EEP Project Closeout Summary

Project ID & Status

Project Name/Number: Payne Dairy (Jumping Run Creek)
EEP ID 279
County: Alexander
Project Type: Stream Restoration, Enhancement
Wetland Preservation
Current Status: 5 Years of Monitoring complete

Project Setting & Classifications

Basin:	Catawba
Physiographic Region:	Piedmont
Ecoregion:	Central Piedmont
USGS Hydro Unit:	03050101-120040
NCDWQ Subbasin:	11-62-3-1
Thermal Regime:	Warm
Trout Water:	No
Designer:	Kimley-Horn
Monitoring	Kimley-Horn, NCSU, SEC

Project Timeline

Milestone	Date
Construction Completed	
As-built survey	**June 2000**
Monitoring Year-1	**June 2001**
Repair and Maintenance	
Monitoring Year-2	**June 2002**
Monitoring Year-3	**June 2003**
Monitoring Year-4	**June 2004**
Monitoring Year-5	**June 2005**
Monitoring Year -6 (Veg)	**June 2006**

Table 1. Project Restoration Components and Mitigation Assets

Stream			Asset Data										Watershed Data and Characteristics						
	Drainage/Hydrology Component	Restoration Component	Asset				Ratio							Wetland	DA	Stream	%	Land	
			Map #	Approach	Level	Ratio	Multip	Feet	SMU	Acres	WMU		P/I/E	Type	(SM)	Order	Imper	Use	303d
	Jumping Run Upper (Above Henry Road)	Segment 1	1	P1/P2	R	1.00	1.00	4377	4377	-	-		P	-	1.2	1st	<5%	Ag-Past	No
	Jumping Run Lower	Segment 1 (Down to confluence)	2	P2	R	1.00	1.00	800	800	-	-		P	-					
	(Below Payne Store Road)	Segment 2 (Confl to Pres segm)	3	P2	EI	1.50	0.67	380	253	-	-		P	-					
		Segment 3 (Preserv - one side)	4	-	-	-	0.00	1450	0	-	-		P	-	2.2	2nd	<5%	Ag-Past	No
	Tributary	Segment 1 (Upper)	5	Fence/Plant	EII	2.00	0.50	1350	675	-	-		P	-					
		Segment 2 (Lower 90 feet)	6	P2	EI	1.50	0.67	90	60	-	-		P	-	0.4	1st	<5%	Ag-Past	No
Wetland																			
	Jumping Run Upper (Above Henry Road)	Wetland 1	7	-	P	5.00	0.20	-	-	2.36	0.47		-	BLH	-	-	-	-	-
		Wetland 2	8	-	P	5.00	0.20	-	-	0.03	0.01		-	BLH	-	-	-	-	-
		Wetland 3	9	-	P	5.00	0.20	-	-	0.26	0.05		-	BLH	-	-	-	-	-
		Wetland 4	10	-	P	5.00	0.20	-	-	0.30	0.06		-	BLH	-	-	-	-	-
		Wetland 5	11	-	P	5.00	0.20	-	-	1.87	0.37		-	BLH	-	-	-	-	-
	Jumping Run Lower (Below Payne Rd))	Wetland 9	12	-	P	5.00	0.20	-	-	1.40	0.28		-	BLH	-	-	-	-	-
	Tributary	Wetland 6	13	-	P	5.00	0.20	-	-	0.01	0.00		-	BLH	-	-	-	-	-
		Wetland 7	14	-	P	5.00	0.20	-	-	0.10	0.02		-	BLH	-	-	-	-	-
		Wetland 8	15	-	P	5.00	0.20	-	-	0.07	0.01		-	BLH	-	-	-	-	-
Buffer																			
	Jumping Run Upper (Above Henry Road)	Segment 1	1	-	-	-	-	-	-	25.36	-		-	-	-	-	-	-	-

P1 = Priority I Restoration
P2 = Priority II Restoration
P3 = Priority III Restoration

R = Restoration
E = Wetland Enhancement
EI = Stream Enhancement I
EII = Stream Enhancemnt II
C = Wetland Creation
P = Preservation

SMU =Stream Mitigation Units
WMU = Wetland Mitigation Units
P/I/E = Perennial, Intermittent, Ephemeral

Asset Summary

Level	Feet	SMU	Acres	WMU	Buffer
R	5177	5177			
E					
EI	470	313			
EII	1350	675			
C					
P	1450		6.40	1.28	
	8447	**6165**	**6.40**	**1.28**	**25.36**

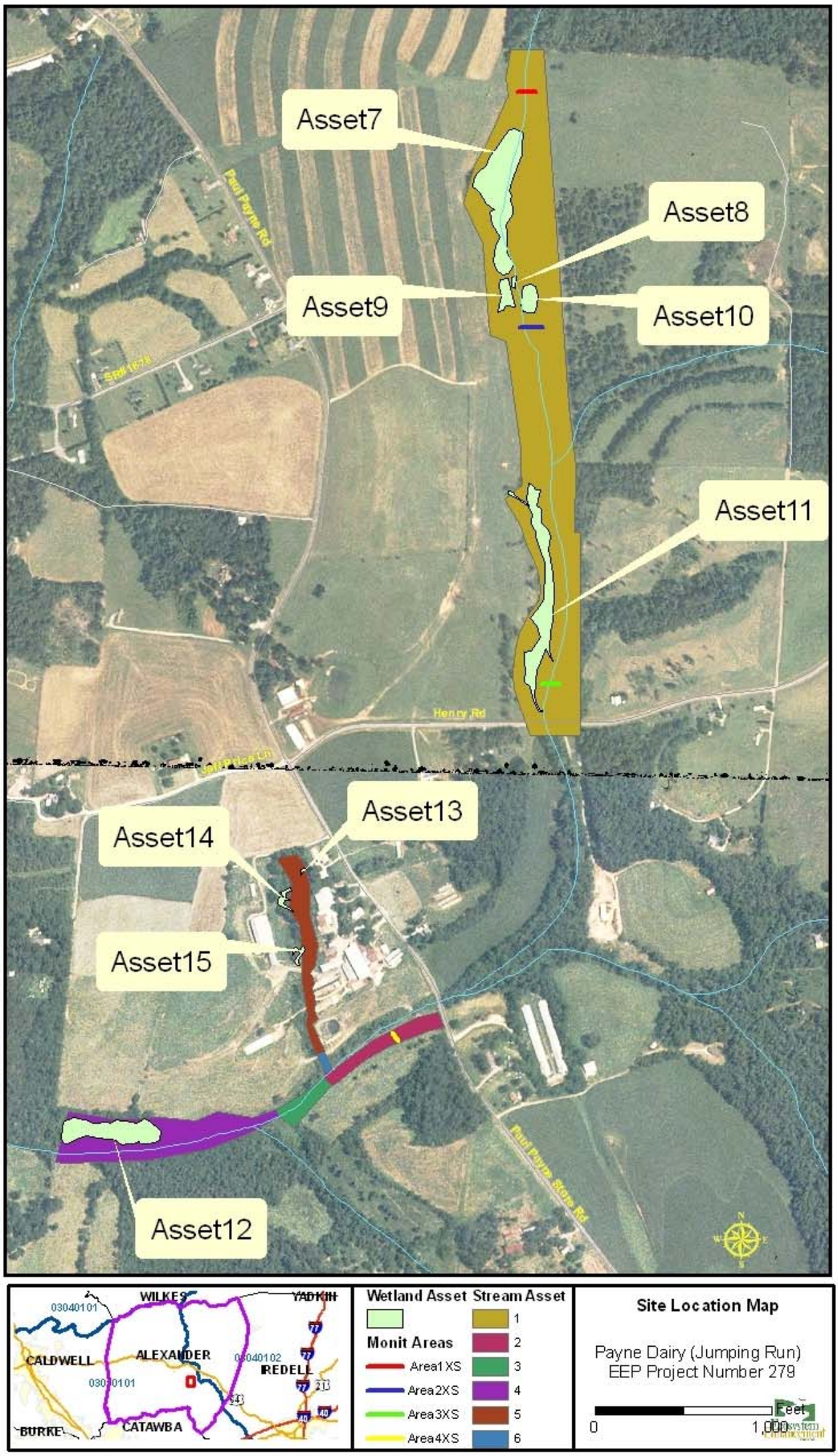

Figure 1. Project Site Map

Figure 2. Payne Dairy (EEP Project Number 279) Pre-existing Condition Photos

As-built (2000) Monitoring Year 5 (2005)

Photo point #3, view upstream at pool X-section.

Photo point #40, view downstream near Henry Road.

As-built (2000) Monitoring Year 5 (2005)

Photo point # 48, Upstream Pool View

Photo point #49, view downstream at riffle X-section.

Figure 3. Payne Dairy (EEP Project Number 279) As-built comparison photos

Channel Stability

Dimension

The restored channel's dimension exhibited stability. There appeared to be some lateral migration in one of the paired riffle and pool cross-sections at the very upper end of the project, but this may have been a lateral shift in the survey by the monitoring consultant in years 3-5. In any case, this is not evident in the field and did not represent a systemic reach response. The riffle cross-sectional areas were either maintained or decreased due to a decrease in channel width, primarily below the bankfull elevation (development of an inner berm feature See Area 1 Riffle Cross section below), which was coincident with the development of dense vegetation in year 3. The riffle cross-sections classified as either the C channel that was designed or exhibited tendencies towards development of an E channel as a result of the aforementioned narrowing. In all cases, healthy entrenchment ratios were maintained indicating good floodplain capacity. With the exception of one riffle-pool cross-section pairing, the pool cross-sections exhibited and maintained greater depths than the riffles, indicating the maintenance of distinct bedform features. Collectively, these conditions indicate stability or stable trends of the restored dimension. The plots below describe or typify some of the conditions and trends with regard to channel dimension.

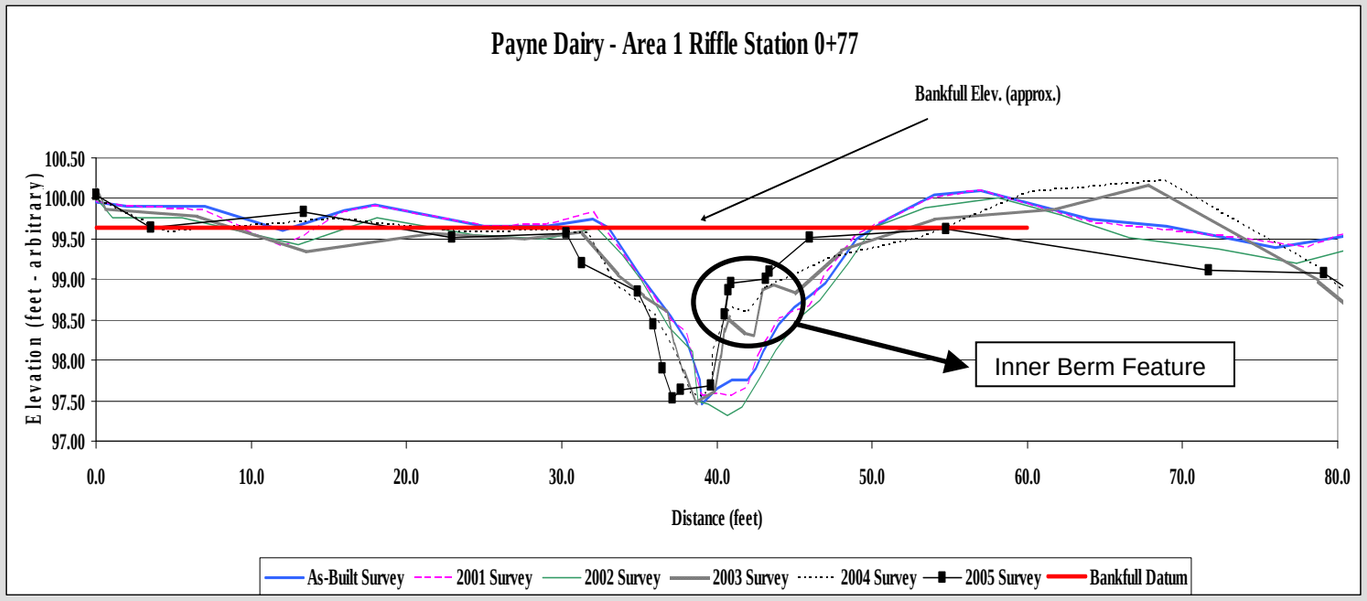

Figure 4. Area 1 Riffle cross-section typifying the development of an inner-berm feature

Table 2. Cross-Sectional Areas Based on As-built Bkfl Datum

Riffle	MY0	MY1	MY2	MY3	MY4	MY5
Area 1	17.66	17.86	20.46	16.48	16.63	15.09
Area 2	25.71	25.53	28.07	25.04	23.27	25.48
Area 3	17.35	17.03	17.93	17.57	14.93	14.85
Area 4	32.4	29.46	32.22	24.23	22.99	23.05
Mean	**20.24**	**20.14**	**22.16**	**19.70**	**18.27**	**18.47**

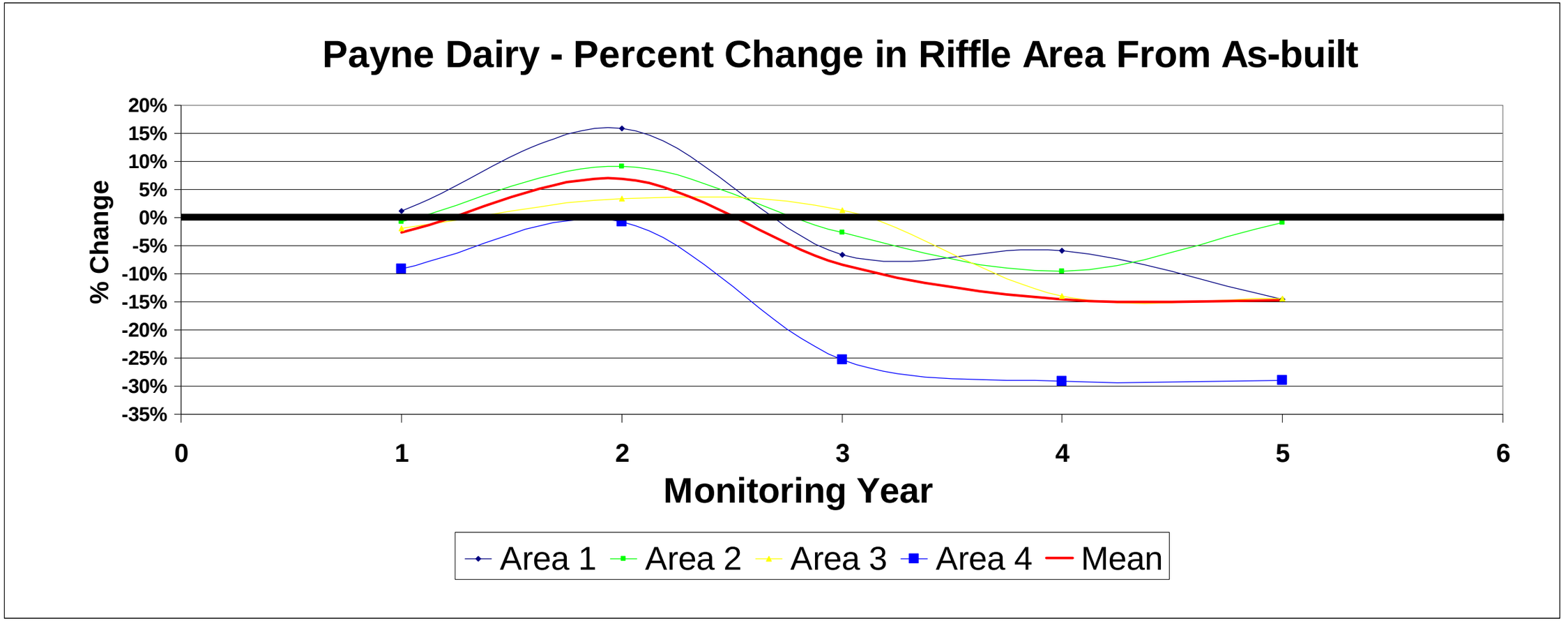

Figure 5. Percent change from As-built cross-sectional area

In order for the reach dimension to be considered stable, the change in the cross-sectional area should not be unidirectional and the amplitude in the variation should not increase over the 5-year monitoring period. A streams cross-section may exhibit an initial adjustment before a stable variation pattern can be observed around some new point of equilibrium. This is often due to the fact that there is some level of uncertainty in any stream design, and the vegetation often takes 2-3 years to exert significant influence on the channel. The above plot includes the percent change relative to the as-built for each of the 4 project riffle cross-sections. The mean is also included. The projects cross-sectional area generally demonstrated a healthy pattern of variability. After an initial moderate increase in the cross-section between years 1 and 2, the cross-section generally decreased with the development of an inner berm depositional feature, effectively narrowing the channel. This condition was particularly evident in the cross-section from area 4. The onset of very dense vegetation was coincident with this decrease in area in Year 3. This adjustment was followed by a lower level of variation in years 4 and 5, indicating the cross-section has likely reached a stable equilibrium. The observed pattern indicates that the intended floodplain access was provided and maintained. Maintenance of a mean entrenchment ratio of approximately 5 over the 4 riffle cross-sections supports this observation.

Profile

The upper section of the reach above Henry road demonstrated some vertical adjustment during year 2 which has since arrested. There was some aggradation above structure 2 near the top of the project and some downcutting below it resulting from a short headcut for this upper section, but the monitoring reports/data for years 3 through 5 indicated this has stabilized. The measured profiles indicated that the project reaches were vertically stable overall. The figure below provides a sampling of the surveyed profile. Bedform slope and spacing distributions naturally varied from year to year, but distinct riffle-pool bedform distributions were maintained, providing diversity in the project bedform.

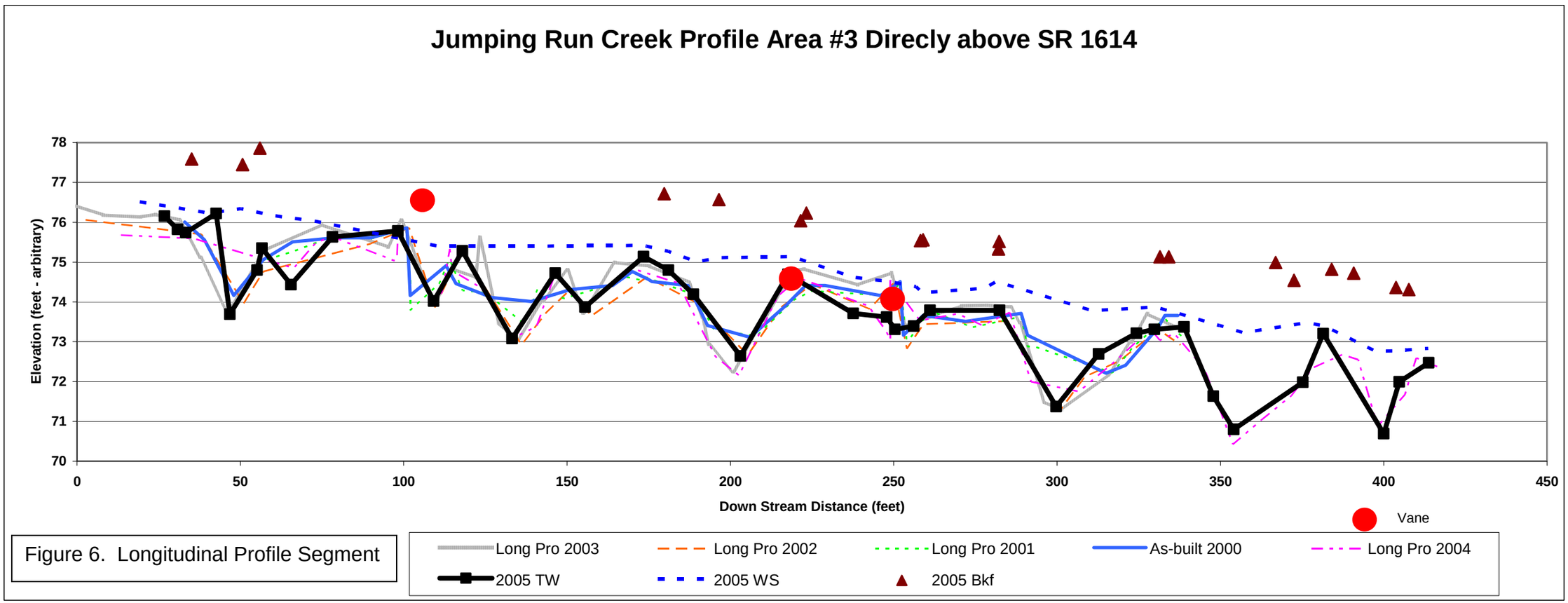

Figure 6. Longitudinal Profile Segment

Substrate

The substrate data collected from the 4 pairs of cross-sections in the 4 restoration reaches was somewhat variable and indicated sediments were being moved by the system, but were not always depositing in bedforms that were typical for the observed substrate distributions. The restoration plan indicated that the materials in the existing channel were silt and fine sand and that based on upstream sediment distributions, the restoration reaches should maintain coarse sand to medium gravel in riffles. Overall, while there were fluctuations in the distributions, the substrates were in keeping with the classes described in the restoration plan.

Area 1 XS1 – Riffle: 5 year mean - Coarse sand (d50) to Fine gravel (d84). Fines observed in years 2-4 with coarsening in year 5. Coarser than paired pool

Area 2 XS1 – Riffle: 5 year mean - Very Coarse sand (d50) to Medium Gravel (d84). Fines observed in years 3-4 with some recovery in year 5, but still generally finer than earlier years. As-built was extremely coarse, which may have been an artifact of a constructed riffle. Paired pool data indicates some of the riffle material may have been dislodged into the pool, because coarsening was observed in the paired pool as well.

Area 3 XS1 – Riffle: 5 Year Mean - Medium (d50) to coarse gravel (d84). Generally much coarser than the upstream riffle cross sections. A pattern similar to that of Area 2 riffle cross-section was observed with some fining in years 3 and 4 , but final riffle substrate in year 5 was medium to coarse gravel. As with Area 2 it appears some of the riffle material was dislodged into the pool, because the pool distribution exhibited some coarser material.

Area 4 XS1 – Riffle: 5 Year Mean - Medium (d50) to coarse gravel (d84)

Table 3. Project Bedform Substrate Means

Mean (AB-Year 5)	D50	D84		Mean (AB-Year 5)	D50	D84
Riffle Area 1	0.6	4.0		**Pool Area 1**	0.5	2.0
Riffle Area 2	1.7	11.3		**Pool Area 2**	2.3	9.8
Riffle Area 3	13.9	30.4		**Pool Area 3**	0.9	9.8
Riffle Area 4	10.2	25.8		**Pool Area 4**	0.9	10.5

Status of Engineered Structures

Grade control structures were comprised of log sills and rock cross vanes. These were 37 in number throughout the project, two of which were identified as significant structural failures and 9 of which were identified as stressed in 2006. This project was constructed in 2000 and the rock cross vanes were not constructed according to current standards. They did not possess a significant vane arm angle and several were oversized, ineffectual and bypassed by flow. The project also included many root wads and single arm log vanes, the vast majority of which are functioning well. Overall, the projects grade has been maintained and the majority of the projects structures are providing the intended function.

Macrobenthos

Monitoring of the benthos was performed pre-construction and in monitoring years 2-6 by David Penrose of NCSU. Samples were collected at an upstream reference site (site 1), a site within the restoration reach about 150 feet upstream of Henry road (site 2), and a third site just below the project extent (site 3). Prior to construction, all metrics (EPT metrics and keystone taxa in particular) were considerably lower at sites 2 and 3 as compared to the upstream reference. The first sampling event after construction exhibited even lower biological quality at sites 2 and 3 as compared to the upstream reference, but after this initial response, these sites demonstrated steady improvement in all metrics between 2003 and 2005 and achieved levels that were significantly better than pre-construction and close to the upstream reference. However, sampling in 2006 saw a drop in quality at all stations, particularly at sites 2 and 3. Site 3 still exhibited improvement over pre-construction levels. Sampling took place during high flows in 2006 in November as opposed to October. 2006 also saw the establishment of beaver dams above site 2, which were manually breached by the adjacent landowner. Benthos sampling and measurement will continue at this project site as part of EEP funded research.

Table 4. Macrobenthic Data

	Site 1, Upstream Reference						Site 2, Restored Reach						Site 3, Recovery					
Metric/Year	10/00	10/02	10/03	10/04	10/05	11/06	10/00	10/02	10/03	10/04	10/05	11/06	10/00	10/02	10/03	10/04	10/05	11/06
Total Taxa Richness	43	37	44	41	44	35	38	12	20	27	43	22	31	28	44	44	42	34
EPT Taxa Richness	19	20	19	20	24	23	8	3	12	11	17	3	9	7	16	16	18	13
EPT Abundance	67	88	87	88	88	77	39	7	34	39	61	7	47	28	71	54	93	68
Dominants in Common Index (%)*	-	-	-	-	-	-	25%	5%	29%	30%	55%	27%	25%	16%	47%	60%	50%	47%
# Indicator taxa	10	12	14	19	21	15	2	0	5	6	13	3	4	0	6	12	13	9

*Abundant and Common taxa were used in the analyses.

Overbank Events

There is evidence of recent deposition and wrack along the project reach (see Figure 7).

Figure 7. Fresh overbank deposition near top of project (2007).

Table 5. Project Stem Counts

Stem Counts per Acre by Plot												
			Plots									
rfMY	**CY**	**Ave**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Y1	2001	**<260**	Transects									
Y2	2002	**<260**	Transects									
Y3	2003	**490**	360	240	840	520						
Y4	2004	**120**	80	0	120	280						
Y5	2005	**982**	809	1255	769	1093						
Y6	2006	**459**	121	40	688	486	0	688	607	891	1417	457

During the six years of vegetation monitoring, 3 different protocols have been applied. In year five, the data suggests no distinction was made between planted stems and volunteers. Also, some of the change in numbers is attributed to changes in plot locations. Regardless, the condition of the vegetation is considered to be adequate for Close-out purposes.

Project Goals, Outcomes and Conclusions:

The above is summary of the salient information from the project restoration plan, mitigation plan and monitoring reports, which should be consulted if additional detail is sought. The primary project goal as stated in the project restoration plan is to improve water quality and the natural function of Jumping Run. This was to be accomplished through the restoration of the altered/degraded stream corridor, including adjacent riparian zones and flood prone areas, to its natural or referenced, stable condition.

The project served to connect 3 existing corridors that are nearly completely forested along the Jumping Run mainstem including its headwaters. The longest contiguous forested segment was approximately 4700 feet prior to restoration, and is approximately 16,400 feet post-restoration. Livestock are excluded from the entire project extent (all stream asset polygons in Figure 1). The fenced easement also encompasses 9 wetland features depicted in Figure 1, which have been preserved, enhanced or restored as a result of project measures. The easement surrounding the upper stream segment (asset #1) encompasses an area that exceeds the standard 50 foot buffer acreage by 18.7 acres. The tributary in the lower section (Map assets 5 & 6) flows directly through the farm and the enhancement implemented on this segment provides protection not only from direct livestock pressures, but from a wider array of stressors related directly to operations of the farm complex.

The restored stream segments have exhibited geomorphologic stability, maintained floodplain access, and are surrounded by a dense buffer with a canopy that is providing significant shading to the stream. The restored pattern, dimension and profile are maintaining distinct bedforms and have yielded improved quality and distribution of instream habitat. The benthic community exhibited improvement between 2003 and 2005, demonstrating a steady migration from pre-construction conditions towards reference. However, the sites within and below the project, sites 1 and 2, exhibited a drop in 2006 as compared to the improvements realized in 2005. This may be related to the development and breach of beaver dams upstream of site 2 in 2006 and/or that sampling occurred at elevated flows in 2006, but the actual cause is unknown. Even with what is interpreted as a temporary downturn, given the 3 prior years of improvement, the downstream site (site 3) still indicates improvement over pre-construction conditions. This indicates improvement to the catchment has likely been realized. Monitoring of the benthos will continue as part of EEP-funded research.

Collectively, the characteristics of the projects' assets and their measured performance yielded the ratios listed in table 1. EEP considers the project to be functioning well with a trajectory such that the sites potential functional uplift has or will be realized. EEP seeks regulatory closure on the assets detailed in Table 1.