Little Sugar Creek Restoration
At Freedom Park

2004 As-Built Report

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Ecosystem Enhancement PROGRAM

NCDENR

NC STATE UNIVERSITY

2004 Little Sugar Creek at Freedom Park As-built Assessment Abstract

Little Sugar Creek was enhanced/restored through the North Carolina Ecosystem Enhancement Program (NCEEP). The objectives of the project are to:

1.) Stabilize the stream banks using a combination of native vegetation and engineered structures
2.) Provide for some floodplain benching and flood storage
3.) Increase aquatic habitat diversity
4.) Improve on-site water quality
5.) Aesthetically enhance the stream setting

This is the as-built assessment to be used as a baseline for the 5-year monitoring plan for Little Sugar Creek at Freedom Park in Charlotte, NC.

Table 1A. Background Information

Project Name	Little Sugar Creek at Freedom Park
Designer's Name	HDR Engineering, Inc. of the Carolinas 128 South Tryon St, Suite 1400 Charlotte, NC, 28202
Contractor's Name	SEI Environmental
Directions to Project Site	From Raleigh follow I-40 west to I-85 South. Turn on to I-77 south. Take the west blvd exit. Turn left onto west blvd. The project is located about 3 miles on the right. Follow entrance to Freedom Park (Note: west blvd becomes east blvd)
Drainage Area	13.6 sq. mi. (Ranges from 12 to 14 throughout the project)
USGS Hydro Unit	03050103
NCDWQ Subbasin	11-173-08
Project Length	4,500 linear feet
Restoration Approach	4,500 feet of dimension, pattern, and profile adjustments on Little Sugar Creek
Date of Completion	September 2003
Monitoring Dates	June 2004 (as-built)

Results and Discussion

Most of the stream appears to be functioning well and is stable. There are some areas of concern and areas of immediate need. Table 2A shows a summary of as-built assessment measurement results. Overall the project is performing well.

Channel dimension, pattern, and profile appear stable at this time. Vegetation plantings are not succeeding to levels required for mitigation credit. Supplemental plantings will be necessary to meet mitigation requirements. Herbaceous cover is sparse in several areas, thus risking bank stability. Soil amelioration is recommended to improve the compacted soils for plant growth. Invasive vegetation is currently not a problem on this site and no recommendations are being made at this time.

Table 2A. Summary of Channel Conditions

DIMENSION	Little Sugar Creek Cross-section #1 Riffle As-Built		Little Sugar Creek Cross-section #2 Pool As-Built		Little Sugar Creek Cross-section #3 Riffle As-Built		Little Sugar Creek Cross-section #4 Pool As-Built		Little Sugar Creek Cross-section #5 Riffle As-Built		Little Sugar Creek Cross-section #6 Pool As-Built		Little Sugar Creek Cross-section #7 Riffle As-Built		Little Sugar Creek Cross-section #8 Riffle As-Built		Little Sugar Creek Cross-section #9 Pool As-Built	
	Bankfull	Top of Bank	Bankfull	Top of Bank	Bankfull	Top of Bank	Bankfull	Top of Ban	Bankfull	Top of Bank	Bankfull	Top of Ban	Bankfull	Top of Bank	Bankfull	Top of Bank	Bankfull	Top of Bank
Bankfull Cross-sectional Area	197	493	275	740	219	373	283	799	169	510	414	1177	250	658	372	632	189	759
Bankfull Width	46	68	73	109	53	58	84	100	39	75	107	142	74	88	68	79	53	94
Bankfull Mean Depth	4.3	7.2	3.8	6.8	4.2	6.5	3.4	8.0	4.3	6.8	3.9	8.3	3.4	7.5	5.5	8.0	3.6	8.1
Width to Depth Ratio	10.9	9.4	19.5	15.9	12.6	8.9	25.1	12.4	9.1	11.1	27.4	17.2	21.9	11.8	12.3	10.0	14.8	11.7
Bankfull Max Depth	5.5	10.6	7.1	12.3	6.7	9.9	6.8	13.3	5.9	11.4	9.4	15.7	5.0	10.8	7.2	10.7	8.7	16.3

PATTERN	Little Sugar Creek As-built		
	Min	Max	Median
Meander Wave Length	403	840	531
Radius of Curvature	72	232	148
Beltwidth	105	236	153

PROFILE	Little Sugar Creek As-built		
	Min	Max	Median
Riffle Length	15	207	66
Riffle Slope	0.27%	1.75%	1.15%
Run Length	27	280	118
Run Slope	-0.06%	0.33%	0.04%
Pool Length	76	252	132
Pool to Pool Spacing	171	587	294
Average Water Surface Slope		0.25%	

Ratios			
avg Riffle Bkfl width		56	feet
	Min	Max	Median
WL/W	7.2	15.0	9.5
RC/W	1.3	4.2	2.6
MWR	1.9	4.2	2.7
	Min	Max	Median
RL/W	0.3	3.7	1.2
RS/S	1.1	7.1	4.7
RNL/W	0.5	5.0	2.1
RNS/S	-0.2	1.4	0.2
PL/W	1.4	4.5	2.4
PP/W	3.1	10.5	5.3

SUBSTRATE	Little Sugar Creek Cross-section #1 Riffle As-built		Little Sugar Creek Cross-section #2 Pool As-built		Little Sugar Creek Cross-section #3 Riffle As-built		Little Sugar Creek Cross-section #4 Pool As-built		Little Sugar Creek Cross-section #5 Riffle As-built		Little Sugar Creek Cross-section #6 Pool As-built		Little Sugar Creek Cross-section #7 Riffle As-built		Brush Creek Cross-section #8 Riffle As-built		Brush Creek Cross-section #9 Pool As-built	
d50	1.13		0.31		0.19		0.24		0.52		0.06		0.53		0.18		0.85	
d84	2.8		2.3		4.7		1.4		2.0		0.2		1.5		1.3		1.5	

VEGETATION	Trees Planted	Quad 1		Quad 2		Quad 3		Quad 1	
	2004	2004		2004		2004		2004	
		% Cover	Density	% Cover	Density	% Cover	Density	% Cover	Density
	#/acre		(trees/ac)		(trees/ac)		(trees/ac)		(trees/ac)
Tree Stratum	n/a	-	0	-	243	-	0	-	405
Trees Naturally Regenerated	-	-	2640	-	930	-	7487	-	1376
Shrub Stratum	n/a	44%	1174	3.0%	405	3.0%	1133	1.0%	202
Herb Stratum	n/a	116%	-	40%	-	6%	-	3.0%	

Figure 1A. Plan view of 2004 Site Conditions

Areas of Concern
The following areas of concern should be monitored closely and considered for repair as suggested. A plan sheet follows which shows locations of areas of concern and plan view of existing conditions overlain as-built conditions.

Little Sugar Creek

1.) Areas with poor herbaceous cover
   - These areas (Table 3 below) need supplemental herbaceous plantings in order to establish sufficient vegetation cover to resist erosion. Soil compaction is a problem in many areas and should be addressed when replanting.

Table 3A. Locations of Degraded Areas along Little Sugar Creek

Stations	Problem
25+00 to 28+00	Left bank has poor herbaceous success
31+00 to 32+00	Left bank has poor herbaceous success
34+00 to 35+00	Right bank has poor herbaceous success
37+00 to 44+79	Both banks have poor herbaceous success
Throughout (both streams)	Poor hardwood tree and live stake establishment

2.) Scour along bridge abutment at Station 28+50
   - This area should me closely monitored to ensure scour does not continue into the bridge abutment. At this time, the scour is limited to areas around boulders upstream of the bridge abutment.

3.) The constructed channel appears incised
   - The channel stability should be watched to look for any adverse effects resulting from the incised nature of the channel.

Photos
The following are photographs of typical sections and areas of concern throughout the project.

Little Sugar Creek

Typical Photo 1.
Typical Riffle along Little Sugar Creek.

Typical Photo 2.
Typical Pool along Little Sugar Creek.

Issue Photo 1.
Near Station 28+50.
Poor vegetation establishment along the stream bank.

Issue Photo 2.
Near Station 36+50.
Potential scour at bridge abutment.

Issue Photo 3.
Near Station 43+00.
Poor vegetation establishment along the stream bank.

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Tables and Figures

1.0 BACKGROUND INFORMATION

The background information for this report is referenced from previous monitoring reports conducted by HDR, Inc. The following was excerpted from 2003 HDR monitoring report section 2.1:

> The Project Area is located on Little Sugar Creek in the Catawba River Basin (HU No. 03050103) in Mecklenburg County, North Carolina. The stream reach is approximately 4,200 linear feet (LF) in length, bounded by East Boulevard and Princeton Avenue, and lies entirely within Freedom Park and the City of Charlotte (City). Freedom Park is a part of the Mecklenburg County Park and Recreation Department public park system.
>
> At this site, Little Sugar Creek has a drainage area of approximately 12 to 14 square miles. The range in drainage area is due to the additional drainage represented largely by Dairy Branch, a tributary that enters Little Sugar Creek within Freedom Park. The headwaters of Little Sugar Creek begin near the interchange of Interstate I-85 and NC 29/49 and flow south-southwest through a highly urbanized portion of the City, including the uptown business district, to Freedom Park.
>
> Past records indicate that multiple entities have dredged and/or channelized Little Sugar Creek, including the 4,200 LF of stream within Freedom Park. The dredging of Little Sugar Creek was completed by 1917 to a minimum channel width of approximately 20 feet and depth of 8 feet. Overall, the current alignment has existed since early part of the 1900s. In the mid-1960s and early 1970s, the City initiated an erosion control system along the banks of Little Sugar Creek, as it flows through Freedom Park, using a combination of grouted riprap and concrete bank covering. The bottom of the channel was left in its "natural" condition. During July 2002, the County removed the grouted riprap and concrete banking and temporarily stabilized the banks with erosion control matting. Additionally, the large flood control weir structure located approximately 450 feet upstream of Princeton Avenue was removed.
>
> The goals of the restoration project were to increase aquatic habitat diversity, improve on-site water quality, stabilize the stream banks using a combination of native vegetation and engineered structures, provide for some floodplain benching and flood storage and to aesthetically enhance the stream setting.

Figure 1. Project Location Map

Figure 2. Watershed Ortho-Photo

Figure 3. Plan view of As-built conditions

(To be attached)
showing all structures with station numbers
showing vegetation permanent plots
showing permanent cross-sections and benchmarks
showing vegetation plots
showing monitoring gauges

2.0 YEAR 2004 RESULTS AND DISCUSSION

Year 2004 as-built assessment results are shown for Little Sugar Creek Monitoring.

2.1 Vegetation

Using the Draft Vegetation Monitoring Plan for NCWRP Riparian Buffer and Wetland Restoration Projects, four vegetation-monitoring plots were randomly located within the riparian buffer of the Freedom Park project. No reference area was studied; therefore no comparisons could be made to reference conditions.

2.1.1 Results and Discussion

Vegetation within the riparian buffer of Little Sugar Creek is overall considered mixed in success. Many portions of the restoration site were well vegetated with live stakes and naturally regenerating native species of shrubs and trees. *Cornus amomum* was the predominant healthy live stake species throughout the area. *Quercus rubra* and *Ulmus* spp. comprised a large portion of the naturally regenerating trees. Early successional herbaceous species were growing well in some areas while scantily in others. Because stream banks were steep, in many areas soil conditions were droughty. It was noted that most of the site had compacted soils.

Extrapolation from the four plots resulted in an overall average of approximately 160 planted trees per acre for this restoration site. The majority of surviving planted trees was located in a small area at the head of the project. The approximately lower three quarters of the project contained little, if any surviving planted trees. If natural regeneration is included with planted trees, the number is increased to an average of approximately 3240 trees per acre. Both of these estimates are based on a diverse mix of species as well. Natural regeneration obviously plays an important role in the restoration of this site; however, more planted trees are needed to meet mitigation requirements.

Invasive plant species on the site included *Sorghum halepense* and *Commelina communis* though nowhere abundant.

Recommendations include replanting trees to obtain mitigation requirements. The site could benefit from larger containerized trees both for bank stability and aesthetics due to its park setting. Several eroding banks would benefit from native herbaceous species. Soil amelioration is recommended to improve the compacted soils for plant growth. Further, watering may be necessary for plants to achieve successful establishment due to droughty conditions. Invasive vegetation is currently not a problem on this site and no recommendations are being made at this time.

2.2 Morphology

Restored channel dimension, pattern, profile and substrate were examined during the 2004 as-built assessment. This data will be used as baseline for upcoming monitoring reports.

2.2.1 Results and Discussion

Channel dimension varies throughout the project. In riffle sections, the top of bank cross-sectional area ranged from 373 to 658 square feet. Bankfull cross-sectional area ranged from 169 to 372 square feet. Pool top of bank areas ranged from 740 to 1171 square feet and bankfull cross-sectional areas ranged from 189 to 414 square feet.

It should be noted that consistent bankfull indicators are not well-formed on recently constructed channels. Several storm events producing bankfull or greater flows are required before bankfull benches become established. For this reason, the top of bank cross-sectional area measurements will be used for annual comparison purposes. Given that premise, the predicted bankfull cross-sectional area from the rural North Carolina Piedmont regional curve for a 13.6 square mile drainage area is between 80 and 210 square feet. This corresponds with the field indicators found at Freedom Park. The bankfull cross-sectional predicted by the urban regional curve is between 280 and 400 square feet, which is generally lower than that found for the top of bank measurements at Freedom Park. These results indicate that the channel may be incised and is expected to develop bankfull benches at an elevation below top of bank.

The average water surface slope is 0.25%. Riffle slopes ranged from 0.27% to 1.75%. Run slopes range from 0 to 0.33%. Pool to pool spacing ranged from 171 to 587 feet.

Meander wavelength ranged from 403 to 840 feet. Channel radius of curvature ranged from 72 to 232 feet. Channel belt width ranged from 105 to 236 feet.

Channel bed materials ranged from a d50 of 0.18 to 1.13mm (fine sand to very coarse sand) and d84 of 1.3 to 4.7mm (very coarse sand to fine gravel) in riffles. Pool bed material ranged from a d50 of silt to 0.85mm (coarse sand) and d84 of 0.2 to 2.3mm (fine sand to very fine gravel).

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VEGETATION	Trees Planted	Quad 1		Quad 2		Quad 3		Quad 1	
	2004	2004		2004		2004		2004	
		% Cover	Density	% Cover	Density	% Cover	Density	% Cover	Density
	#/acre		(trees/ac)		(trees/ac)		(trees/ac)		(trees/ac)
Tree Stratum	n/a	-	0	-	243	-	0	-	405
Trees Naturally Regenerated	-	-	2640	-	930	-	7487	-	1376
Shrub Stratum	n/a	44%	1174	3.0%	405	3.0%	1133	1.0%	202
Herb Stratum	n/a	116%	-	40%	-	6%	-	3.0%	

Figure 4. Little Sugar Creek Profile

2.3 Areas of Concern

Little Sugar Creek

1.) Areas with poor herbaceous cover
   - These areas (Table 2 below) need supplemental herbaceous plantings in order to establish sufficient vegetation cover to resist erosion. Soil compaction is a problem in many areas and should be addressed when replanting.

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3.) The constructed channel appears incised
   - The channel stability should be watched to look for any adverse effects resulting from the incised nature of the channel.

2.4 Photo Log

Little Sugar Creek Photo Log

Appendices

A. Methods
    1. Vegetation
    2. Morphology
B. Vegetation data
    1. Listed by plot
    2. Species, number and age
    3. Analysis of planted vs. natural recruitment
C. Morphology Data
    1. Cross-section data and plotted
    2. Longitudinal data and plotted
    3. Pebble count data and plotted
    4. Pattern

Little Sugar Creek at Freedom Park
Photo Log

P1. XSC 1 Looking Downstream (Station 5+70)

P2. XSC 1 Right Bank (Station 5+60)

P3. Downstream of XSC 2 - Left bank (Station 13+00)

P4. Near XSC-2 Right bank (Station 13+60)

P5. XSC-2 looking Upstream (Station 12+60)

P6. XSC-3 Looking Downstream (Station 14+00)

P7. Outside Meander – Looking Downstream (Station 15+50)

P8. Bedrock Riffle - Looking Downstream (Station 16+20)

P9. Bedrock Riffle - Looking Upstream (Station 16+20)

P10. XSC-4 Looking Downstream (Station 18+00)

P11. Below XSC-4 Looking Downstream (Station 19+20)

P12. Looking Downstream from Bridge (Station 22+80)

P13. XSC-5 Looking Upstream (Station 25+50)

P14. XSC-6 Looking Upstream (Station 27+50)

P15. XSC-7 Looking Downstream (Station 30+20)

P16. Below XSC-7 Left Bank (Station 30+80)

P17. XSC-8 Right Bank (Station 34+40)

P18. XSC-8 Left Bank (Station 34+40)

P19. Bridge Abutment Looking Upstream Right Bank (Station 36+40)

P20. XSC-9 Left Bank (Station 40+20)

P21. XSC-9 Left Bank (Station 40+80)

P22. Looking Downstream from XSC-9 (Station 42+00)

P23. Looking Downstream at the end of the project (Station 44+00)

Project Name	Little Sugar Creek at Freedom Park
Cross Section	#1
Feature	Riffle **Station:** 5+48
Date	7/15/04
Crew	Bidelspach, Clinton

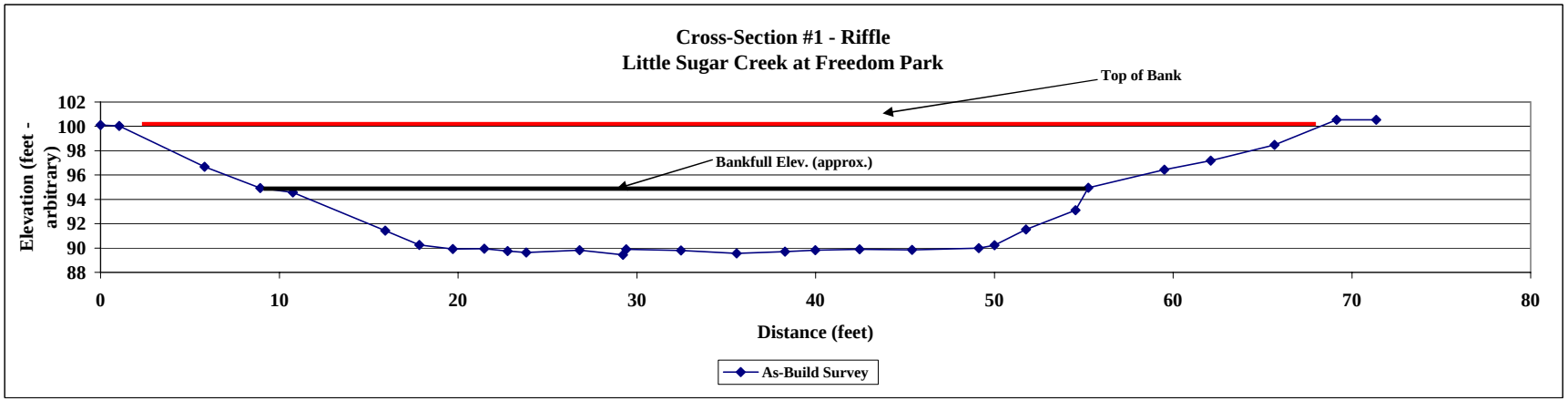
2004 As-Build Survey

Station	Elevation	Notes	
0	100.11	(X1LP)	
1.04	100.04	(X1)	TOB
5.82	96.67	(X1)	
8.94	94.92	(X1)	BKF
10.75	94.58	(X1)	
15.93	91.42	(X1)	
17.84	90.26	(X1)	
19.7	89.92	(X1)	
21.47	89.94	(X1W)	
22.77	89.76	(X1)	
23.81	89.64	(X1)	
26.79	89.83	(X1)	
29.22	89.43	(X1T)	
29.4	89.89	(X1W)	
32.47	89.79	(X1)	
35.58	89.56	(X1)	
38.29	89.7	(X1)	
39.98	89.82	(X1)	
42.46	89.9	(X1)	
45.39	89.85	(X1W)	
49.12	89.99	(X1W)	
50.01	90.24	(X1)	
51.77	91.52	(X1)	
54.54	93.11	(X1)	
55.25	94.96	(X1)	BKF
59.51	96.43	(X1)	
62.11	97.18	(X1)	
65.68	98.48	(X1)	
69.15	100.53	(X1)	TOB
71.36	100.53	(X1RP)	

-4.98

Photo of Cross-Section #1 - Looking Downstream

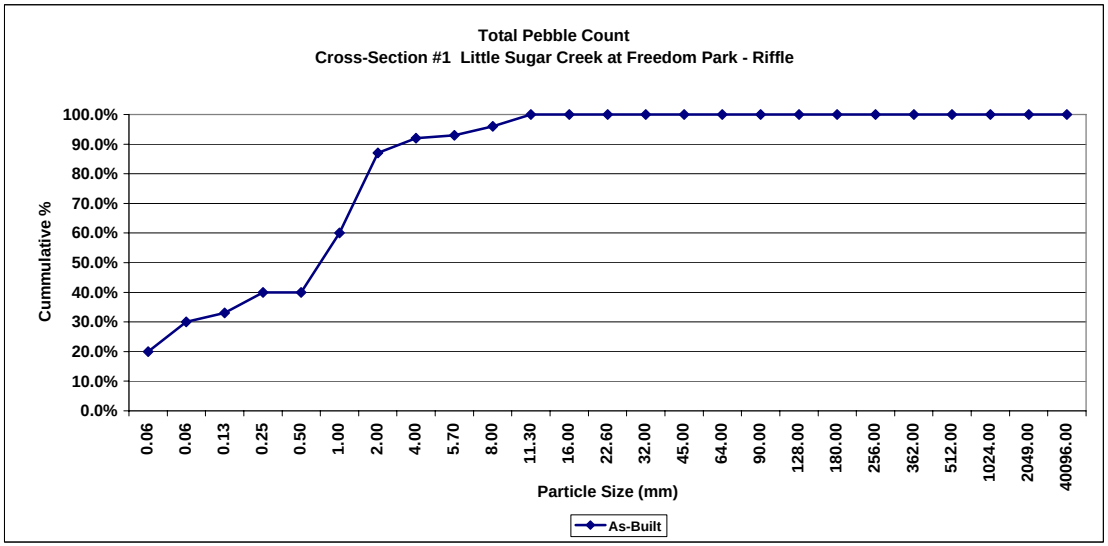
As-Built	BKF	TOB
Area	197.3	493.2
Width	46.3	68.1
Mean Deptl	4.3	7.2
Max Depth	5.5	10.6



Project Name	Little Sugar Creek at Freedom Park
Cross Section	#1
Feature	Riffle
Date	6/15/04
Crew	Shaffer, Bidelspach, Clinton

		2004	As-Built			
Description	**Material**	**Size (mm)**	**Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	10	10	20.0%	20.0%
Sand	very fine sand	0.062	0	10	10.0%	30.0%
	fine sand	0.125	0	3	3.0%	33.0%
	medium sand	0.25	4	3	7.0%	40.0%
	course sand	0.50	0	0	0.0%	40.0%
	very course sand	1.0	20	0	20.0%	60.0%
G r a v e l	very fine gravel	2.0	25	2	27.0%	87.0%
	fine gravel	4.0	4	1	5.0%	92.0%
	fine gravel	5.7	0	1	1.0%	93.0%
	medium gravel	8.0	3	0	3.0%	96.0%
	medium gravel	11.3	4	0	4.0%	100.0%
	course gravel	16.0	0	0	0.0%	100.0%
	course gravel	22.6	0	0	0.0%	100.0%
	very course gravel	32	0	0	0.0%	100.0%
	very course gravel	45	0	0	0.0%	100.0%
Cobble	small cobble	64	0	0	0.0%	100.0%
	medium cobble	90	0	0	0.0%	100.0%
	large cobble	128	0	0	0.0%	100.0%
	very large cobble	180	0	0	0.0%	100.0%
Boulder	small boulder	256	0	0	0.0%	100.0%
	small boulder	362	0	0	0.0%	100.0%
	medium boulder	512	0	0	0.0%	100.0%
	large boulder	1024	0	0	0.0%	100.0%
	very large boulder	2049	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	0	0.0%	100.0%
TOTAL / %of whole count			70	30	100.0%	

	d16	**d35**	**d50**	**d84**	**d95**
As-Built	0.06	0.24	1.13	2.83	8.72



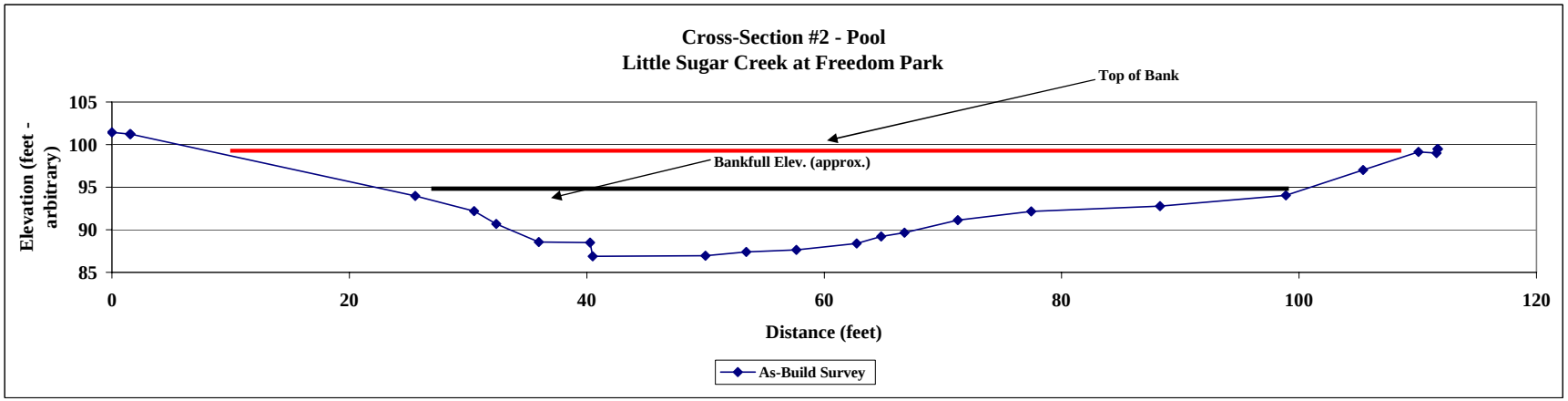
Project Name	Little Sugar Creek at Freedom Park
Cross Section	#2
Feature	Pool **Station:** 12+62
Date	7/15/04
Crew	Bidelspach, Clinton

2004 As-Build Survey

Station	Elevation	Notes	
0	101.44	(X2LP)	
1.53	101.24	(X2)	TOB
1.58	101.23	(X2)	
25.55	93.97	(X2)	BKF
30.51	92.2	(X2)	
32.38	90.68	(X2)	
35.95	88.55	(X2W)	
40.29	88.51	(X2W)	
40.51	86.9	(X2T)	
50.01	86.96	(X2)	
53.43	87.4	(X2)	
57.66	87.65	(X2)	
62.74	88.39	(X2W)	
64.81	89.21	(X2)	
66.76	89.67	(X2)	
71.25	91.13	(X2)	
77.43	92.16	(X2)	
88.3	92.79	(X2)	
98.88	94.05	(X2)	BKF
105.39	97.02	(X2)	
110.07	99.15	(X2)	TOB
111.58	99.01	(X2RP)	
111.66	99.49	(X2RP)	
111.71	99.47	(X2RP)	

Photo of Cross-Section #2 - Looking Upstream

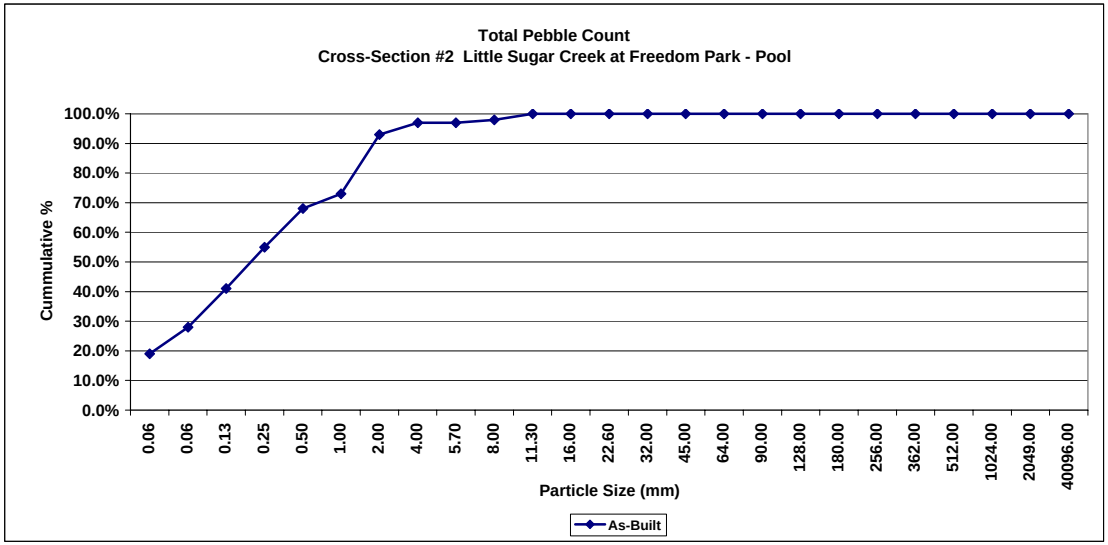
As-Built	BKF	TOB	TOB
Area	274.9	739.7	
Width	73.3	108.5	
Mean Deptl	3.7	6.8	
Max Depth	7.1	12.3	



Project Name	Little Sugar Creek at Freedom Park
Cross Section	#2
Feature	Pool
Date	6/15/04
Crew	Shaffer, Bidelspach, Clinton

		2004		As-Built		
Description	**Material**	**Size (mm)**	**Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	10	9	19.0%	19.0%
Sand	very fine sand	0.062	3	6	9.0%	28.0%
	fine sand	0.125	12	1	13.0%	41.0%
	medium sand	0.25	12	2	14.0%	55.0%
	course sand	0.50	13	0	13.0%	68.0%
	very course sand	1.0	5	0	5.0%	73.0%
Gravel	very fine gravel	2.0	10	10	20.0%	93.0%
	fine gravel	4.0	2	2	4.0%	97.0%
	fine gravel	5.7	0	0	0.0%	97.0%
	medium gravel	8.0	1	0	1.0%	98.0%
	medium gravel	11.3	2	0	2.0%	100.0%
	course gravel	16.0	0	0	0.0%	100.0%
	course gravel	22.6	0	0	0.0%	100.0%
	very course gravel	32	0	0	0.0%	100.0%
	very course gravel	45	0	0	0.0%	100.0%
Cobble	small cobble	64	0	0	0.0%	100.0%
	medium cobble	90	0	0	0.0%	100.0%
	large cobble	128	0	0	0.0%	100.0%
	very large cobble	180	0	0	0.0%	100.0%
Boulder	small boulder	256	0	0	0.0%	100.0%
	small boulder	362	0	0	0.0%	100.0%
	medium boulder	512	0	0	0.0%	100.0%
	large boulder	1024	0	0	0.0%	100.0%
	very large boulder	2049	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	0	0.0%	100.0%
TOTAL / %of whole count			70	30	100.0%	

	d16	**d35**	**d50**	**d84**	**d95**
As-Built	0.06	0.14	0.31	2.33	3.92



Project Name	Little Sugar Creek at Freedom Park
Cross Section	#3
Feature	Riffle **Station:** 14+10
Date	7/15/04
Crew	Bidelspach, Clinton

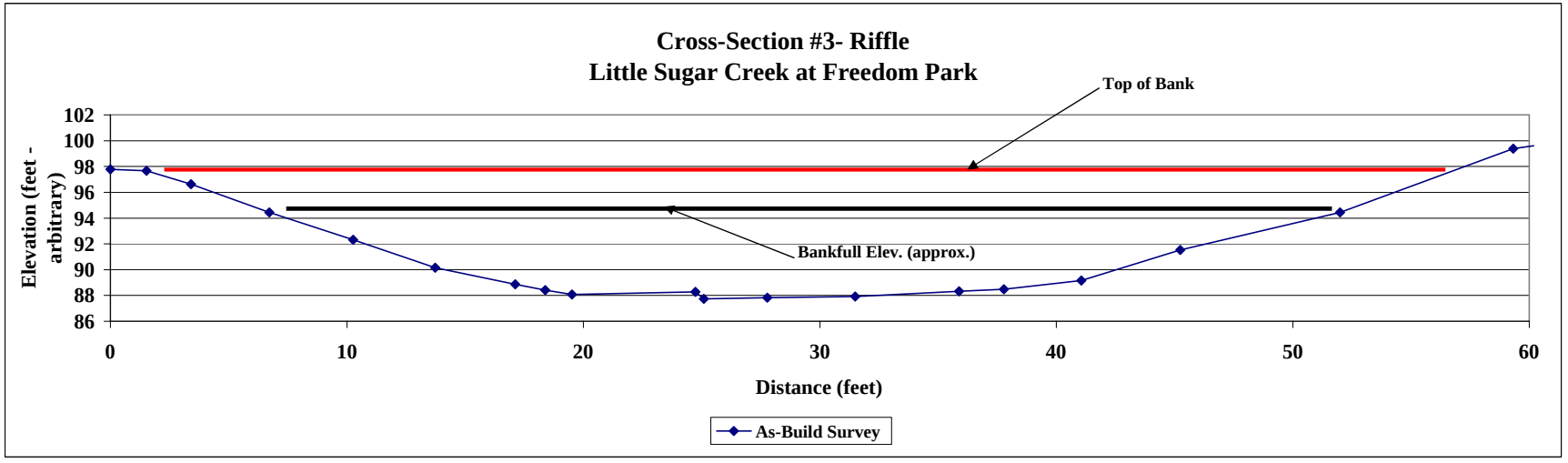
2004 As-Build Survey

Station	Elevation	Notes	
0	97.79	(X3RP)	
1.52	97.66	(X3RP)	TOB
3.41	96.64	(X3RP)	
6.72	94.45	(X3)	BKF
10.26	92.31	(X3)	
13.73	90.15	(X3)	
17.12	88.86	(X3)	
18.39	88.42	(X3W)	
19.52	88.08	(X3)	
24.74	88.29	(X3W)	
25.1	87.74	(X3T)	
27.78	87.83	(X3)	
31.49	87.92	(X3)	
35.89	88.33	(X3)	
37.79	88.48	(X3)	
41.06	89.15	(X3)	
45.24	91.52	(X3)	
52	94.45	(X3)	BKF*
59.32	99.39	(X3)	TOB
60.18	99.6	(X3LP)	

* point inserted

Photo of Cross-Section #3 - Looking at right bank

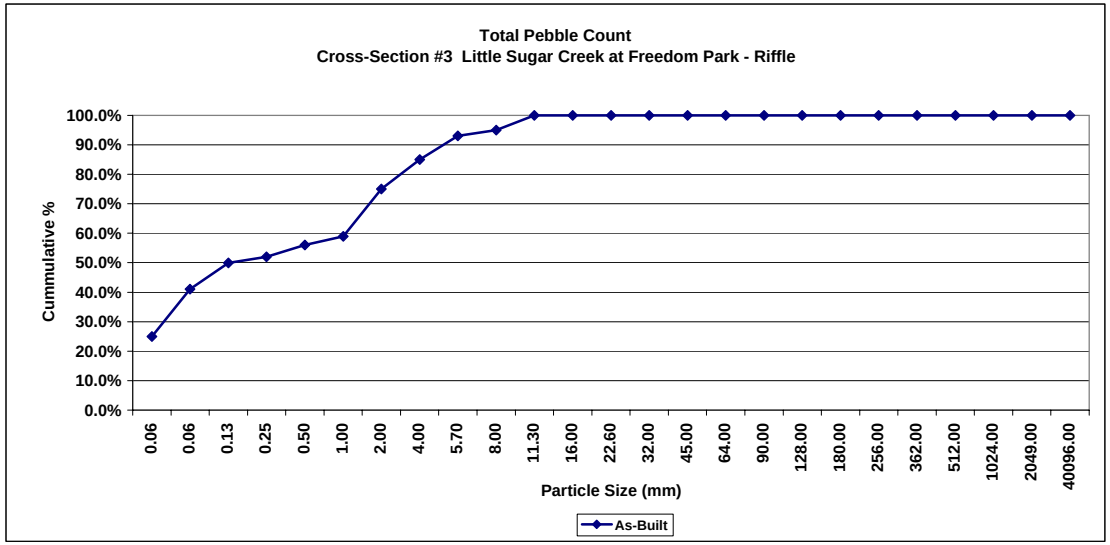
As-Built	BKF	TOB
Area	219.0	373.3
Width	52.6	57.8
Mean Deptl	4.2	6.5
Max Depth	6.7	9.9



Project Name	Little Sugar Creek at Freedom Park
Cross Section	#3
Feature	Riffle
Date	6/15/04
Crew	Shaffer, Bidelspach, Clinton

		2004		As-Built		
Description	**Material**	**Size (mm)**	**Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	10	15	25.0%	25.0%
Sand	very fine sand	0.062	2	14	16.0%	41.0%
	fine sand	0.125	4	5	9.0%	50.0%
	medium sand	0.25	2	0	2.0%	52.0%
	course sand	0.50	2	2	4.0%	56.0%
	very course sand	1.0	3	0	3.0%	59.0%
G r a v e l	very fine gravel	2.0	10	6	16.0%	75.0%
	fine gravel	4.0	10	0	10.0%	85.0%
	fine gravel	5.7	5	3	8.0%	93.0%
	medium gravel	8.0	0	2	2.0%	95.0%
	medium gravel	11.3	2	3	5.0%	100.0%
	course gravel	16.0	0	0	0.0%	100.0%
	course gravel	22.6	0	0	0.0%	100.0%
	very course gravel	32	0	0	0.0%	100.0%
	very course gravel	45	0	0	0.0%	100.0%
Cobble	small cobble	64	0	0	0.0%	100.0%
	medium cobble	90	0	0	0.0%	100.0%
	large cobble	128	0	0	0.0%	100.0%
	very large cobble	180	0	0	0.0%	100.0%
Boulder	small boulder	256	0	0	0.0%	100.0%
	small boulder	362	0	0	0.0%	100.0%
	medium boulder	512	0	0	0.0%	100.0%
	large boulder	1024	0	0	0.0%	100.0%
	very large boulder	2049	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	0	0.0%	100.0%
TOTAL / %of whole count			50	50	100.0%	

	d16	**d35**	**d50**	**d84**	**d95**
As-Built	0.06	0.08	0.19	4.67	9.65



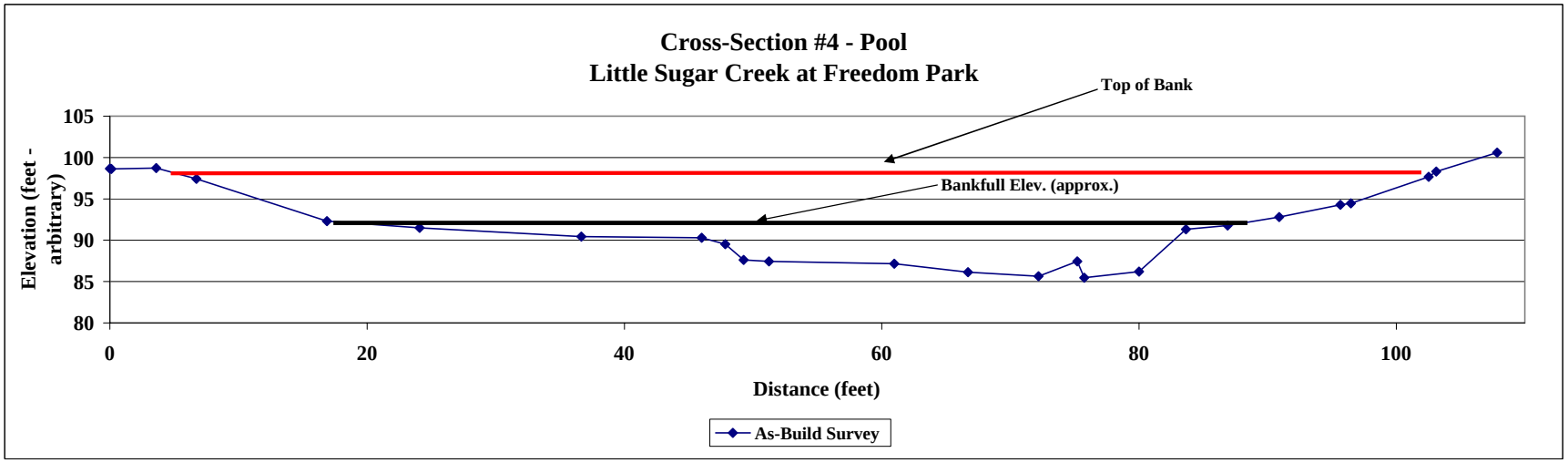
Project Name	Little Sugar Creek at Freedom Park
Cross Section	#4
Feature	Pool **Station:** 19+16
Date	7/15/04
Crew	Bidelspach, Clinton

2004 As-Build Survey

Station	Elevation	Notes	
0	98.65	(X4RP)	
0.11	98.62	(X4RP)	
3.6	98.73	(X4)	TOB
6.72	97.43	(X4)	
16.87	92.31	(X4)	BKF
24.09	91.5	(X4)	
36.65	90.43	(X4)	
46.01	90.28	(X4)	
47.85	89.52	(X4)	
49.27	87.62	(X4)	
51.24	87.44	(X4W)	
60.97	87.15	(X4)	
66.72	86.13	(X4)	
72.19	85.63	(X4)	
75.21	87.43	(X4W)	
75.75	85.48	(X4T)	
80	86.2	(X4)	
83.65	91.32	(X4)	
86.89	91.79	(X4)	
90.91	92.8	(X4)	BKF
95.66	94.28	(X4)	
96.48	94.44	(X4)	
102.53	97.66	(X4)	
103.12	98.29	(X4)	
107.85	100.61	(X4LP)	

Photo of Cross-Section #4 - Looking Downstream

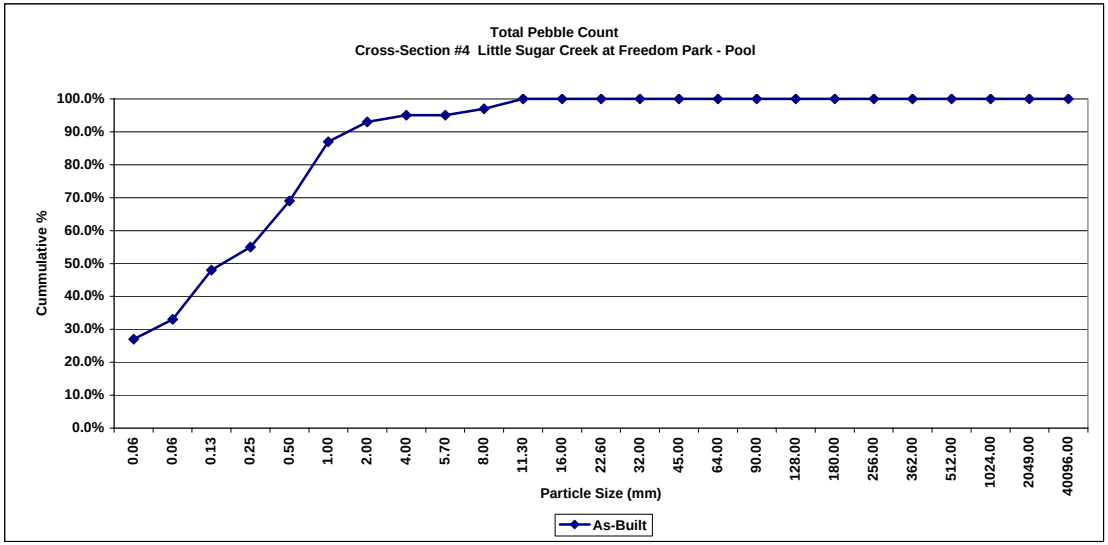
As-Built	BKF	TOB
Area	282.9	798.7
Width	84.2	99.5
Mean Deptl	3.4	8.0
Max Depth	6.8	13.3



Project Name	Little Sugar Creek at Freedom Park
Cross Section	#4
Feature	Pool
Date	6/15/04
Crew	Shaffer, Bidelspach, Clinton

		2004		As-Built		
Description	**Material**	**Size (mm)**	**Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	12	15	27.0%	27.0%
Sand	very fine sand	0.062	2	4	6.0%	33.0%
	fine sand	0.125	3	12	15.0%	48.0%
	medium sand	0.25	5	2	7.0%	55.0%
	course sand	0.50	11	3	14.0%	69.0%
	very course sand	1.0	18	0	18.0%	87.0%
Gravel	very fine gravel	2.0	3	3	6.0%	93.0%
	fine gravel	4.0	1	1	2.0%	95.0%
	fine gravel	5.7	0	0	0.0%	95.0%
	medium gravel	8.0	2	0	2.0%	97.0%
	medium gravel	11.3	3	0	3.0%	100.0%
	course gravel	16.0	0	0	0.0%	100.0%
	course gravel	22.6	0	0	0.0%	100.0%
	very course gravel	32	0	0	0.0%	100.0%
	very course gravel	45	0	0	0.0%	100.0%
Cobble	small cobble	64	0	0	0.0%	100.0%
	medium cobble	90	0	0	0.0%	100.0%
	large cobble	128	0	0	0.0%	100.0%
	very large cobble	180	0	0	0.0%	100.0%
Boulder	small boulder	256	0	0	0.0%	100.0%
	small boulder	362	0	0	0.0%	100.0%
	medium boulder	512	0	0	0.0%	100.0%
	large boulder	1024	0	0	0.0%	100.0%
	very large boulder	2049	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	0	0.0%	100.0%
TOTAL / %of whole count			60	40	100.0%	

	d16	**d35**	**d50**	**d84**	**d95**
As-Built	0.06	0.11	0.24	1.38	5.85



Project Name	Little Sugar Creek at Freedom Park
Cross Section	#5
Feature	Riffle **Station:** 25+00
Date	7/15/04
Crew	Bidelspach, Clinton

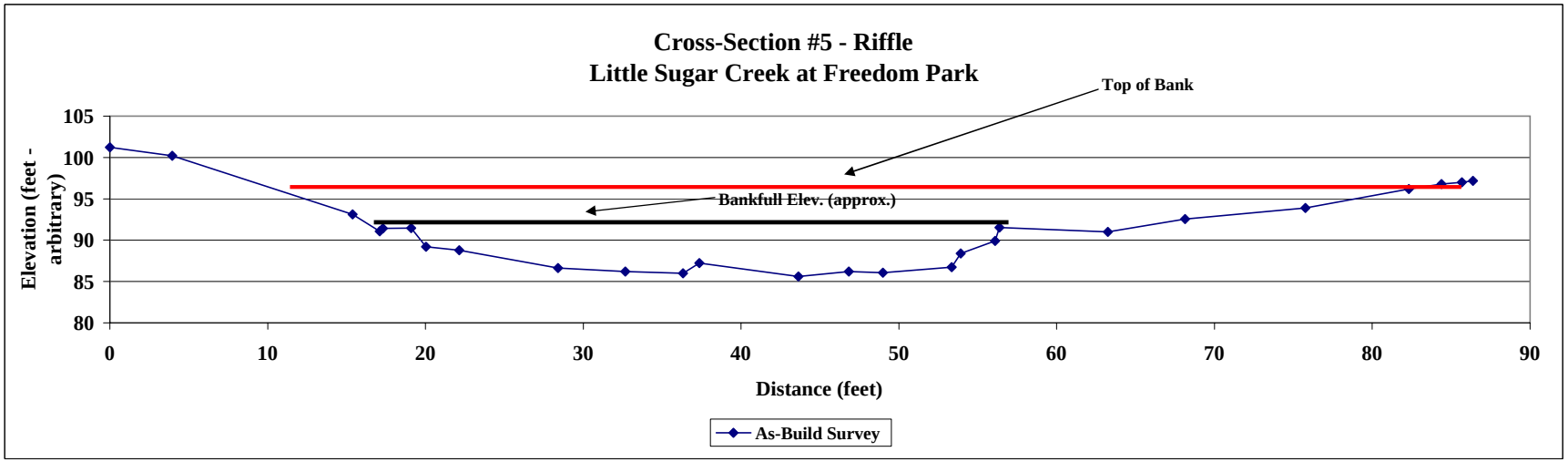
2004 As-Build Survey

Station	Elevation	Notes	
0	101.24	(X6LP)	
3.95	100.2	(X6)	TOB
15.38	93.13	(X6)	BKF
17.1	91.07	(X6)	
17.31	91.44	(X6)	
19.1	91.47	(X6)	
20.04	89.21	(X6)	
22.14	88.79	(X6)	
28.4	86.64	(X6W)	
32.67	86.21	(X6)	
36.32	85.98	(X6T)	
37.35	87.22	(X6W)	
43.63	85.61	(X6)	
46.82	86.2	(X6)	
48.98	86.06	(X6)	
53.35	86.72	(X6W)	
53.92	88.4	(X6)	
56.09	89.92	(X6)	
56.38	91.52	(X6)	BKF
63.24	91	(X6)	
68.14	92.54	(X6)	
75.76	93.88	(X6)	
82.32	96.2	(X6)	
84.38	96.78	(X6)	TOB
85.68	97	(X6)	
86.39	97.17	(X5RP)	

-4.8

Photo of Cross-Section #5 - Looking Upstream

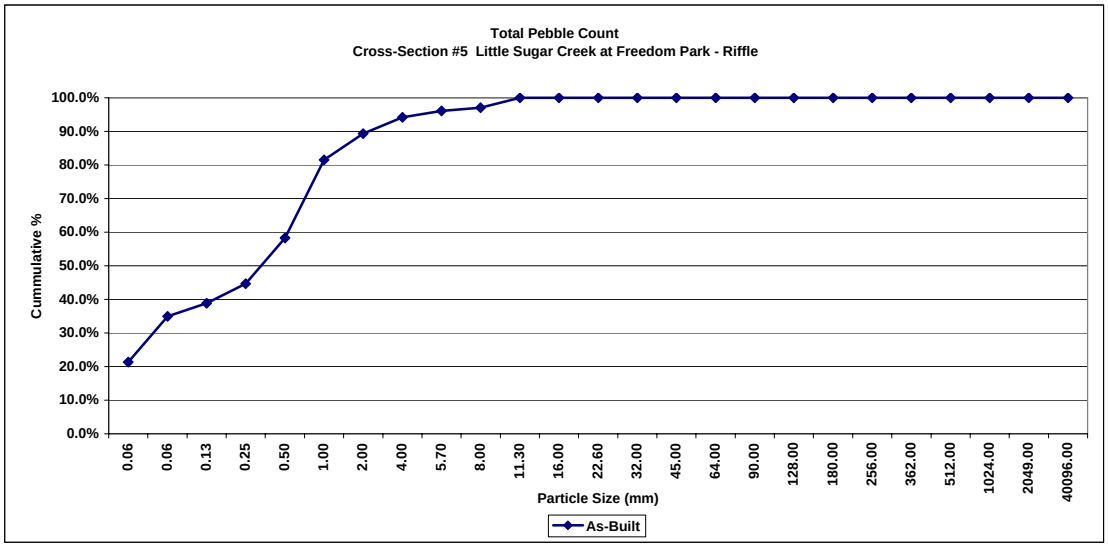
As-Built	BKF	TOB
Area	168.5	510.0
Width	39.1	75.3
Mean Deptl	4.3	6.8
Max Depth	5.9	11.4



Project Name	Little Sugar Creek at Freedom Park
Cross Section	#5
Feature	Riffle
Date	6/15/04
Crew	Shaffer, Bidelspach, Clinton

		2004		As-Built		
Description	**Material**	**Size (mm)**	**Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	10	12	21.4%	21.4%
Sand	very fine sand	0.062	6	8	13.6%	35.0%
	fine sand	0.125	2	2	3.9%	38.8%
	medium sand	0.25	5	1	5.8%	44.7%
	course sand	0.50	14	0	13.6%	58.3%
	very course sand	1.0	24	0	23.3%	81.6%
G r a v e l	very fine gravel	2.0	4	4	7.8%	89.3%
	fine gravel	4.0	2	3	4.9%	94.2%
	fine gravel	5.7	2	0	1.9%	96.1%
	medium gravel	8.0	1	0	1.0%	97.1%
	medium gravel	11.3	3	0	2.9%	100.0%
	course gravel	16.0	0	0	0.0%	100.0%
	course gravel	22.6	0	0	0.0%	100.0%
	very course gravel	32	0	0	0.0%	100.0%
	very course gravel	45	0	0	0.0%	100.0%
Cobble	small cobble	64	0	0	0.0%	100.0%
	medium cobble	90	0	0	0.0%	100.0%
	large cobble	128	0	0	0.0%	100.0%
	very large cobble	180	0	0	0.0%	100.0%
Boulder	small boulder	256	0	0	0.0%	100.0%
	small boulder	362	0	0	0.0%	100.0%
	medium boulder	512	0	0	0.0%	100.0%
	large boulder	1024	0	0	0.0%	100.0%
	very large boulder	2049	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	0	0.0%	100.0%
TOTAL / %of whole count			73	30	100.0%	

	d16	**d35**	**d50**	**d84**	**d95**
As-Built	0.06	0.09	0.52	1.97	5.70



Project Name	Little Sugar Creek at Freedom Park
Cross Section	#6
Feature	Pool **Station:** 26+50
Date	7/15/04
Crew	Bidelspach, Clinton

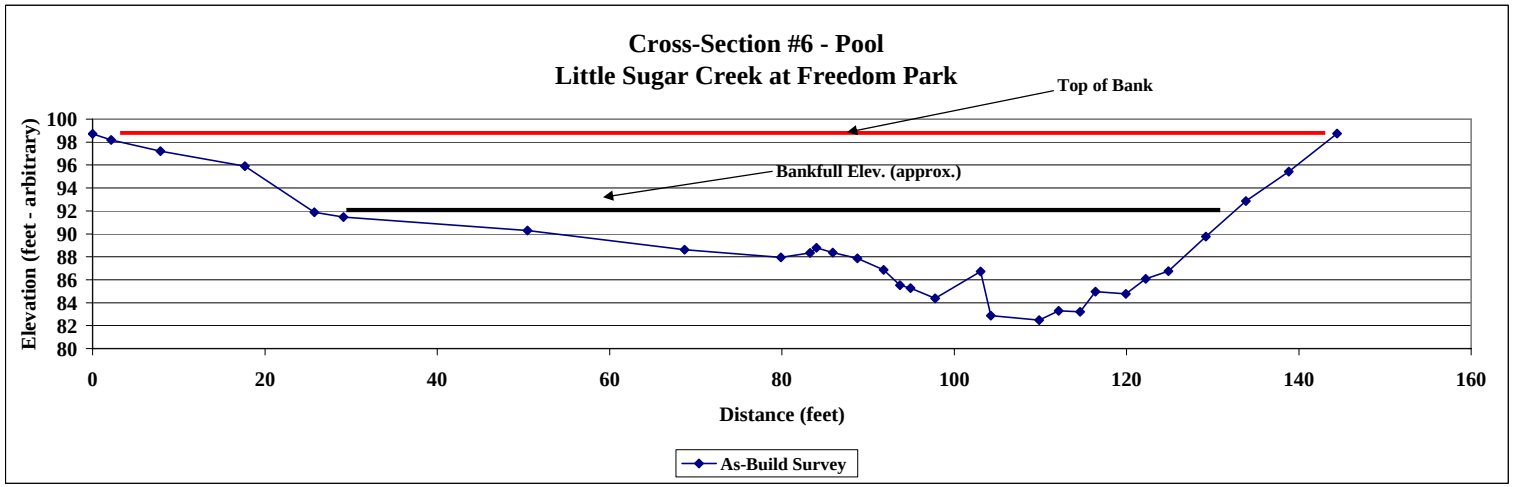
2004 As-Build Survey

Station	Elevation	Notes	
0	98.72	(X7RP)	
2.14	98.2	(X7)	TOB
7.88	97.2	(X7)	
17.68	95.91	(X7)	
25.73	91.89	(X7)	BKF
29.13	91.47	(X7)	
50.49	90.28	(X7)	
68.7	88.63	(X7)	
79.89	87.96	(X7)	
83.26	88.35	(X7)	
84	88.8	(X7)	
85.9	88.38	(X7)	
88.77	87.88	(X7)	
91.81	86.85	(X7)	
93.7	85.53	(X7)	
94.94	85.28	(X7)	
97.79	84.39	(X7)	
103.08	86.73	(X7W)	
104.26	82.86	(X7)	
109.85	82.49	(X7)	
112.14	83.28	(X7)	
114.6	83.21	(X7)	
116.39	84.97	(X7)	
119.93	84.76	(X7)	
122.24	86.07	(X7)	
124.86	86.74	(X7W)	
129.21	89.77	(X7)	
133.86	92.86	(X7)	BKF
138.82	95.43	(X7)	
144.43	98.74	(X7)	
147.4	100.09	(X7LP)	TOB

-5.15

Photo of Cross-Section #6 - Looking Upstream

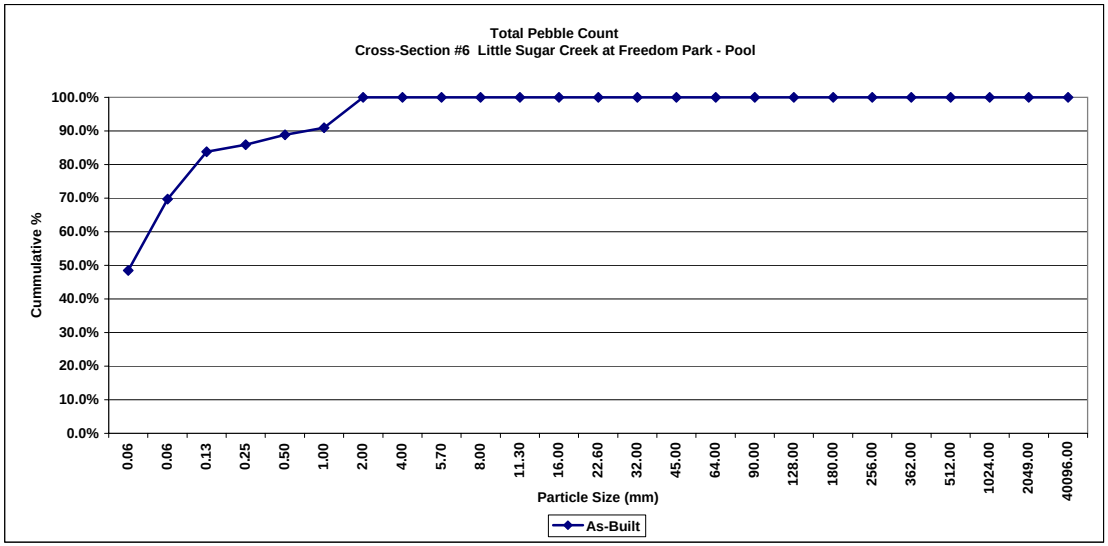
As-Built	BKF	TOB
Area	414.2	1177.4
Width	106.5	142.3
Mean Dept	3.9	8.3
Max Depth	9.4	15.7



Project Name	Little Sugar Creek at Freedom Park
Cross Section	#6
Feature	Pool
Date	6/15/04
Crew	Shaffer, Bidelspach, Clinton

		2004	As-Built			
Description	**Material**	**Size (mm)**	**Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	18	30	48.5%	48.5%
Sand	very fine sand	0.062	8	13	21.2%	69.7%
	fine sand	0.125	4	10	14.1%	83.8%
	medium sand	0.25	0	2	2.0%	85.9%
	course sand	0.50	3	0	3.0%	88.9%
	very course sand	1.0	2	0	2.0%	90.9%
Gravel	very fine gravel	2.0	5	4	9.1%	100.0%
	fine gravel	4.0	0	0	0.0%	100.0%
	fine gravel	5.7	0	0	0.0%	100.0%
	medium gravel	8.0	0	0	0.0%	100.0%
	medium gravel	11.3	0	0	0.0%	100.0%
	course gravel	16.0	0	0	0.0%	100.0%
	course gravel	22.6	0	0	0.0%	100.0%
	very course gravel	32	0	0	0.0%	100.0%
	very course gravel	45	0	0	0.0%	100.0%
Cobble	small cobble	64	0	0	0.0%	100.0%
	medium cobble	90	0	0	0.0%	100.0%
	large cobble	128	0	0	0.0%	100.0%
	very large cobble	180	0	0	0.0%	100.0%
Boulder	small boulder	256	0	0	0.0%	100.0%
	small boulder	362	0	0	0.0%	100.0%
	medium boulder	512	0	0	0.0%	100.0%
	large boulder	1024	0	0	0.0%	100.0%
	very large boulder	2049	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	0	0.0%	100.0%
TOTAL / %of whole count			40	59	100.0%	

	d16	**d35**	**d50**	**d84**	**d95**
As-Built	0.06	0.06	0.06	0.20	2.18



Project Name	Little Sugar Creek at Freedom Park
Cross Section	#7
Feature	Riffle **Station:** 30+00
Date	7/15/04
Crew	Bidelspach, Clinton

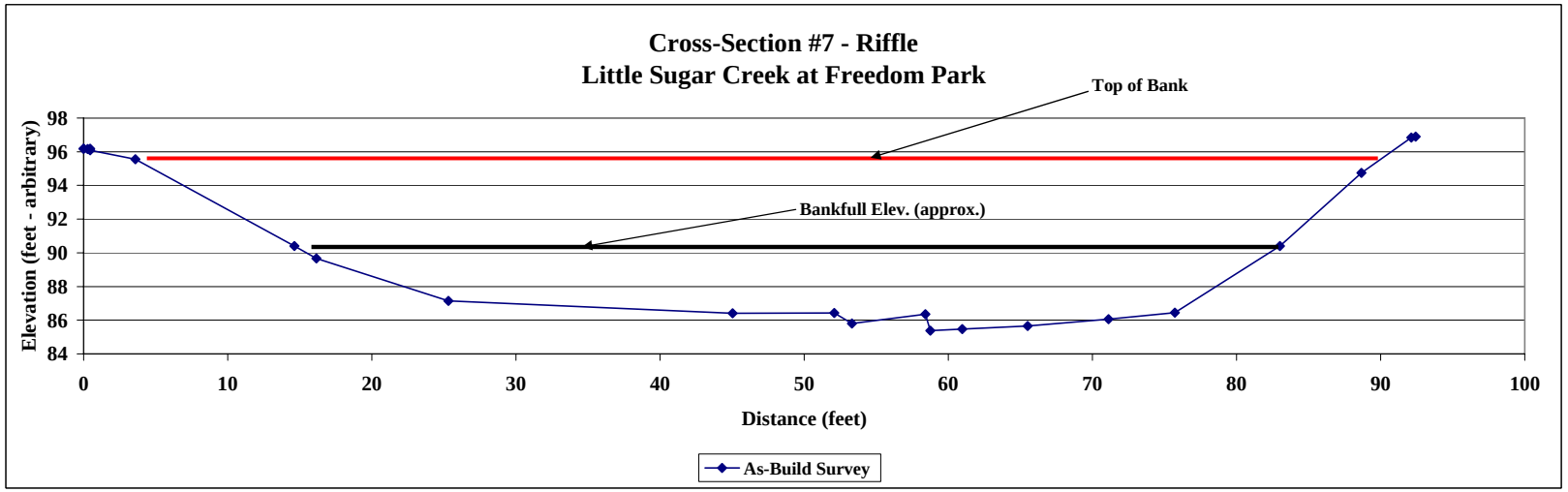
2004 As-Build Survey

Station	Elevation	Notes	
0	96.17	(X8LP)	
0	96.17	(X8LP)	
0.28	96.16	(X8LP)	
0.45	96.17	(X8RP)	TOB
0.46	96.08	(X7LP)	
3.6	95.56	(X8)	
14.63	90.4	(X8)	BKF
16.15	89.66	(X8)	
25.32	87.14	(X8)	
45.03	86.41	(X8)	
52.08	86.42	(X8)	
53.32	85.81	(X8)	
58.4	86.36	(X)	
58.76	85.38	(X8T)	
60.97	85.47	(X8W)	
65.5	85.66	(X8)	
71.11	86.06	(X8)	
75.72	86.45	(X8)	
83	90.4		BKF
88.67	94.74	(X8)	
92.12	96.84	(X7LP)	
92.43	96.9	(X8RP)	TOB

-4.93

Photo of Cross-Section #7 - Looking at left bank

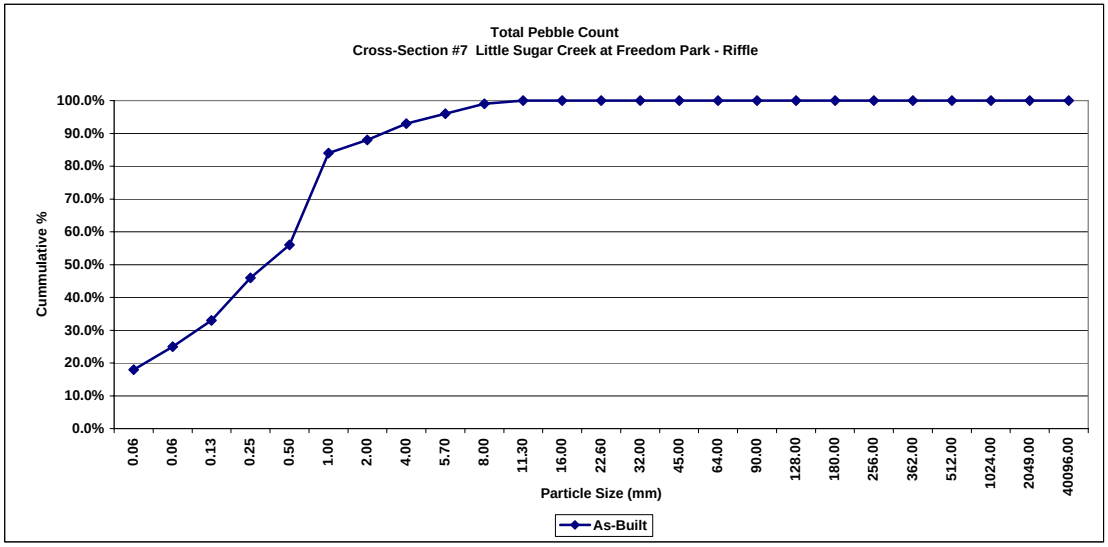
As-Built	BKF	TOB
Area	250.4	658.2
Width	74.0	88.2
Mean Depth	3.4	7.5
Max Depth	5.0	10.8



Project Name	Little Sugar Creek at Freedom Park
Cross Section	#7
Feature	Riffle
Date	6/15/04
Crew	Shaffer, Bidelspach, Clinton

		2004	As-Built			
Description	**Material**	**Size (mm)**	**Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	4	14	18.0%	18.0%
Sand	very fine sand	0.062	2	5	7.0%	25.0%
	fine sand	0.125	4	4	8.0%	33.0%
	medium sand	0.25	10	3	13.0%	46.0%
	course sand	0.50	4	6	10.0%	56.0%
	very course sand	1.0	16	12	28.0%	84.0%
Gravel	very fine gravel	2.0	0	4	4.0%	88.0%
	fine gravel	4.0	0	5	5.0%	93.0%
	fine gravel	5.7	0	3	3.0%	96.0%
	medium gravel	8.0	0	3	3.0%	99.0%
	medium gravel	11.3	0	1	1.0%	100.0%
	course gravel	16.0	0	0	0.0%	100.0%
	course gravel	22.6	0	0	0.0%	100.0%
	very course gravel	32	0	0	0.0%	100.0%
	very course gravel	45	0	0	0.0%	100.0%
Cobble	small cobble	64	0	0	0.0%	100.0%
	medium cobble	90	0	0	0.0%	100.0%
	large cobble	128	0	0	0.0%	100.0%
	very large cobble	180	0	0	0.0%	100.0%
Boulder	small boulder	256	0	0	0.0%	100.0%
	small boulder	362	0	0	0.0%	100.0%
	medium boulder	512	0	0	0.0%	100.0%
	large boulder	1024	0	0	0.0%	100.0%
	very large boulder	2049	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	0	0.0%	100.0%
TOTAL / %of whole count			40	60	100.0%	

	d16	**d35**	**d50**	**d84**	**d95**
As-Built	0.06	0.22	0.53	1.50	6.18



Project Name	Little Sugar Creek at Freedom Park
Cross Section	#8
Feature	Riffle **Station:** 34+33
Date	7/15/04
Crew	Bidelspach, Clinton

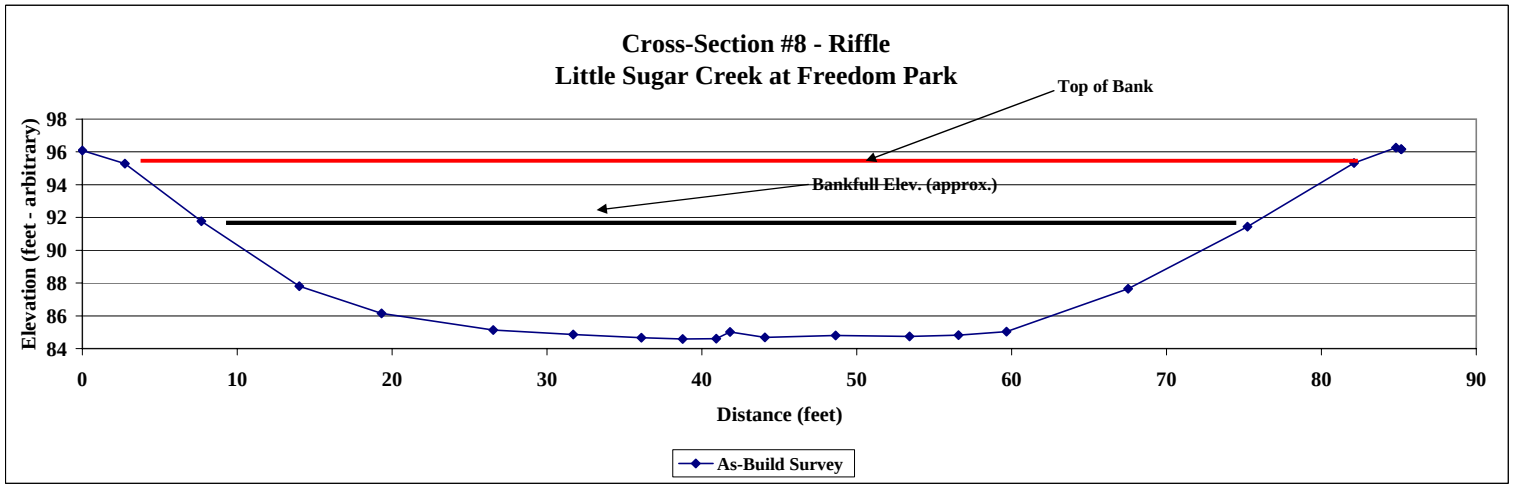
2004 As-Build Survey

Station	Elevation	Notes	
0	96.08	(X8RP)	
2.74	95.29	(X8)	TOB
7.69	91.77	(X8)	BKF
14.01	87.81	(X8)	
19.31	86.15	(X8)	
26.52	85.14	(X8)	
31.69	84.86	(X8W)	
36.09	84.66	(X8)	
38.77	84.59	(X8)	
40.94	84.6	(X8T)	
41.82	85.02	(X8W)	
44.07	84.69	(X8)	
48.64	84.8	(X8)	
53.4	84.75	(X8)	
56.58	84.82	(X8)	
59.67	85.04	(X8W)	
67.53	87.66	(X8)	
75.22	91.44	(X8)	BKF
82.1	95.32	(X8)	TOB
84.81	96.27	(X8LP)	
85.15	96.17	(X9LP)	
85.16	96.17	(X9LP)	

-6.4

Photo of Cross-Section #8 - Looking at left bank

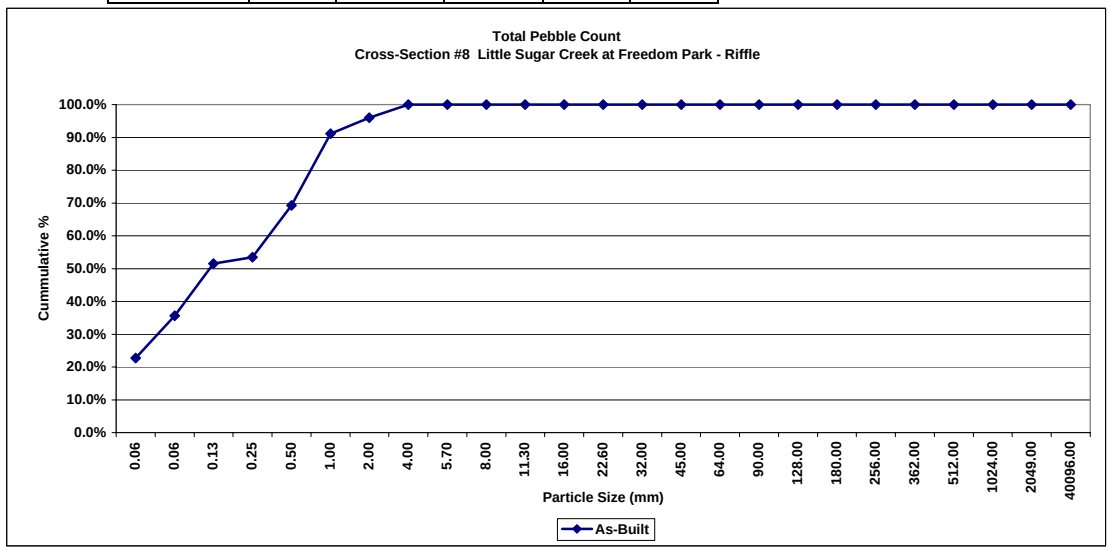
As-Built	BKF	TOB
Area	371.5	632.3
Width	67.5	79.4
Mean Dept	5.5	8.0
Max Depth	7.2	10.7



Project Name	Little Sugar Creek at Freedom Park
Cross Section	#8
Feature	Riffle
Date	6/15/04
Crew	Shaffer, Bidelspach, Clinton

		2004	As-Built			
Description	**Material**	**Size (mm)**	**Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	3	20	22.8%	22.8%
Sand	very fine sand	0.062	2	11	12.9%	35.6%
	fine sand	0.125	4	12	15.8%	51.5%
	medium sand	0.25	0	2	2.0%	53.5%
	course sand	0.50	10	6	15.8%	69.3%
	very course sand	1.0	20	2	21.8%	91.1%
Gravel	very fine gravel	2.0	0	5	5.0%	96.0%
	fine gravel	4.0	2	2	4.0%	100.0%
	fine gravel	5.7	0	0	0.0%	100.0%
	medium gravel	8.0	0	0	0.0%	100.0%
	medium gravel	11.3	0	0	0.0%	100.0%
	course gravel	16.0	0	0	0.0%	100.0%
	course gravel	22.6	0	0	0.0%	100.0%
	very course gravel	32	0	0	0.0%	100.0%
	very course gravel	45	0	0	0.0%	100.0%
Cobble	small cobble	64	0	0	0.0%	100.0%
	medium cobble	90	0	0	0.0%	100.0%
	large cobble	128	0	0	0.0%	100.0%
	very large cobble	180	0	0	0.0%	100.0%
Boulder	small boulder	256	0	0	0.0%	100.0%
	small boulder	362	0	0	0.0%	100.0%
	medium boulder	512	0	0	0.0%	100.0%
	large boulder	1024	0	0	0.0%	100.0%
	very large boulder	2049	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	0	0.0%	100.0%
TOTAL / %of whole count			41	60	100.0%	

	d16	**d35**	**d50**	**d84**	**d95**
As-Built	0.06	0.09	0.18	1.26	2.68



Project Name	Little Sugar Creek at Freedom Park
Cross Section	#9
Feature	Pool **Station:** 41+13
Date	7/15/04
Crew	Bidelspach, Clinton

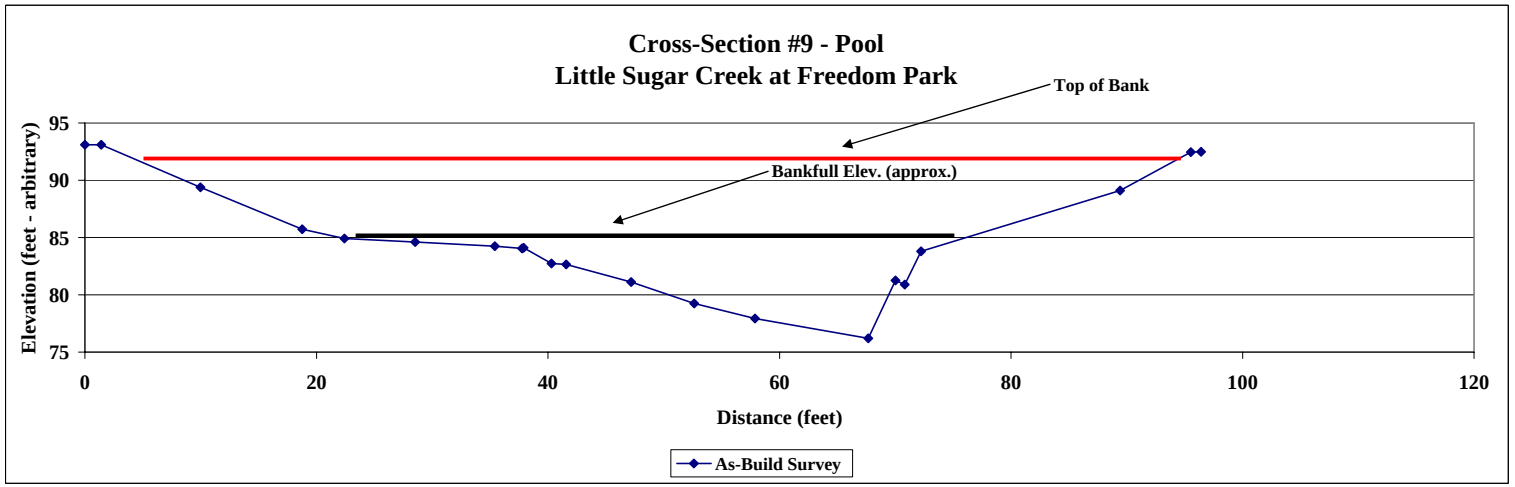
2004 As-Build Survey

Station	Elevation	Notes	
0	93.1	(X9RP)	
1.4	93.11	(X9)	TOB
9.98	89.38	(X9)	
18.76	85.74	(X9)	
22.41	84.93	(X9)	BKF
28.52	84.61	(X9)	
35.41	84.25	(X9)	
37.75	84.06	(X9)	
37.91	84.11	(X9)	
40.31	82.74	(X9)	
41.57	82.65	(X9)	
47.19	81.12	(X9)	
52.64	79.24	(X9)	
57.88	77.94	(X9)	
67.66	76.19	(X9)	
70.03	81.27	(X9)	
70.81	80.89	(X9W)	
72.22	83.8	(X9)	BKF
89.42	89.1	(X9)	
95.53	92.47	(X9)	TOB
96.43	92.5	(X9RP)	

-4.04

Photo of Cross-Section #9 - Looking Downstream

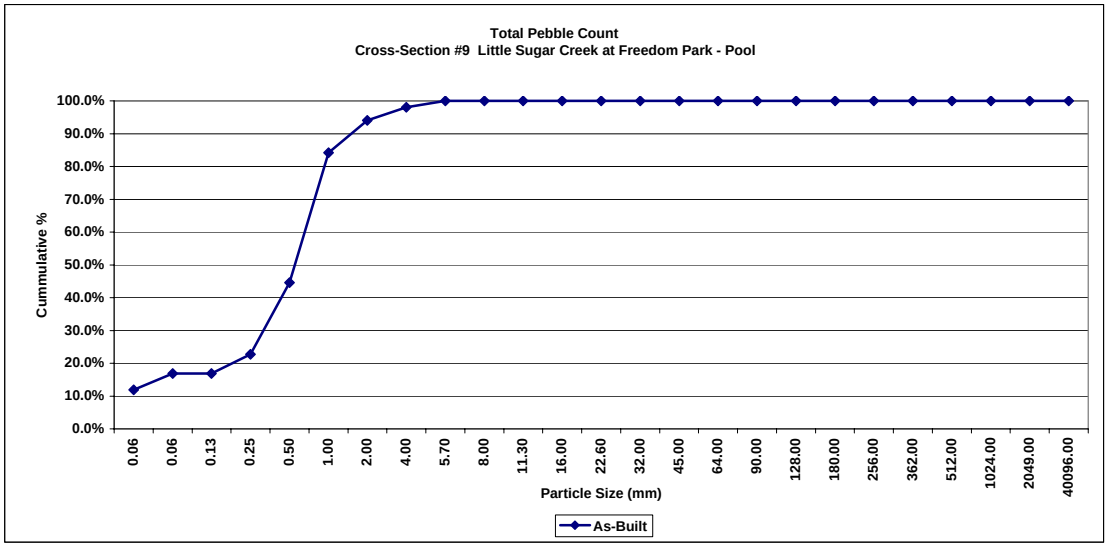
As-Built	BKF	TOB
Area	189.0	759.1
Width	52.8	94.1
Mean Dept	3.6	8.1
Max Depth	8.7	16.3



Project Name	Little Sugar Creek at Freedom Park
Cross Section	#9
Feature	Pool
Date	6/15/04
Crew	Shaffer, Bidelspach, Clinton

		2004	As-Built			
Description	**Material**	**Size (mm)**	**Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	3	9	11.9%	11.9%
Sand	very fine sand	0.062	2	3	5.0%	16.8%
	fine sand	0.125	0	0	0.0%	16.8%
	medium sand	0.25	2	4	5.9%	22.8%
	course sand	0.50	10	12	21.8%	44.6%
	very course sand	1.0	20	20	39.6%	84.2%
G r a v e l	very fine gravel	2.0	2	8	9.9%	94.1%
	fine gravel	4.0	2	2	4.0%	98.0%
	fine gravel	5.7	0	2	2.0%	100.0%
	medium gravel	8.0	0	0	0.0%	100.0%
	medium gravel	11.3	0	0	0.0%	100.0%
	course gravel	16.0	0	0	0.0%	100.0%
	course gravel	22.6	0	0	0.0%	100.0%
	very course gravel	32	0	0	0.0%	100.0%
	very course gravel	45	0	0	0.0%	100.0%
Cobble	small cobble	64	0	0	0.0%	100.0%
	medium cobble	90	0	0	0.0%	100.0%
	large cobble	128	0	0	0.0%	100.0%
	very large cobble	180	0	0	0.0%	100.0%
Boulder	small boulder	256	0	0	0.0%	100.0%
	small boulder	362	0	0	0.0%	100.0%
	medium boulder	512	0	0	0.0%	100.0%
	large boulder	1024	0	0	0.0%	100.0%
	very large boulder	2049	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	0	0.0%	100.0%
TOTAL / %of whole count			41	60	100.0%	

	d16	**d35**	**d50**	**d84**	**d95**
As-Built	0.09	0.59	0.85	1.50	3.44



Project Nai Little Sugar Creek at Freedom Park
Task Longitudinal Profile

Date 7/15/04
Crew Bidelspach, Clinton

TW Station	TW Elevation	TW Descrip	WS Station	WS Elevation	Feature Notes
0	88.63	(MP)			
2.26	88.91	(T)	16.54	91.2	
24.92	90.29	(P)	24.61	90.59	TP
34.26	88.93	(MP)	34.84	90.59	
44.4	89.39	(T)	44.63	90.38	
56.76	88.02	(MP)	56.17	90.63	
65.87	88.76	(G)	67.27	90.7	
72.85	89.45	(U)	72.69	90.52	
95.37	89.62	(T)	95.32	90.91	
109.93	89.6	(T)	109.82	90.61	
130.74	89.42	(T)	130.11	90.76	
146.29	89.58	(T)	146.48	90.68	
173.55	90.04	(T)	173.2	90.69	
196.96	90.2	(T)	196.92	90.79	TR
			219.87	90.6	
236.61	90.01	(T)	236.3	90.46	
258.96	89.49	(U)	258.64	89.93	TU
279.49	88.87	(T)	279.56	89.92	
302.79	88.53	(T)	302.11	90	
319.73	88.77	(T)	319.26	90.08	
336.81	88.55	(T)	336.21	90.05	
355.6	88.65	(T)	355.49	90.01	
375.14	88.35	(T)	374.63	89.97	
394.24	88.85	(T)	393.58	90.15	
415.25	89.19	(T)	414.74	90.04	
434.04	88.1	(T)	433.61	90.07	
456.4	88.57	(T)	455.93	90.05	
477.87	88.89	(T)	477.92	90.11	
500.42	88.85	(T)	499.87	90.13	
520.46	89.32	(T)	520.6	90.15	
539.08	89.61	(R)	538.97	90.09	TR
554.25	89.46	(T)	554.46	89.81	
574.26	88.94	(U)	574.31	89.5	TP
593.38	88.35	(T)	593.05	89.55	
615.3	88.28	(T)	615.21	89.53	
637.25	88.39	(T)	637.39	89.46	
667.22	88.71	(T)	667.21	89.49	
695.83	89.16	(T)	695.71	89.57	
723.08	89.36	(R)	723.01	89.55	TU
748.92	88.43	(T)	748.76	89.54	Bridge
760.07	88.55	(T)	760.28	89.5	
770.31	88.26	(T)	770.49	89.53	
786.28	89.15	(T)	787.03	89.64	
800.87	89.04	(T)	803.08	89.65	
812.39	88.93	(T)			
826.91	89.08	(T)			
843.26	88.59	(T)	843.23	89.41	
895.82	88.54	(T)	896.36	89.41	TP
918.45	88.33	(T)	918.28	89.35	
945.14	88.1	(T)	945.32	89.28	
987.29	88.59	(T)			
1002.08	88.86	(T)	1002.3	89.33	
1027.45	89.19	(R)	1028.26	89.51	TR
1052.67	88.95	(T)	1052.21	88.98	
1071.39	87.93	(T)	1073.17	88.73	
1092.67	87.7	(T)	1093.42	88.47	TU
1103.94	87.6	(T)	1103.78	88.62	
1122.19	88.28	(T)	1123.42	88.52	
1147.92	87.62	(T)	1148.44	88.41	
1180.37	87.39	(T)	1180.41	88.49	
1205.19	87.55	(T)	1205.47	88.39	
1218.18	87.01	(P)	1218.27	88.32	TP
1229.19	86.8	(T)			
1239.86	86.7	(T)	1239.97	88.4	
1257.81	86.69	(T)	1257.57	88.5	
1271.7	86.82	(T)	1271.56	88.6	
1283.6	86.76	(T)	1283.71	88.53	
1306.89	87.27	(T)	1306.81	88.64	
1319.54	87	(T)	1319.93	88.49	
1335.28	86.76	(T)	1335.11	88.65	
1347.6	86.34	(P)	1346.85	88.49	
1360.94	87.18	(G)	1359.87	88.5	
1374.17	88.01	(T)	1374.69	88.5	TR
1397.02	88	(R)	1397.54	88.25	
1430.75	87.63	(T)	1430.75	88.26	TU
1457.4	87.14	(P)	1457.62	88.27	TP
1470.06	86.7	(M)	1469.15	88.31	
1480.71	85.96	(M)	1480.73	88.22	
1496.44	85.78	(T)	1495.06	88.24	
1513.43	86.55	(T)	1513.51	88.28	
1535.18	86.77	(T)	1535.37	88.26	TU
1546.5	86.61	(T)	1544.67	87.83	
1563.72	86.32	(T)	1565.84	87.77	
1593.84	86.66	(T)	1594.51	88	
1616.49	86.19	(T)	1615.67	87.89	
1626.89	85.67	(T)	1625.83	88.09	
1641.51	85.68	(P)	1640.83	87.98	

TW Station	TW Elevation	TW Descrip	WS Station	WS Elevation	Feature Notes
1654.43	86.48	(T)	1653.8	87.95	
1681.15	86.91	(T)	1669.49	87.94	TR
1688.71	87.02	(T)	1688.55	87.54	
1700.09	86.72	(T)	1700.45	87.41	TU
1712.33	86.91	(T)	1711.29	87.43	
1730.6	86.79	(T)	1729.91	87.44	
1746.81	86.37	(T)	1746.76	87.39	
1764.39	86.02	(T)	1763.56	87.37	
1786.61	86.31	(T)	1786.21	87.46	
1801.74	85.94	(T)	1800.82	87.42	
1815.87	85.98	(T)	1816.21	87.48	
1832.06	86.08	(T)	1833.15	87.47	
1852.73	86.09	(T)	1852.64	87.46	TP
1865.32	85.79	(T)	1865.5	87.42	
1880.85	85.79	(T)			
1889.88	85.4	(T)	1890.24	87.41	
1905.22	85.44	(T)	1905.95	87.4	
1916.77	85.3	(T)	1917.46	87.38	
1930.96	85.28	(T)	1931	87.42	
1943.9	86.11	(T)	1944.93	87.32	
		(T)	1963.73	87.53	
1972.63	85.95	(T)	1973	87.44	
1978.79	85.93	(T)	1981.03	87.42	
1999.9	86.15	(T)	1999.7	87.5	
2019.56	85.93	(T)	2020.31	87.38	
2035.45	84.91	(T)	2035.84	87.49	
2052.36	85.43	(T)	2052.22	87.4	
2068.36	85.39	(MP)			
2074.78	86.1	(T)	2073.9	87.46	
			2087.52	87.52	TR
2090.96	86.37	(T)	2091.18	87.43	
2097.37	86.03	(T)	2098.18	87.34	
2110.54	86.44	(T)	2112.83	87.21	
2130.6	86.28	(T)	2129.75	87.24	
2143.73	86.3	(T)	2143.93	87.27	
2147.23	85.98	(T)	2147.31	87.23	
2168.25	86.44	(T)	2169.05	87.2	
2171.47	86.24	(T)	2169.91	87.21	
2182.48	86.22	(T)	2181.6	87.05	TP
2198.8	86.3	(T)	2197.92	87.21	
2216.05	85.52	(MP)	2216.5	87.13	
2237.29	85.7	(T)	2237.61	87.14	
2255.32	86.75	(T)	2255.07	87.11	
2279.93	86.17	(T)			Bridge
2293.43	86.99	(T)			
2305.81	86.84	(T)	2305.43	87.3	TR
2341.29	85.52	(M)	2340.96	87.25	
2364.24	86.73	(R)	2363.63	87.14	
2379.84	86.02	(P)	2379.61	86.89	TP
2399.94	85.83	(P)	2399.75	86.93	
2412.89	85.65	(T)	2412.81	86.97	
2431.98	85.87	(T)	2431.35	86.92	
2447.5	86.19	(T)	2446.39	86.92	
2456.34	86.42	(R)	2456.04	86.91	TR
2470.98	86.21	(U)	2471.31	86.78	TU
2499.21	85.47	(T)	2498.91	86.77	TP
2511.25	84.92	(P)	2511.08	86.74	
2522.83	84.14	(T)	2522.48	86.77	
2538.28	84.54	(T)	2538.09	86.74	
2554.98	84.66	(T)	2554.2	86.73	
2575.79	84.07	(T)	2576.35	86.58	
2580.16	84.04	(T)	2580.13	86.73	
2593.76	83.65	(M)	2593.93	86.76	
2610.84	82.58	(M)	2609.56	86.72	
2627	82.56	(M)	2626.6	86.84	
2649.39	82.62	(T)	2649.54	86.74	
2660.42	82.32	(T)	2662.39	86.61	
2664.79	83.59	(T)			
2677.89	82.89	(T)			
2683.8	83.03	(T)	2684.05	86.75	
2696.18	85.05	(T)	2696.03	86.72	
2702.85	85.83	(T)	2702.72	86.77	TU
2731.48	85.76	(T)	2731.59	86.73	
2756.67	85.01	(T)	2756.43	86.73	
2765.82	84.93	(T)			
2767.9	84.46	(T)	2768.36	86.74	
2787.8	85.16	(T)	2787.49	86.72	
2811.58	85.53	(T)	2811.92	86.73	
2841.63	85.74	(T)	2841.62	86.7	
2867.52	84.89	(T)			
2896.08	84.58	(T)	2896.99	86.74	
2924.56	85.2	(T)			
2951.3	85.64	(T)	2950.73	86.74	
2967.04	86.02	(T)	2967.27	86.71	TR
2980.89	85.58	(T)	2981.12	86.49	
2999.89	85.21	(T)	3001.99	86.25	
3012.96	85.48	(T)	3011.36	86.4	
3021.6	86.13	(T)			
3023.48	85.76	(T)	3023.27	86.44	
3046.07	85.45	(T)	3046.42	85.83	TU

TW Station	TW Elevation	TW Descrip	WS Station	WS Elevation	Feature Notes
3072.14	85.02	(T)	3072.16	85.77	
3095.67	85.22	(T)	3095.65	85.75	
			3114.21	85.81	
3124.94	85.2	(T)	3124.75	85.76	
3141.97	85.39	(T)	3141.38	85.8	
3148.23	84.5	(P)	3148.04	85.73	TP
3162.88	84.16	(T)	3162.63	85.76	
3174.26	84.35	(T)	3174.22	85.74	
3194.54	84.3	(T)	3194.32	85.82	
3210.4	84.41	(T)	3209.69	85.78	
3217.87	84.99	(G)	3217.74	85.86	
3228.12	85.47	(R)	3228.04	85.78	TR
3262.84	85.26	(T)	3262.61	85.7	
3284.31	85.41	(T)	3284.29	85.69	
3303.09	85.2	(T)	3303.11	85.53	
3315.99	84.87	(T)	3315.86	85.54	TP
3332.33	84.32	(T)	3331.99	85.56	
3347.17	84.26	(T)	3346.67	85.57	
3363.19	84.29	(T)	3362.95	85.57	
3384.47	84.49	(T)	3383.79	85.55	
3402.54	84.83	(R)	3402.63	85.55	TR
3426.95	84.71	(T)	3426.89	85.03	
3446.87	84.25	(T)	3446.64	84.86	
3468.98	83.8	(M)	3468.72	84.79	TU
3486.64	84.1	(T)	3486.73	84.74	
3505.2	83.86	(T)	3505.31	84.76	
3526.3	84.03	(T)	3526.36	84.74	
3550.98	84.04	(T)	3551.1	84.71	
3573.67	84.43	(R)	3573.59	84.75	TR
3595.45	84.11	(T)	3595.58	84.46	
3617.82	84.1	(T)	3617.75	84.29	
3636.15	83.18	(T)	3635.91	83.86	
3649.54	83.26	(T)			Bridge
3664.03	83.11	(T)	3664.4	83.57	
3686.24	82.46	(T)	3686.52	82.76	
			3694.38	82.64	
3705.72	81.64	(P)	3706.44	82.47	
3715.87	81.23	(T)	3716.14	82.47	
3722.09	80.57	(M)	3723.76	82.52	
3728.09	81.52	(T)	3728.34	82.47	
3737.71	81.72	(T)	3737.75	82.45	
3753.59	82.07	(R)	3753.81	82.34	
3767.07	81.57	(T)	3767.54	82.06	
3780.75	81.11	(T)	3781	82.01	TU
3790	80.69	(M)	3789.8	82	
3795.86	81.03	(T)	3795.94	82.02	
3813.82	81.14	(T)	3814.34	81.91	
3831.88	80.94	(T)			
3840.11	80.66	(T)	3839.7	81.82	
3846.75	80.19	(M)	3846.81	81.83	
3858.96	80.87	(P)	3859.01	81.75	TP
3884.73	79.21	(M)	3885.07	81.7	
3898.41	79.97	(T)	3898.78	81.75	
3910.22	78.89	(M)	3909.3	81.83	
3923.92	79.42	(T)	3924.06	81.65	
3939.07	80.05	(T)	3938.91	81.81	
3951.75	80.79	(T)	3951.34	81.86	
			3969.72	81.81	TR
3969.9	81.36				
3988.15	81.23	(T)	3988.08	81.69	
4005.49	81.06	(T)	4005.43	81.52	
4026.04	80.58	(T)	4025.99	81.44	
4041.77	80.49	(T)	4041.6	81.16	
4049.47	80.06	(T)	4049.3	80.97	
4054.64	79.57	(P)	4054.36	80.83	TP
4069.23	77.94	(T)	4069.41	80.77	
4085.43	76.96	(M)	4085.44	80.89	
4093.93	76.15	(M)	4094.94	80.69	
4103.58	76.57	(T)	4103.89	80.87	
4117.36	76.32	(T)	4117.84	81.16	
4120.34	76.44	(M)	4120.66	80.67	
4135.59	76.73	(T)	4135.26	80.87	
4150.19	77.44	(T)	4150.01	80.78	
4163.83	78.54	(T)	4163.97	80.86	
4184.64	77.96	(T)	4186.17	80.73	
4218.83	77.52	(T)	4219.31	80.82	
4234.79	78.01	(T)	4234.38	80.77	
4249.98	79.23	(T)	4250.65	80.79	
			4259.33	80.75	
			4268.28	80.79	
4284.37	79.75	(T)	4284.29	80.81	
4306.79	80.14	(T)	4306.68	80.78	TR
4330.04	80.06	(T)	4329.01	80.39	TU
4360.25	78.72	(T)	4360.27	80.48	
4380.91	78.9	(T)	4381.22	80.36	
4391.95	78.48	(T)	4392.15	80.44	
4410.96	78.99	(T)	4410.5	80.35	
4439.69	79.6	(T)	4440.69	80.37	TR
4455.24	79.82	(R)	4454.43	80.23	
4479.6	79.04	(T)	4479.63	79.98	

Project Name	Little Pine and Brush Creeks
Task	Feature Slope and Length Calculations
Date	7/15/04
Crew	Shaffer, Bidelspach, Clinton

As-Built 2004 data

Little Sugar Riffle

Station	Length	Water elevation	change	slope
197		90.79		
259	62	89.93	0.86	1.39%
539		90.09		
574	35	89.5	0.59	1.67%
1028		89.51		
1093	65	88.47	1.04	1.60%
1375		88.5		
1431	56	88.26	0.24	0.43%
1669		87.94		
1700	31	87.41	0.53	1.71%
2088		87.52		
2182	94	87.05	0.47	0.50%
2305		87.3		
2380	74	86.89	0.41	0.55%
2456		86.91		
2471	15	86.78	0.13	0.85%
2967		86.71		
3046	79	85.83	0.88	1.11%
3228		85.78		
3316	88	85.54	0.24	0.27%
3403		85.55		
3469	66	84.79	0.76	1.15%
3574		84.75		
3781	207	82.01	2.74	1.32%
3970		81.81		
4054	85	80.83	0.98	1.16%
4307		80.78		
4329	22	80.39	0.39	1.75%

Little Sugar Run

Station	Length	Water elevation	change	slope
258.64		89.93		
538.97	280.33	90.09	-0.16	-0.06%
723.01		89.55		
896.36	173.35	89.41	0.14	0.08%
1093.42		88.47		
1218.27	124.85	88.32	0.15	0.12%
1430.75		88.26		
1457.62	26.87	88.27	-0.01	-0.04%
1535.37		88.26		
1669.49	134.12	87.94	0.32	0.24%
1700.45		87.41		
1852.64	152.19	87.46	-0.05	-0.03%
2471.31		86.78		
2498.91	27.6	86.77	0.01	0.04%
2702.72		86.77		
2967.27	264.55	86.71	0.06	0.02%
3046.42		85.83		
3148.04	101.62	85.73	0.1	0.10%
3468.72		84.79		
3573.59	104.87	84.75	0.04	0.04%
3781		82.01		
3859.01	78.01	81.75	0.26	0.33%
4329.01		80.39		
4440.69	111.68	80.37	0.02	0.02%

Pool	length	p-p spacing
24.61		
196.92	172.31	
574.31		
723.01	148.7	537.895
896.36		
1028.26	131.9	313.65
1218.27		
1374.69	156.42	334.17
1457.62		
1535.37	77.75	200.015
1852.64		
2087.52	234.88	473.585
2181.6		
2305.43	123.83	273.435
2379.61		
2456.04	76.43	174.31
2498.91		
2702.72	203.81	182.99
3148.04		
3228.04	80	587.225
3315.86		
3402.63	86.77	171.205
3859.01		
3969.72	110.71	555.12
4054.36		
4306.68	252.32	266.155

PROFILE	Little Sugar Creek As-built		
	Min	Max	Median
Riffle Length	15	207	66
Riffle Slope	0.27%	1.75%	1.15%
Run Length	27	280	118
Run Slope	-0.06%	0.33%	0.04%
Pool Length	76	252	132
Pool to Pool Spacing	171	587	294
Average Water Surface Slope		0.25%	

Project Name	Little Sugar Creek at Freedom Park
Task	Channel Pattern Measurements
Date	
Crew	Shaffer, Bidelspach, Clinton

Little Sugar Creek 2004			
Radius of Curvature	**Meander Wavelength**	**Channel Beltwidth**	
232	584	135	
163	604	153	
206	531	164	
213	674	154	
88	427	105	
73	403	131	
151	446	138	
122	840	236	
144	487	228	
72			
91			
162			
72	403	105	***min***
232	840	236	***max***
147.5	531	153	***median***

Project Name	Little Sugar Creek at Freedom Park
Task	Vegetation Measurements
Location	Quad 1
Date	7/15/04
Crew	Hall

Tree Stratum

Species	Height (cm)	Diameter (mm)	Radius (mm)	Σ X-sec. (mm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)	Average
Quercus phellos	20	1.0	0.5	0.8					
	20	1.0	0.5	0.8					
	20	1.0	0.5	0.8					
	15	1.0	0.5	0.8					
	14	1.0	0.5	0.8					
	9	1.0	0.5	0.8					
	15	1.0	0.5	0.8					
	14	1.0	0.5	0.8					
	17	1.0	0.5	0.8					
	3	0.5	0.25	0.2					
	6	0.5	0.25	0.2					
	3	0.5	0.25	0.2					
	15	1.0	0.5	0.8					
	14	1.0	0.5	0.8					
	5	0.5	0.25	0.2					
	6	0.5	0.25	0.2					
	6	0.5	0.25	0.2					
	6	0.5	0.25	0.2					
	9	1.0	0.5	0.8					
	10	1.0	0.5	0.8					
	10	1.0	0.5	0.8					
	7	0.5	0.25	0.2					
	19	1.0	0.5	0.8					
	20	1.0	0.5	0.8					
	8	0.5	0.25	0.2					
	6	0.5	0.25	0.2					
	12	1.0	0.5	0.8					
	11	1.0	0.5	0.8					
	11	1.0	0.5	0.8					
	17	1.0	0.5	0.8					
	18	1.0	0.5	0.8					
	15	1.0	0.5	0.8					
Total				**19.2**	**10.3**	**32**	**48.5**	**2**	**29.4**
Liriodendron tulipifera	12	3.0	1.5	7.1					
Total				**7.1**	**3.8**	**1**	**1.5**	**6**	**2.7**
Acer rubrum	17	2.0	1	3.1					
	15.5	2.0	1	3.1					
Total				**6.3**	**3.4**	**2**	**3.0**	**5**	**3.2**
Fraxinus pennsylvanica	36	5.0	2.5	19.6					
	15	2.0	1	3.1					
	34	3.0	1.5	7.1					
	16.5	2.0	1	3.1					
	12.5	2.0	1	3.1					
	37	4.0	2	12.6					
	27	4.0	2	12.6					
	31	4.0	2	12.6					
Total	**209**	**26.0**	**13**	**73.8**	**39.6**	**8**	**12.1**	**3**	**25.9**
Liquidambar styraciflua	10	1.0	0.5	0.8					
	9	1.0	0.5	0.8					
	11	1.0	0.5	0.8					
	10	1.0	0.5	0.8					
Total	**40**	**4.0**	**2.0**	**3.1**	**1.7**	**4**	**6.1**	**4**	**3.9**
Ulmus sp.	54.5	5.0	2.5	19.6					
	54.5	5.0	2.5	19.6					
	39	3.0	1.5	7.1					
	35	2.0	1	3.1					
	18.3	1.0	0.5	0.8					
	18	1.0	0.5	0.8					
	49	2.0	1	3.1					
	21.5	1.0	0.5	0.8					
	30	2.0	1	3.1					
	42	2.0	1	3.1					
	20	1.0	0.5	0.8					
	24	1.0	0.5	0.8					
	20	1.0	0.5	0.8					
	24	1.0	0.5	0.8					
	27.5	1.0	0.5	0.8					
	31	2.0	1	3.1					
	15	1.0	0.5	0.8					
	15	1.0	0.5	0.8					
	24.5	3.0	1.5	7.1					
Total				**77.0**	**41.3**	**19**	**28.8**	**1**	**35.0**
Overall Total				**186.5**	**100**	**66**	**100**		
Total Trees per acre						2671			
Planted trees per acre						0			
Natural regen. trees per acre						2671			

Shrub Stratum

Species	Cover (%)	Rel. cover (%)	Density	Rel. Density (%)	Rank (Importance)
Sambucus canadensis	1	2.3	1	3.4	3
Salix nigra	2	4.5	4	13.8	2
Cornus amomum	40	90.9	23	79.3	1
Alnus serrulata	1	2.3	1	3.4	3
Total	**44**	**100.0**	**29**	**100**	
			1174	shrubs/acre	

Herb Stratum

Species	Cover (%)	Rel. cover (%)	Rank (Importance)
Ipomea sp.	1	0.9	7
Microstegium vimineum	5	4.3	4
Sorghum halapense	1	0.9	7
Bidens sp.	1	0.9	7
Commelina communis	20	17.2	2
Paspalum sp.	1	0.9	7
Polygonum sp.	70	60.3	1
Trifolium sp.	2	1.7	6
Mullein sp.	1	0.9	7
Impatiens sp.	10	8.6	3
Viola sp.	1	0.9	7
Ludwigia sp.	3	2.6	5
Total	**116**	**100**	

Project Name	Little Sugar Creek at Freedom Park
Task	Vegetation Measurements
Location	Quad 2
Date	7/15/04
Crew	Hall

Tree Stratum

Species	Height (cm)	Diameter (mm)	Radius (mm)	Σ X-sec. (mm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)	Average
Celtis sp.	32	3	1.5	7.1					
	18	2	1	3.1					
	22	3	1.5	7.1					
	11.5	1	0.5	0.8					
	18	3	1.5	7.1					
	14	1	0.5	0.8					
	18	1	0.5	0.8					
	11	1	0.5	0.8					
	19	2	1	3.1					
	10	1	0.5	0.8					
	9	1	0.5	0.8					
	9	1	0.5	0.8					
	8	1	0.5	0.8					
	10	1	0.5	0.8					
	8	1	0.5	0.8					
	6	0.5	0.25	0.2					
	9	1	0.5	0.8					
	11	1	0.5	0.8					
	12	1	0.5	0.8					
	8	1	0.5	0.8					
	7	0.5	0.25	0.2					
	3	1	0.5	0.8					
Total				**39.7**	**1.89**	**22**	**75.9**	**1**	**38.9**
Fraxinus pennsylvanica	121	20	10	314.2					
	127	30	15	706.9					
	144.5	21	10.5	346.4					
Total				**1367.4**	**65.32**	**3**	**10.3**	**2**	**37.8**
Quercus michauxii	119.5	8	4	50.3					
Total				**50.3**	**2.40**	**1**	**3.4**	**5**	**2.9**
Betula nigra	157.3	21	10.5	346.4					
	167	15	7.5	176.7					
Total				**523.1**	**24.99**	**2**	**6.9**	**3**	**15.9**
Platanus occidentalis	67	12	6	113.1					
Total				**113.1**	**5.40**	**1**	**3.4**	**4**	**4.4**
Overall Total				**2093.5**	**100.0**	**29**	**100**		
Total Trees per acre						1174			
Planted trees per acre						243			
Natural regen. trees per acre						931			

Shrub Stratum

Species	Cover (%)	Rel. cover (%)	Density	Rel. Density (%)	Rank (Importance)
Alnus serrulata	1	33.3	4	40	2
Sambucus canadensis	1	33.3	5	50	1
Unk. Sp.	1	33.3	1	10	3
Total	**3**	**100**	**10**	**100**	
			405		

Herb Stratum

Species	Cover (%)	Rel. cover (%)	Rank (Importance)
Paspalum sp.	30	75.0	1
Astrgalus gilviflorus	2	5.0	3
Unk.	1	2.5	4
Mullein sp.	3	7.5	2
Erigeron sp.	2	5.0	3
Panicum clandestinum	1	2.5	4
Trifolium sp.	1	2.5	4
Total	**40**	**100**	

Project Name	Little Sugar Creek at Freedom Park
Task	Vegetation Measurements
Location	Quad 3
Date	7/15/04
Crew	Hall

Tree Stratum

Species	Height (cm)	Diameter (mm)	Radius (mm)	Σ X-sec. (mm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)	Average
Acer rubrum	10	1	0.5	121.7		155			
(155 stem/avg ht 10cm)									
Total			**77.5**	**121.7**	**55.2**	**155**	**83.8**	**1**	**69.5**
Quercus rubra	12.2	2	1	3.1					
	12.2	2	1	3.1					
	12.2	2	1	3.1					
	7.7	2	1	3.1					
	8.5	1	0.5	0.8					
	7	1	0.5	0.8					
	14	3	1.5	7.1					
	14	2	1	3.1					
	16.5	3	1.5	7.1					
	8	2	1	3.1					
	9	3	1.5	7.1					
	10	2	1	3.1					
	18.5	2	1	3.1					
	18.5	2	1	3.1					
	14	2	1	3.1					
	12	3	1.5	7.1					
	12	2	1	3.1					
	12	2	1	3.1					
	11.5	2	1	3.1					
	12.6	1	0.5	0.8					
	21	3	1.5	7.1					
	8	2	1	3.1					
	12.2	2	1	3.1					
	3.7	3	1.5	7.1					
	10	1	0.5	0.8					
	9	1	0.5	0.8					
	12	1	0.5	0.8					
	9	2	1	3.1					
	9.5	1	0.5	0.8					
	4.3	1	0.5	0.8					
Total			**29**	**99.0**	**44.8**	**30**	**16.2**	**2**	**30.5**
Overall Total				**220.7**	**100**	**185**	**100**		
Total Trees per acre						7487			
Planted trees per acre						0			
Natural regen. trees per acre						7487			

Shrub Stratum

Species	Cover (%)	Rel. cover (%)	Density	Rel. Density (%)	Rank (Importance)
Aronia sp.	2	66.7	22	78.6	1
Cornus amomum	1	33.3	6	21.4	2
Total	**3**	**100**	**28**	**100**	
			1133		

Herb Stratum

Species	Cover (%)	Rel. cover (%)	Rank (Importance)
Bidens sp.	1	16.7	1
Toxicodendron radicans	1	16.7	1
Trifolium sp.	1	16.7	1
Epibolium angustifolium	1	16.7	1
Unk. 1	1	16.7	1
Commelina communus	1	16.7	1
Total	**6**	**100**	

Project Name	Little Sugar Creek at Freedom Park
Task	Vegetation Measurements
Location	Quad 4
Date	7/15/04
Crew	Hall

Tree Stratum

Species	Height (cm)	Diameter (mm)	Radius (mm)	Σ X-sec. (mm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)	Average
Prunus sp.	216	20	10	314.2					
	215	38	19	1134.1					
	254	33	16.5	855.3					
Total			**45.5**	**2303.6**	**52.8**	**3**	**6.8**	**2**	**29.8**
Quercus michauxii	147	18	9	254.5					
	82	15	7.5	176.7					
Total				**431.2**	**9.9**	**2**	**4.5**	**4**	**7.2**
Quercus phellos	233	15	7.5	176.7					
Total			**7.5**	**176.7**	**4.1**	**1**	**2.3**	**5**	**3.2**
Quercus falcata	105	13	6.5	132.7					
Total			**6.5**	**132.7**	**3.0**	**1**	**2.3**	**6**	**2.7**
Fraxinus sp.	304.8	25	12.5	490.9		1			
	138	15	7.5	176.7		1			
(9 stems)	1	1	4.5	63.6		9			
Total			**20**	**731.2**	**16.8**	**11**	**25**	**3**	**20.9**
Acer rubrum	92	11	5.5	95.0		1			
(25 stems)	10	1	12.5	490.9		25			
Total			**18**	**585.9**	**13.4**	**26**	**59.1**	**1**	**36.3**
Overall Total				**4361.3**	**100**	**44**	**100**		
Total Trees per acre						1781			
Planted trees per acre						405			
Natural regen. trees per acre						1376			

Shrub Stratum

Species	Cover (%)	Rel. cover (%)	Density	Rel. Density (%)	Rank (Importance)
Sambucus canadensis	1	100	5	100	
Total	**1**	**100**	**5**	**100**	
			202		

Herb Stratum

Species	Cover (%)	Rel. cover (%)	Rank (Importance)
Aster sp.	1	33.3	
Erichtites hieracifolia	1	33.3	
Unk.	1	33.3	
Total	**3**	**100**	