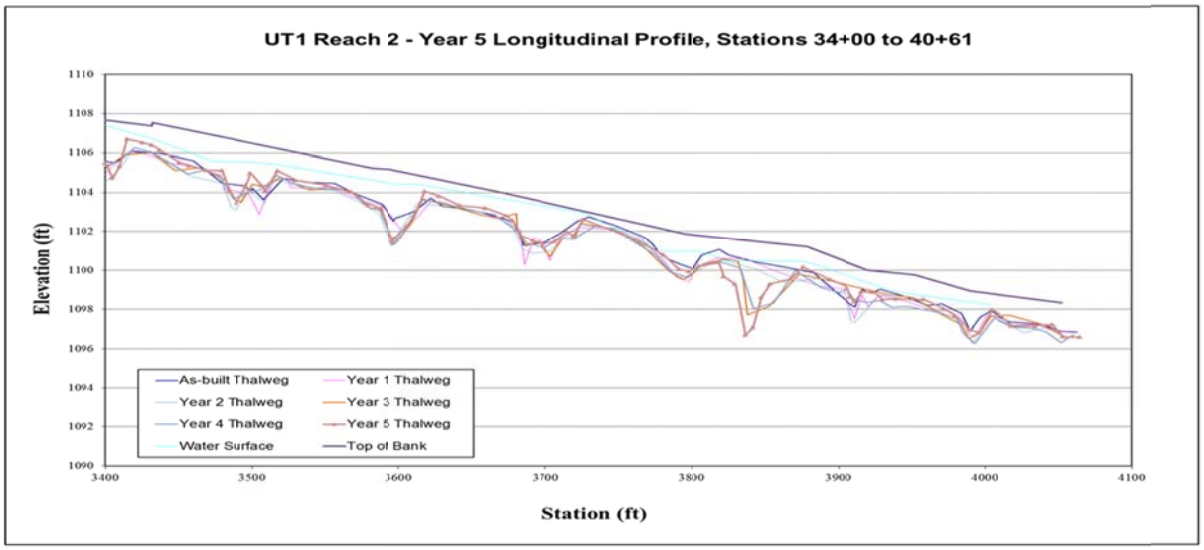

Pinch Gut Cross-section 20
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

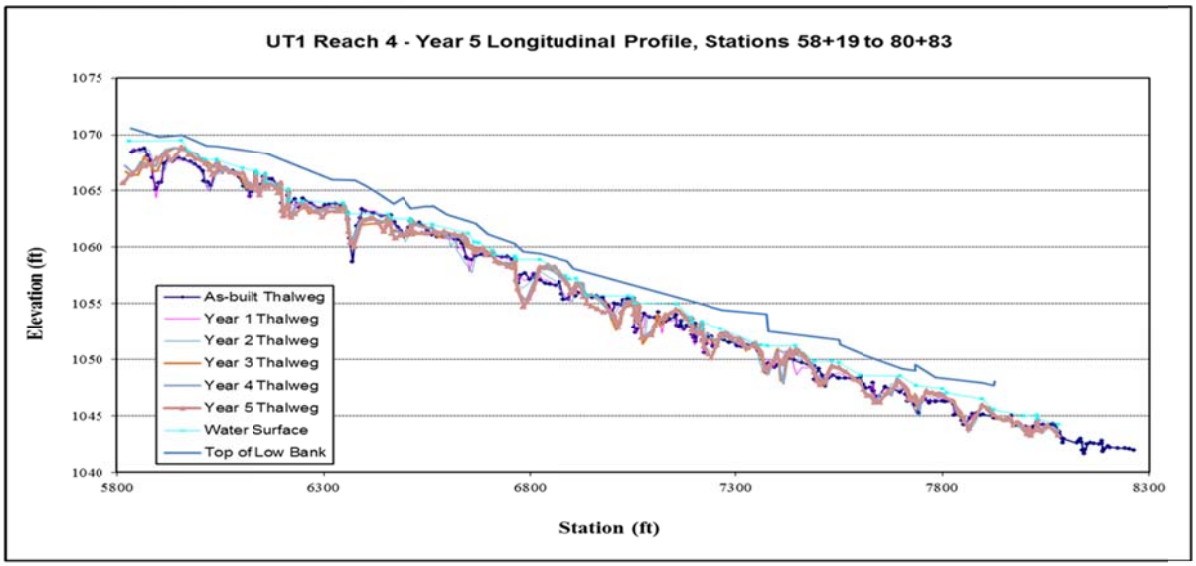

Pinch Gut Cross-section 21
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone

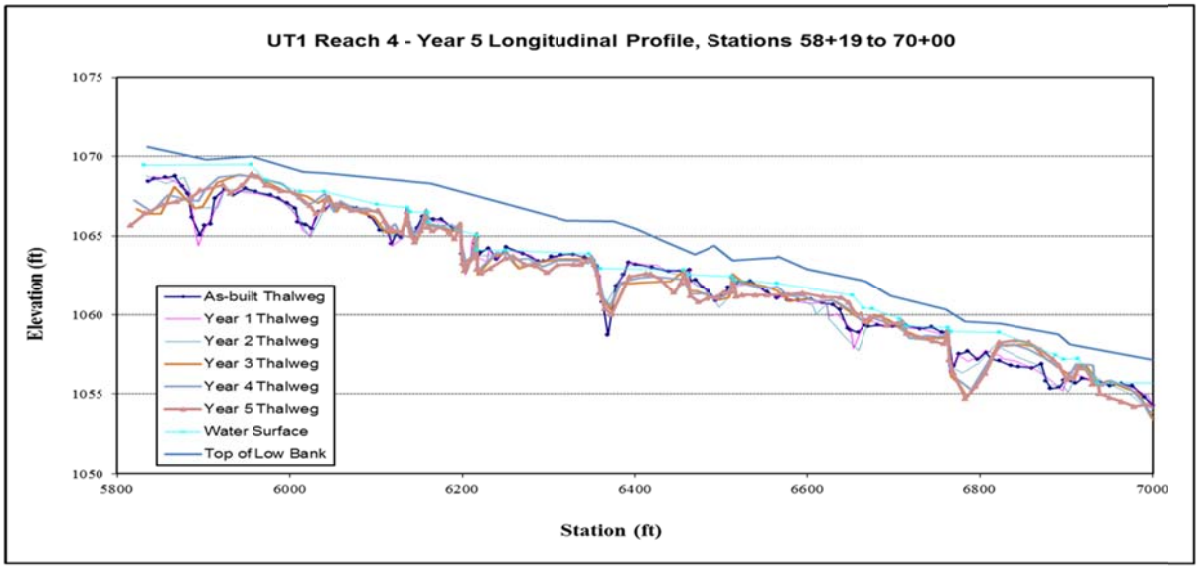

Pinch Gut Cross-section 22
Elevation (ft)
Station (ft)
As-Built
Year 1
Year 2
Year 3
Year 4
Year 5
Bankfull
Floodprone


UT1 Reach 2 - Year 5 Longitudinal Profile, Stations 27+34 to 40+61
Elevation (ft)
Station (ft)
As-built Thalweg
Year 1 Thalweg
Year 2 Thalweg
Year 3 Thalweg
Year 4 Thalweg
Year 5 Thalweg
Water Surface
Top of Bank


UT1 Reach 2 - Year 5 Longitudinal Profile, Stations 27+34 to 34+00
Elevation (ft)
Station (ft)
As-built Thalweg
Year 1 Thalweg
Year 2 Thalweg
Year 3 Thalweg
Year 4 Thalweg
Year 5 Thalweg
Water Surface
Top of Bank


UT1 Reach 2 - Year 5 Longitudinal Profile, Stations 34+00 to 40+61
Elevation (ft)
Station (ft)
As-built Thalweg
Year 1 Thalweg
Year 2 Thalweg
Year 3 Thalweg
Year 4 Thalweg
Year 5 Thalweg
Water Surface
Top of Bank


UT1 Reach 4 - Year 5 Longitudinal Profile, Stations 58+19 to 80+83
Elevation (ft)
1075
1070
1065
1060
1055
1050
1045
1040
5800
6300
6800
7300
7800
8300
Station (ft)
As-built Thalweg
Year 1 Thalweg
Year 2 Thalweg
Year 3 Thalweg
Year 4 Thalweg
Year 5 Thalweg
Water Surface
Top of Low Bank


UT1 Reach 4 - Year 5 Longitudinal Profile, Stations 58+19 to 70+00
Elevation (ft)
1075
1070
1065
1060
1055
1050
5800
6000
6200
6400
6600
6800
7000
Station (ft)
As-built Thalweg
Year 1 Thalweg
Year 2 Thalweg
Year 3 Thalweg
Year 4 Thalweg
Year 5 Thalweg
Water Surface
Top of Low Bank

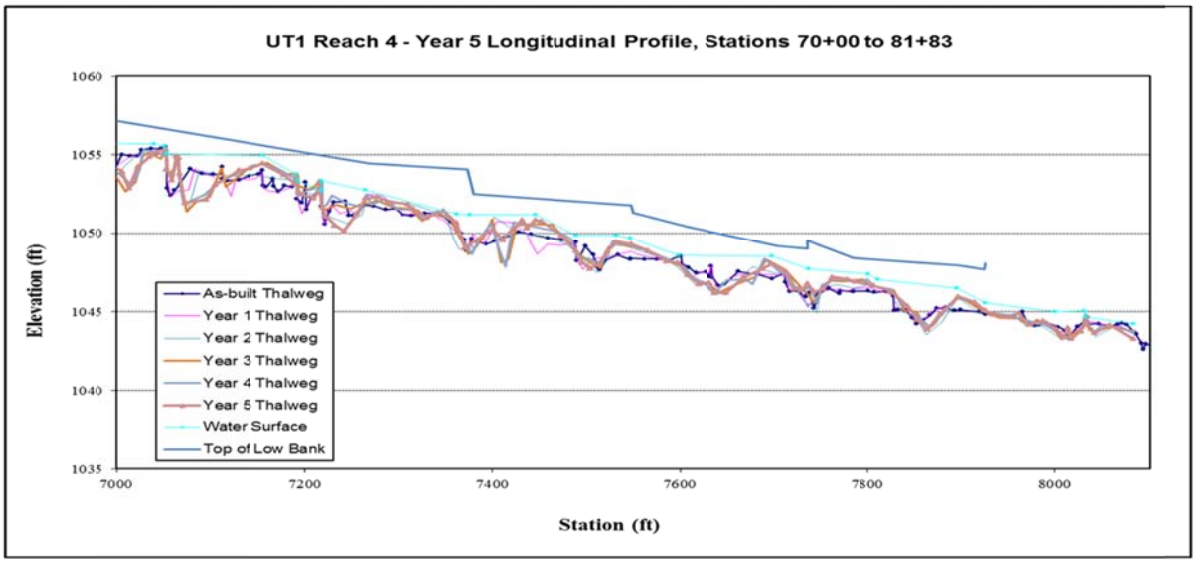

UT1 Reach 4 - Year 5 Longitudinal Profile, Stations 70+00 to 81+83
Elevation (ft)
1060
1055
1050
1045
1040
1035
7000
7200
7400
7600
7800
8000
Station (ft)
As-built Thalweg
Year 1 Thalweg
Year 2 Thalweg
Year 3 Thalweg
Year 4 Thalweg
Year 5 Thalweg
Water Surface
Top of Low Bank

Table B.3. Morphology and Hydraulic Monitoring Summary

Pinch Gut Creek Tributary Site: EEP Contract No. D06043-A

Reach: UT1_R1

Parameter	Cross-section 1					Cross-section 2														
	Riffle					Riffle														
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5										
Dimension																				
BF Width (ft)	12.18	11.88	12.10	12.11	11.96	12.21	14.96	9.80	10.84	8.49										
BF Mean Depth (ft)	0.83	0.89	0.73	0.75	0.79	0.57	0.41	0.42	0.37	0.37										
Width/Depth Ratio	14.64	13.35	16.57	16.25	15.08	21.56	36.45	23.26	29.14	22.75										
BF Cross-sectional Area (ft²)	10.10	10.60	8.80	9.00	9.50	6.90	6.10	4.10	4.00	3.20										
BF Max Depth (ft)	1.46	1.39	1.15	1.27	1.13	1.40	0.97	0.80	1.00	0.64										
Width of Floodprone Area (ft)	18.53	18.39	17.47	18.28	17.26	47.83	43.19	40.57	42.86	37.47										
Entrenchment Ratio	1.50	1.50	1.40	1.50	1.40	3.90	2.90	4.10	4.00	4.40										
Bank Height Ratio	2.40	2.50	2.90	2.80	6.90	1.00	0.80	1.10	1.30	1.20										
Wetted Perimeter (ft)	13.84	13.66	13.56	13.61	13.54	13.35	15.78	10.64	11.58	9.23										
Hydraulic Radius (ft)	0.73	0.78	0.65	0.66	0.70	0.52	0.39	0.39	0.35	0.35										
Substrate																				
d50 (mm)																				
d84 (mm)																				

Reach: UT1_R2

Parameter	Cross-section 3					Cross-section 4					Cross-section 5									
	Pool					Riffle					Pool									
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5					
Dimension																				
BF Width (ft)	18.41	19.09	18.01	16.99	17.69	12.05	14.71	11.66	12.52	10.66	23.25	23.82	25.87	25.03	18.50					
BF Mean Depth (ft)	3.02	0.98	1.17	1.20	1.17	0.86	0.65	0.64	0.55	0.41	0.87	1.17	1.04	1.01	1.28					
Width/Depth Ratio	16.66	19.40	15.40	14.17	15.13	14.03	22.72	18.15	22.78	25.87	26.65	20.29	24.94	24.90	14.44					
BF Cross-sectional Area (ft²)	20.30	18.80	21.10	20.40	20.70	10.40	9.50	7.50	6.90	4.40	20.30	28.00	26.80	25.20	23.70					
BF Max Depth (ft)	3.02	2.92	3.06	3.06	3.04	1.51	1.32	1.29	1.26	0.91	2.77	4.03	4.01	4.02	3.69					
Width of Floodprone Area (ft)	84.82	80.64	85.37	83.91	84.26	82.65	80.66	81.23	80.94	70.04	99.45	108.81	109.62	109.85	106.80					
Entrenchment Ratio	4.60	4.20	4.70	4.90	4.80	6.90	5.50	7.00	6.50	6.60	4.30	4.60	4.20	4.40	5.80					
Bank Height Ratio	1.00	0.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.10	0.90	0.90	1.00	1.00	0.90					
Wetted Perimeter (ft)	24.45	21.05	20.35	19.39	20.03	13.77	16.01	12.94	13.62	11.48	24.99	26.16	27.95	27.05	21.06					
Hydraulic Radius (ft)	0.83	0.89	1.04	1.05	1.03	0.76	0.59	0.58	0.51	0.38	0.81	1.07	0.96	0.93	1.13					
Substrate																				
d50 (mm)																				
d84 (mm)																				

Reach: UT1_R3

Parameter	Cross-section 6					Cross-section 7					Cross-section 8					Cross-section 9				
	Riffle					Pool					Riffle					Pool				
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
Dimension																				
BF Width (ft)	13.16	14.55	11.81	12.00	9.95	15.36	18.65	19.58	16.02	12.52	13.64	13.37	13.32	11.94	11.28	17.94	20.46	19.58	20.07	18.51
BF Mean Depth (ft)	0.96	0.79	0.72	0.70	0.56	1.18	1.03	1.41	0.74	0.80	0.80	0.84	0.85	0.89	1.11	1.34	1.56	1.41	1.25	1.29
Width/Depth Ratio	13.76	18.48	16.31	17.26	17.89	13.02	18.05	13.90	21.52	15.65	16.98	15.88	15.70	13.41	10.12	13.40	13.13	13.90	16.04	14.36
BF Cross-sectional Area (ft²)	12.60	11.50	8.50	8.30	5.50	18.10	19.30	27.60	11.90	10.00	11.00	11.30	11.30	10.60	12.60	17.94	31.90	27.60	25.10	23.80
BF Max Depth (ft)	1.56	1.41	1.06	1.15	0.93	2.94	2.89	3.36	2.30	0.80	1.50	1.70	1.93	1.91	2.47	3.07	4.56	3.36	2.80	3.11
Width of Floodprone Area (ft)	51.92	48.82	43.25	44.10	40.23	77.59	77.50	76.27	75.77	74.87	121.98	121.99	122.00	122.00	121.94	104.30	104.27	104.26	104.28	104.26
Entrenchment Ratio	3.90	3.40	3.70	3.70	4.00	5.00	4.20	5.30	4.70	6.00	8.90	9.10	9.20	10.20	10.80	5.80	5.10	5.30	5.20	5.60
Bank Height Ratio	1.00	1.00	1.10	1.10	1.30	1.00	1.00	1.00	1.00	1.10	1.00	1.00	1.00	1.00	1.10	1.00	1.00	1.00	1.00	0.90
Wetted Perimeter (ft)	15.08	16.13	13.25	13.40	11.07	17.72	20.71	22.40	17.50	14.12	15.24	15.05	15.02	13.72	13.50	20.62	23.58	22.40	22.57	21.09
Hydraulic Radius (ft)	0.84	0.71	0.64	0.62	0.50	1.02	0.93	1.23	0.68	0.71	0.72	0.75	0.75	0.77	0.93	0.87	1.35	1.23	1.11	1.13
Substrate																				
d50 (mm)																				
d84 (mm)																				

Reach: UT1_R4																									
Parameter	Cross-section 10					Cross-section 11					Cross-section 12					Cross-section 13					Cross-section 14				
	Riffle					Pool					Riffle					Pool					Riffle				
	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
Dimension																									
BF Width (ft)	23.27	19.28	18.21	17.26	16.58	44.84	44.61	43.79	41.97	42.03	19.31	20.40	20.10	18.83	17.70	37.32	37.86	34.59	25.78	24.18	21.86	21.82	17.58	18.06	16.47
BF Mean Depth (ft)	1.36	1.32	1.44	1.36	1.47	1.57	1.55	1.52	1.57	1.21	1.51	1.24	1.20	1.19	1.09	1.25	1.09	0.99	1.04	0.97	1.31	1.29	1.54	1.49	1.41
Width/Depth Ratio	17.14	14.58	12.67	12.66	11.29	28.57	28.87	28.90	26.76	34.60	12.75	16.49	16.76	15.84	16.31	29.95	34.80	35.04	24.79	24.91	16.69	16.88	11.43	12.14	11.70
BF Cross-sectional Area (ft²)	31.60	25.50	26.20	23.50	24.40	70.40	68.90	66.40	65.80	51.00	29.20	25.20	24.11	22.40	19.20	46.50	41.20	34.15	26.80	23.50	28.60	28.20	27.02	26.90	23.20
BF Max Depth (ft)	2.70	2.02	2.25	2.00	2.30	4.25	4.70	4.84	4.96	4.35	2.18	1.83	1.89	1.88	1.70	3.87	4.02	3.26	2.78	2.58	2.47	2.51	2.60	2.46	2.43
Width of Floodprone Area (ft)	96.18	96.25	96.22	96.20	96.18	133.42	133.36	133.46	133.38	133.39	137.73	137.73	137.75	137.75	137.72	128.61	128.59	128.65	128.61	128.61	103.62	103.63	103.68	103.68	103.64
Entrenchment Ratio	4.10	5.00	5.30	5.60	5.80	3.00	3.00	3.00	3.20	3.20	6.60	5.70	5.84	6.20	6.20	3.40	3.40	3.72	5.00	5.30	4.70	4.70	5.90	5.70	6.30
Bank Height Ratio	1.00	1.00	1.00	1.00	1.10	1.00	1.00	1.00	1.00	0.90	1.00	1.00	1.04	1.10	1.20	1.00	1.00	0.93	1.00	1.00	1.00	1.00	1.14	1.00	1.10
Wetted Perimeter (ft)	25.99	21.92	21.09	19.98	19.52	47.98	47.71	46.83	45.11	44.45	22.33	22.88	22.50	21.21	19.88	39.82	40.04	36.57	27.86	26.12	24.48	24.40	20.66	21.04	19.29
Hydraulic Radius (ft)	1.22	1.16	1.24	1.18	1.25	1.47	1.44	1.42	1.46	1.15	1.31	1.10	1.07	1.06	0.97	1.17	1.03	0.93	0.96	0.90	1.17	1.16	1.31	1.28	1.20
Substrate																									
d50 (mm)																									
d84 (mm)																									

Reach: UT5																				
Parameter	Cross-section 15					Cross-section 16					Cross-section 17					Cross-section 18				
	Riffle					Pool					Riffle					Pool				
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
Dimension																				
BF Width (ft)	11.37	11.88	12.10	12.19	10.98	15.86	15.57	17.53	18.53	11.83	15.66	15.94	15.16	13.82	12.55	13.32	12.05	17.03	15.76	9.41
BF Mean Depth (ft)	1.75	1.89	1.95	1.88	2.04	1.67	1.26	1.03	1.05	1.16	0.86	0.82	0.95	0.98	1.03	1.93	1.62	1.28	1.06	1.34
Width/Depth Ratio	6.51	6.28	6.20	6.49	5.39	9.52	12.32	17.08	17.68	10.21	18.24	19.48	16.02	14.09	12.24	6.90	7.42	13.28	14.87	7.04
BF Cross-sectional Area (ft²)	19.90	22.50	23.60	22.90	22.30	26.40	19.70	18.00	19.40	13.70	13.40	13.10	14.35	13.60	12.90	25.70	19.60	21.83	16.70	12.60
BF Max Depth (ft)	2.88	3.10	3.18	3.06	3.19	3.63	3.26	2.35	2.63	2.51	2.13	2.45	2.49	2.39	2.10	3.75	3.73	2.87	1.88	2.15
Width of Floodprone Area (ft)	84.46	95.71	97.65	97.49	96.31	81.21	77.34	69.65	70.61	70.72	29.01	30.99	32.02	30.03	28.20	68.36	68.75	66.23	65.18	65.10
Entrenchment Ratio	7.40	8.10	8.10	8.00	8.80	5.10	5.00	3.20	3.00	4.70	1.90	1.90	2.11	2.20	2.20	5.10	5.70	3.24	2.20	3.80
Bank Height Ratio	1.00	1.00	1.00	1.10	1.10	1.00	1.00	0.97	1.10	1.00	0.80	0.80	0.88	2.20	2.60	1.00	1.10	1.22	2.60	1.00
Wetted Perimeter (ft)	14.87	15.66	16.00	15.95	15.06	19.20	18.09	19.59	20.64	14.15	17.38	17.58	17.06	15.78	14.61	17.18	15.29	19.59	17.88	12.09
Hydraulic Radius (ft)	1.34	1.44	1.48	1.44	1.48	1.38	1.09	0.92	0.94	0.97	0.77	0.75	0.84	0.86	0.88	1.50	1.28	1.11	0.93	1.04
Substrate																				
d50 (mm)																				
d84 (mm)																				

Reach: UT6																				
Parameter	Cross-section 19					Cross-section 20					Cross-section 21					Cross-section 22				
	Riffle					Pool					Riffle					Pool				
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
Dimension																				
BF Width (ft)	8.54	8.25	8.66	8.26	7.58	8.35	8.85	8.60	8.53	8.08	8.88	9.17	10.07	9.76	9.06	11.21	12.08	13.56	12.14	10.15
BF Mean Depth (ft)	0.80	0.84	0.73	0.80	0.60	0.88	0.86	0.84	0.83	0.80	0.70	0.70	0.69	0.70	0.65	0.90	0.85	0.98	0.86	1.10
Width/Depth Ratio	10.74	9.81	11.90	10.28	12.66	9.47	10.34	10.28	10.29	10.13	12.74	13.15	14.66	13.90	13.90	12.52	14.13	13.86	14.07	9.19
BF Cross-sectional Area (ft²)	6.80	6.90	6.30	6.60	4.50	7.40	7.60	7.20	7.1	6.40	6.20	6.40	6.90	6.80	5.90	10.00	10.30	13.30	10.50	11.20
BF Max Depth (ft)	1.80	1.50	1.08	1.18	0.99	1.32	1.36	1.26	1.38	1.17	1.45	1.51	1.50	1.59	1.48	1.77	2.05	2.67	2.29	2.27
Width of Floodprone Area (ft)	15.88	14.31	13.37	12.95	11.96	13.54	13.33	13.32	13.9	12.46	49.95	51.04	49.78	51.15	50.36	70.08	75.34	85.48	76.16	77.22
Entrenchment Ratio	1.90	1.70	1.50	1.60	1.60	1.60	1.50	1.50	1.60	1.50	5.60	5.60	4.90	5.20	5.60	6.30	6.20	6.30	6.30	7.60
Bank Height Ratio	2.30	2.90	3.40	3.40	4.00	2.20	2.20	2.30	2.10	2.50	1.00	1.00	1.00	1.00	1.10	1.00	1.00	1.00	1.00	1.00
Wetted Perimeter (ft)	10.14	9.93	10.12	9.86	8.78	10.11	10.57	10.28	10.19	9.68	10.28	10.57	11.45	11.16	10.36	13.01	13.78	15.52	13.86	12.35
Hydraulic Radius (ft)	0.67	0.69	0.62	0.67	0.51	0.73	0.72	0.70	0.70	0.66	0.60	0.61	0.60	0.61	0.57	0.77	0.75	0.86	0.76	0.91
Substrate																				
d50 (mm)																				
d84 (mm)																				

Stem Count for Each Species Arranged by Plot and Plot Densites

Pinch Gut Creek Tributary Site: EEP Contract No. D06043-A

Tree Species	**Plots**																					**Year 5 Totals**	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
Betula nigra		4	3		4	4	3	3	3	2	3	1	4	2	2	2	8	5	3	4		60	
Liriodendron tulipifera				2	1					6		3			5	2		1			2	22	
Quercus phellos			1							1	2	3		3	4			1	1	5	1	22	
Quercus rubra									1				1		2	6			6			16	
Diospyros virginiana		3	2		4				2		4	2	4	4			1					26	
Juglans nigra																						0	
Platanus occidentalis	4			8					4	2		3	5		5	4			4			39	**Yearly Average Stems/acre**
Quercus michauxii																						0	
Unknown																						0	
Shrub Species																							
Alnus serrulata													3									3	
Lindera benzoin	1		2						1	1			3	4								12	
Corylus americana									1			5							3	7	7	23	
Carpinus caroliniana										3		2		1			1	5		1	2	15	
Cornus amomum			2			4	10	10	1													27	
Number of stems/plot	5	7	10	10	9	8	13	13	13	15	9	19	20	14	18	14	10	12	17	17	12	265	
Stems/acre Year 5	**202**	**283**	**405**	**405**	**364**	**324**	**526**	**526**	**526**	**607**	**364**	**769**	**809**	**567**	**728**	**567**	**405**	**486**	**688**	**688**	**486**		**511**
Stems/acre Year 4	202	283	405	405	405	324	526	567	567	647	364	769	809	567	728	607	405	526	688	688	486		522
Stems/acre Year 3	445	324	405	445	405	364	526	567	567	688	364	769	809	567	728	728	486	526	728	647	526		553
Stems/acre Year 2	445	324	486	486	405	364	526	567	607	688	486	769	850	647	728	728	526	607	769	688	526		582
Stems/acre Year 1	526	486	486	526	405	526	567	567	728	688	364	728	890	647	769	728	647	647	769	688	607		619
Stems/acre Initial	526	526	567	567	445	607	567	567	728	769	405	809	809	647	769	728	688	688	769	850	688		653

* Bold - Year 5 vegetation data final counts

Summary of Highest Bankfull Events UT1 Reach 4

Pinch Gut Tributary Site: EEP Contract No. D06043-A			
Date of Data Collection	Date of Occurrence of Bankfull Event	Method of Data Collection	Bankfull Height (feet) *
Year 1 (As-built - 12/31/2008)	None Observed	Crest Gauge	None Observed
Year 2 (9/10/2009)	Unknown	Crest Gauge	**0.46**
Year 3 (2/27/2010)	1/24/2010	Crest Gauge	**3.00**
Year 4 (2/10/2011)	12/1/2010	Crest Gauge	**0.35**
Year 5 (5/22/2012)	Apil-May 2012 storms	Crest Gauge	**2.83**

* Bold - highest yearly bankfull event for reach

Summary of Highest Bankfull Events UT5 Reach 2

Pinch Gut Tributary Site: EEP Contract No. D06043-A			
Date of Data Collection	Date of Occurrence of Bankfull Event	Method of Data Collection	Bankfull Height (feet) *
Year 1 (As-built - 12/31/2008)	None Observed	Crest Gauge	None Observed
Year 2 (6/11/2009)	Unknown	Crest Gauge	**0.96**
Year 3 (10/13/2010)	Unknown	Crest Gauge	**0.68**
Year 4 (2/10/2011)	12/1/2010	Crest Gauge	**0.22**
Year 5 (4/30/2012)	Apil-May 2012 storms	Crest Gauge	**0.96**

* Bold - highest yearly bankfull event for reach

EEP Recommendation and Conclusion

The Pinch Gut Creek Tributary Site has completed 5 years of successful monitoring. Each parameter for success has been achieved. The EEP recommends that the Site be closed generating 10,642 Stream Mitigation Units (SMUs).

Contingencies

This Year 5 monitoring/Closeout report notes one minor repair that was conducted at a localized area along UT5_R1 in January 2013. EEP did observe these areas prior to repair and does not recommend further action be taken in this area. All repairs were conducted by River Works, Inc., and supervised, inspected, and approved by Michael Baker Engineering, Inc.

Existing Conditions Photos

UT1 Reach, view upstream

UT1 Reach 2, view downstream

UT1 Reach 3, view downstream

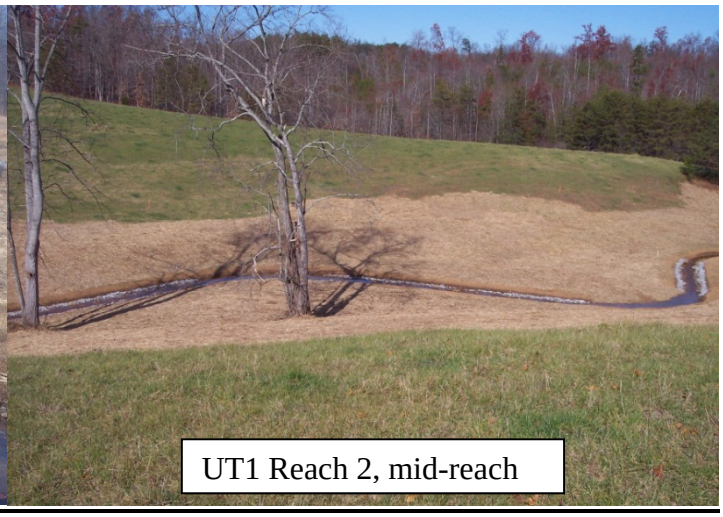
UT1 Reach 4, view upstream

UT1 Reach 5, view upstream

UT6, view upstream

Post-Construction Photos

UT1 Reach 1, view upstream

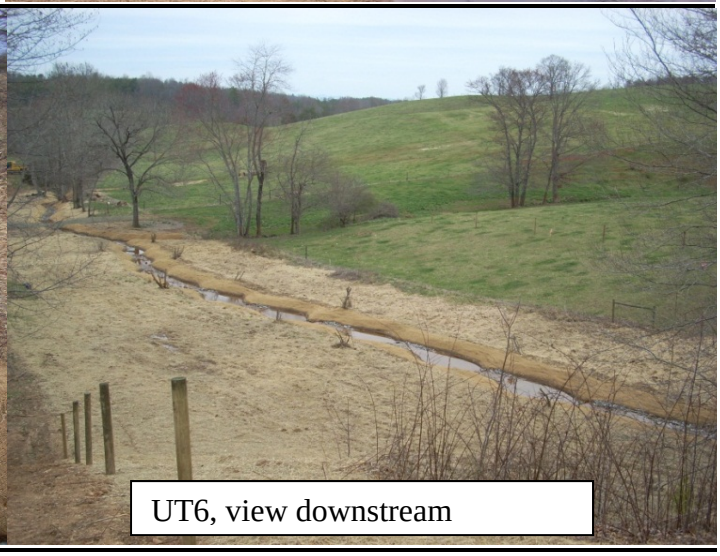


UT1 Reach 2, mid-reach

UT1 Reach 3, view upstream

UT1 Reach 4, view upstream

UT5, view downstream



UT6, view downstream

Year 5 Monitoring Photos

UT1 Reach 1, view upstream

UT1 Reach 2, view upstream

UT1 Reach 3, view upstream

UT1 Reach 4, view upstream

UT5, view upstream

UT6, view upstream

Representative Project Phase Photos

UT4 and UT1 Reach 1 as observed during the project phases

UT1 Reach 3 as observed during the project phases

APPENDIX A - Watershed Planning Summary

EEP

APPENDIX B – Land Ownership and Protection

EEP

INCLUDING LANDOWNER, PRESERVATION MECHANISM, LONG TERM MAINTENANCE PROVIDER

APPENDIX C – Jurisdictional Determinations and Permits

ONLY 404/401

APPENDIX D – Debit Ledger

GENERATED BY EEP