BURNSIDE BRIDGE ROAD

1+50

1+00

0+50

0+00

STEP

POOL

STEP

CHUTE

STEP

POOL

POOL

POOL

STEP

POOL

STEP

STEP

STEP

CHUTE

XBM

XS 1
0+64
POOL 1

XS 1
0+35
CHUTE 1

XS 1
0+17.6
RAPID 1

FERNROCK LANE (GRAVEL ROAD)

N

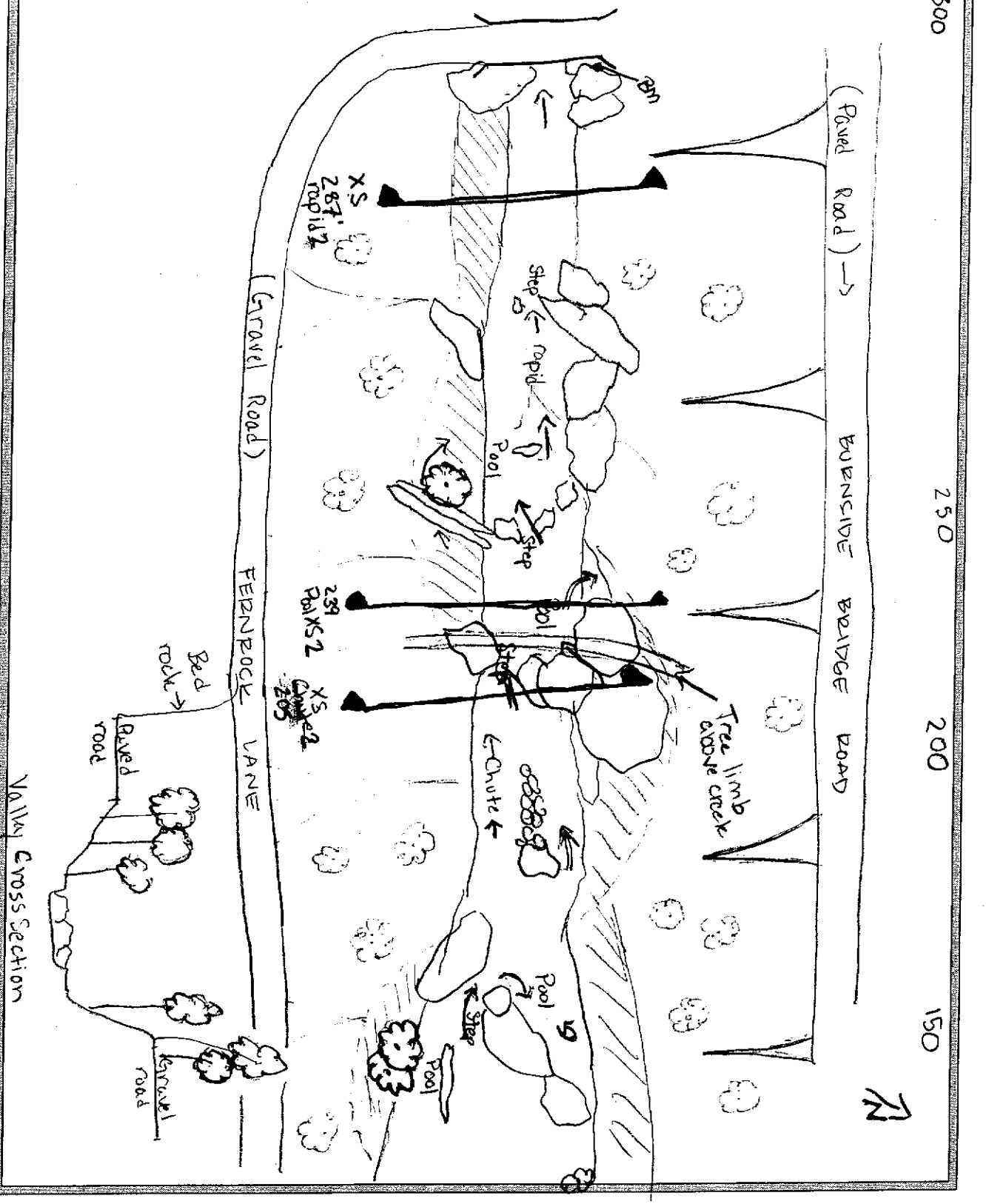
Stream: Sherman's Branch, Reach #1

Team #1

AREA-SITE LOCATION...REACH MAP

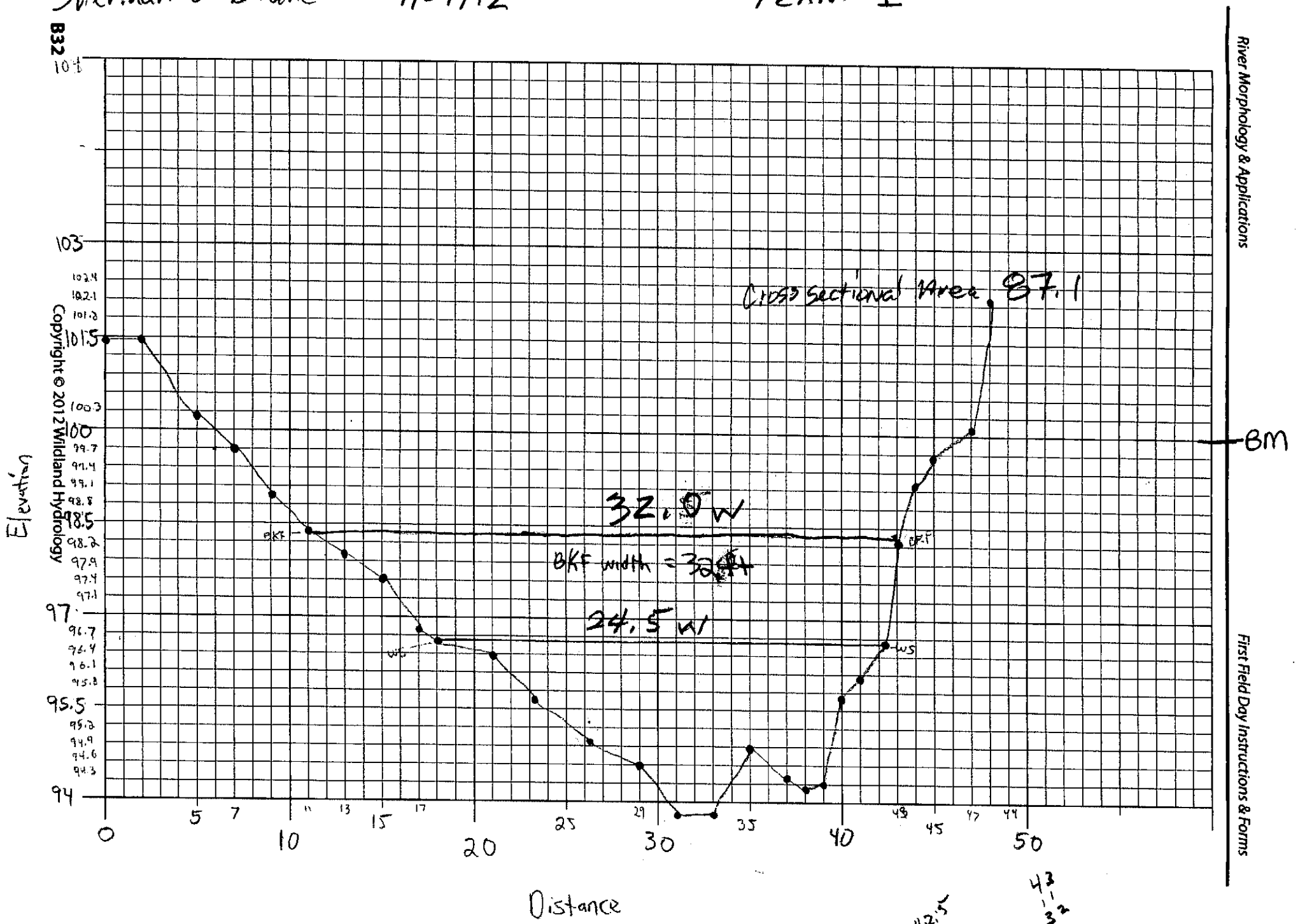
Stream: Sharman's Branch Reach: #1

Drawn By: Amber Bethe + Kelli Bruton Date: April 24, 2012



Copyright © 2012 Wildland Hydrology

Sherman's Branch 4/24/12 Pool #1 TEAM 1



SURVEY DATA → CROSS-SECTION 2

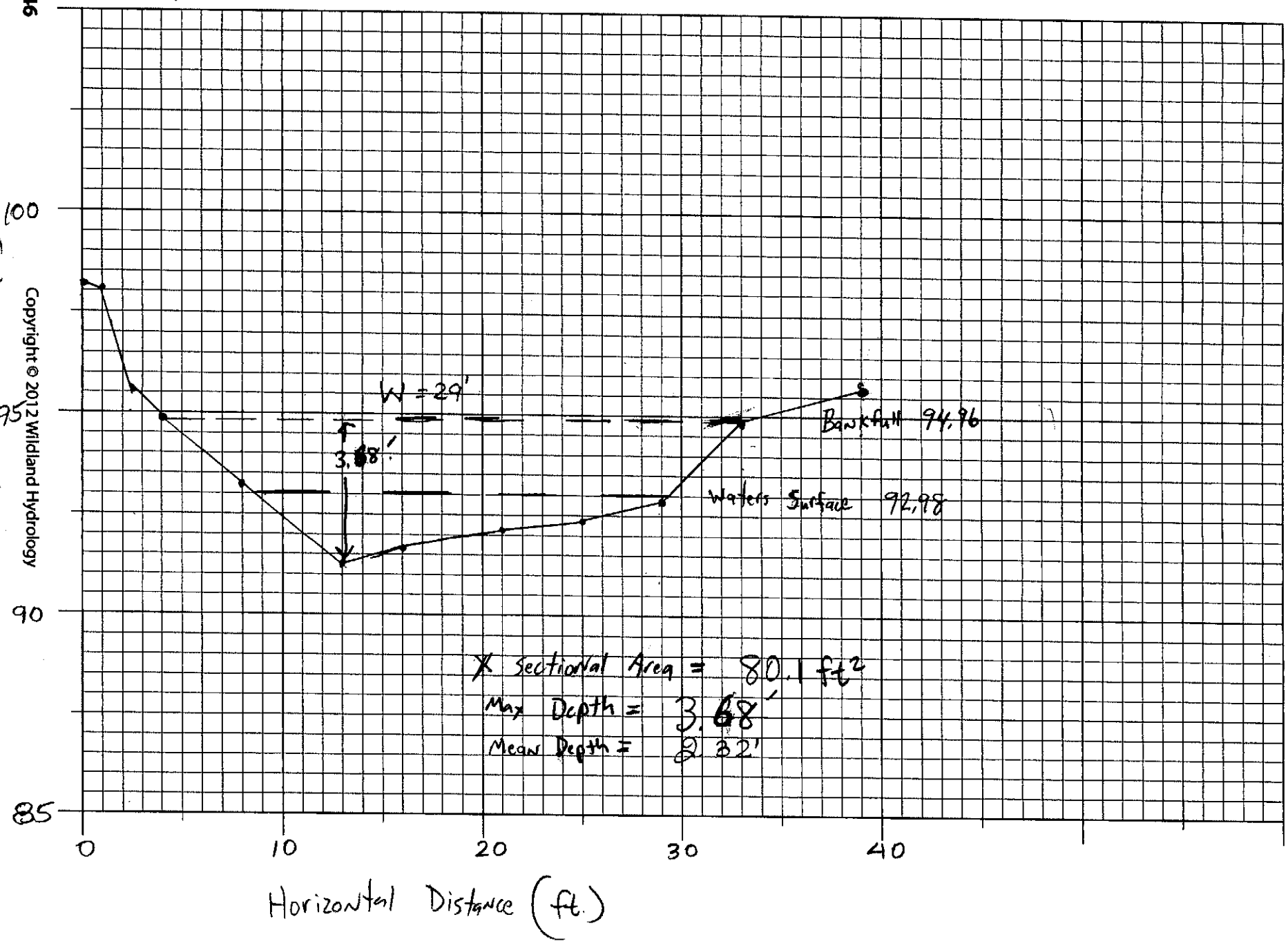
SITE: Pool (upstream) #1 at 0+67 on long. pro. **Date:** 4/27/12

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29	BM	4.48			100.00	
30	0+00			3.02	101.46	
31	0+02			3.01	101.47	
32	5			4.23	100.25	
33	7			4.79	99.69	
34	9			5.49	98.99	
35	10.8			6.05	98.43	BKF
36	13.0			6.51	97.97	
37	15			7.08	97.40	
38	17			7.70	96.78	
39	18.1			7.86	96.62	lws
40	21			8.10	96.38	
41	23.2			8.82	95.66	
42	26.3			9.54	94.94	
43	29			[illegible]	94.60	
44	31			10.[illegible]	93.74	Thalweg
45	33			10.[illegible]	93.84	
46	35			9.[illegible]	94.88	
47	37			10.[illegible]	94.42	
48	38			10.30	94.18	
49	39			10.[illegible]	94.30	
50	40			8.[illegible]	95.68	
51	41			8.42	96.06	
52	42.3			7.80	96.68	rws
53	43			6.22	98.26	BKF
54	44			5.26	99.22	
55	45			4.85	99.63	
56	47			4.38	100.10	
57	49			2.30	102.18	
58						
59						

Copyright © 2012 Wildland Hydrology

Team #1
Sharmans Branch
4/24/12

Channel Cross-Sectional Area
Pool #2 - Station 173+00



Copyright © 2012 Wildland Hydrology

Pool St 173+00 93.96

SURVEY DATA ⟹ **CROSS-SECTION** 7

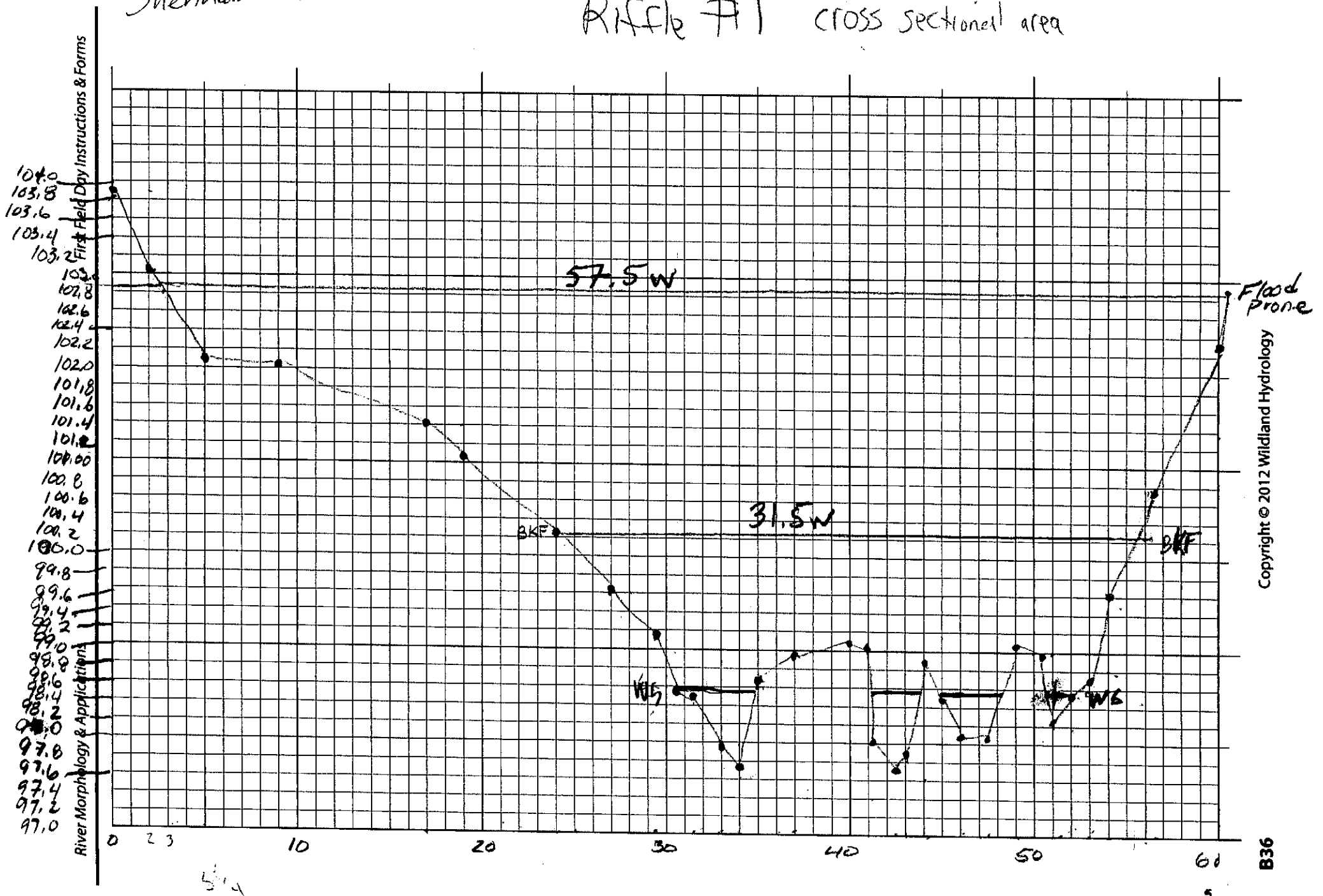
SITE: $H_i = 104.76$ 93.94 ELEV Date:

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
29		10.82	~~104.76~~	~~93.94~~	~~104.76~~	backsight
30	0			6.67	98.11	GS
31	1			6.74	98.04	GS
32	2.5			9.25	95.53	GS
33	~~1.58~~			~~9.80~~ 11.65	93.13	waters edge
34	13.0			13.5	91.28	~~pool step~~
35	16.6			13.2	91.58	
36	~~21~~ 20.0			12.6	92.18	
37	25.0			12.35	92.43	
38	29.0			11.80	92.98	waters edge
39	33.0			9.90	94.88	BF??
40	~~39.0~~			5.19	99.59	
41	~~4~~ 40			9.82	94.96	BF??
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						

Copyright © 2012 Wildland Hydrology

Sherman's Branch 4/24/12 TEAM 1

Riffle #1 cross sectional area



Copyright © 2012 Wildland Hydrology

First Field Day Instructions & Forms
River Morphology & Applications

56.5
25
31.5

SURVEY DATA ⟶ **CROSS - SECTION 1**

SITE: Sherman's Branch 0+17 on long pro Date: 4 27 2012

Location: REACH 1 RAPID VP #1

Party / Notes: HUC: _ _ _ _ _ _ _ _ _ _ _ _

Item	Distance, Point, or STATION ft	Back-Sight BS ft	Height of Instrument HI ft	Fore-Sight FS ft	Elevation ft	REMARKS / COMMENTS / NOTES
1	BM	4.38	100		100.0	BM
2	0	0.47		0.47	103.91	
3	2	1.34		1.34	103.04	
4	5	2.17		2.17	102.21	
5	9	2.24		2.24	102.14	
6	17	2.98		2.98	101.40	
7	19	3.27		3.27	101.11	
8	24	4.12		4.12	100.26	BFull. D=0
9	27			4.77	99.61	
10	29.5			5.21	99.17	
11	30.5			5.29	98.59	30.9 LEW 5.78
12	31.5			5.87	98.51	
13	33			6.45	97.93	
14	34			6.70	97.68	Thalweg
15	35			5.71	98.67	ROCK
16	37			5.43	98.95	ROCK same
17	40			5.25	99.13	ROCK
18	41			5.36	99.02	ROCK
19	41.2			6.38	98.00	
20	42.5			6.68	97.70	
21	43.0			6.64	97.74	
22	44			5.88	98.50	
23	45			5.92	98.54	
24	46			6.26	98.12	
25	47.6			6.20	98.18	
26	49			5.32	99.06	ROCK
27	50.4			5.44	98.94	ROCK
28	50.6			6.12	98.26	
	51.6			6.02	98.36	
	52.0			5.81	98.57	REW
	53.0			5.61	98.77	

Copyright © 2012 Wildland Hydrology

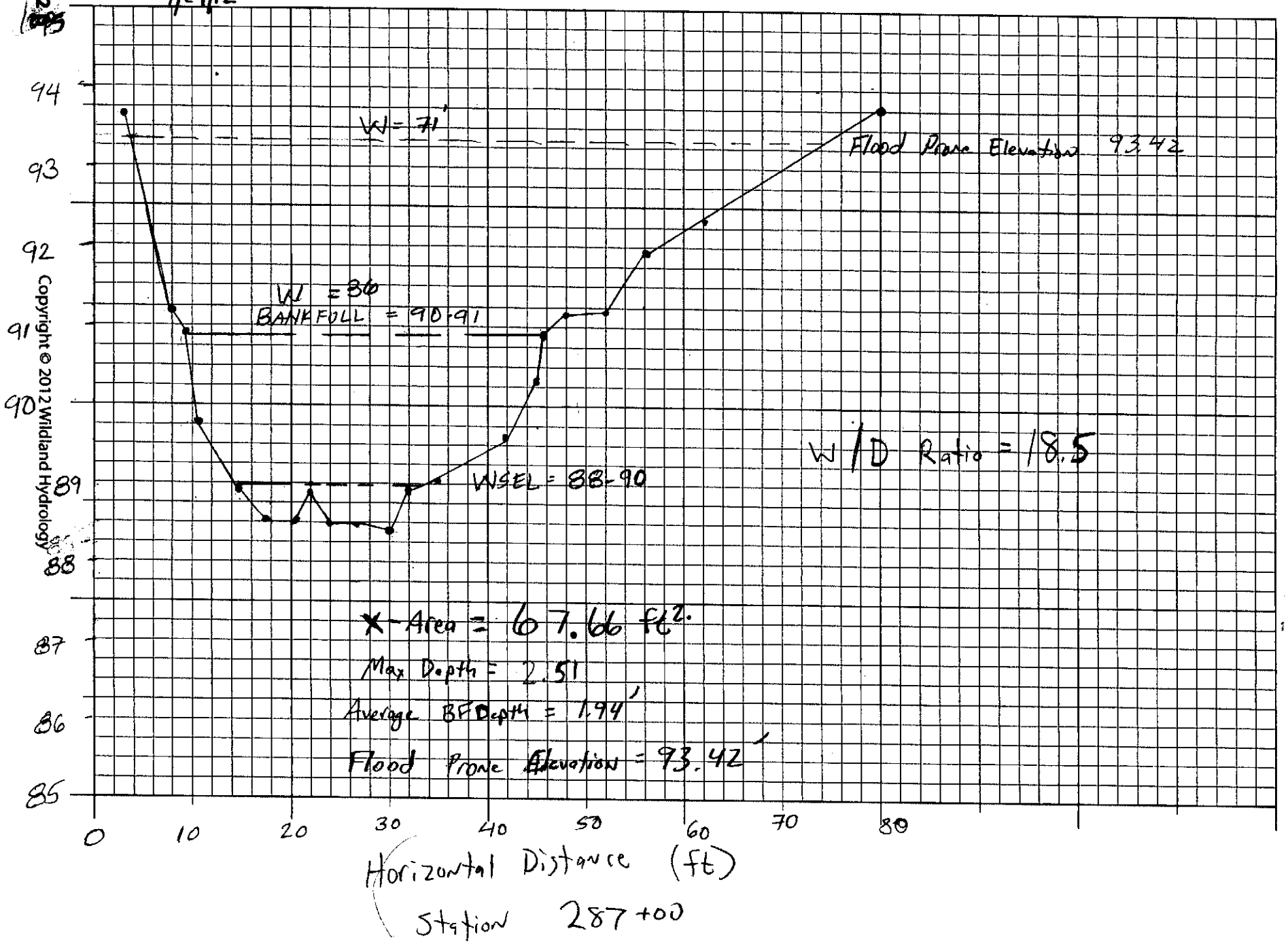
OVer

Station	BS	FS	Elev	Comment
~~54~~ 55.5		4.70	99.68 100.26	
56.6		3.52	100.86	
60		2.11	102.27	
60.5			~~102.94~~ 102.94	

Team #1

Sharmans Branch
4/24/12

Channel Cross-Sectional
Riffle #2 287+00



Copyright © 2012 Wildland Hydrology

SURVEY DATA ⟶ **CROSS-SECTION 5**

SITE: 287+00 **Date:**

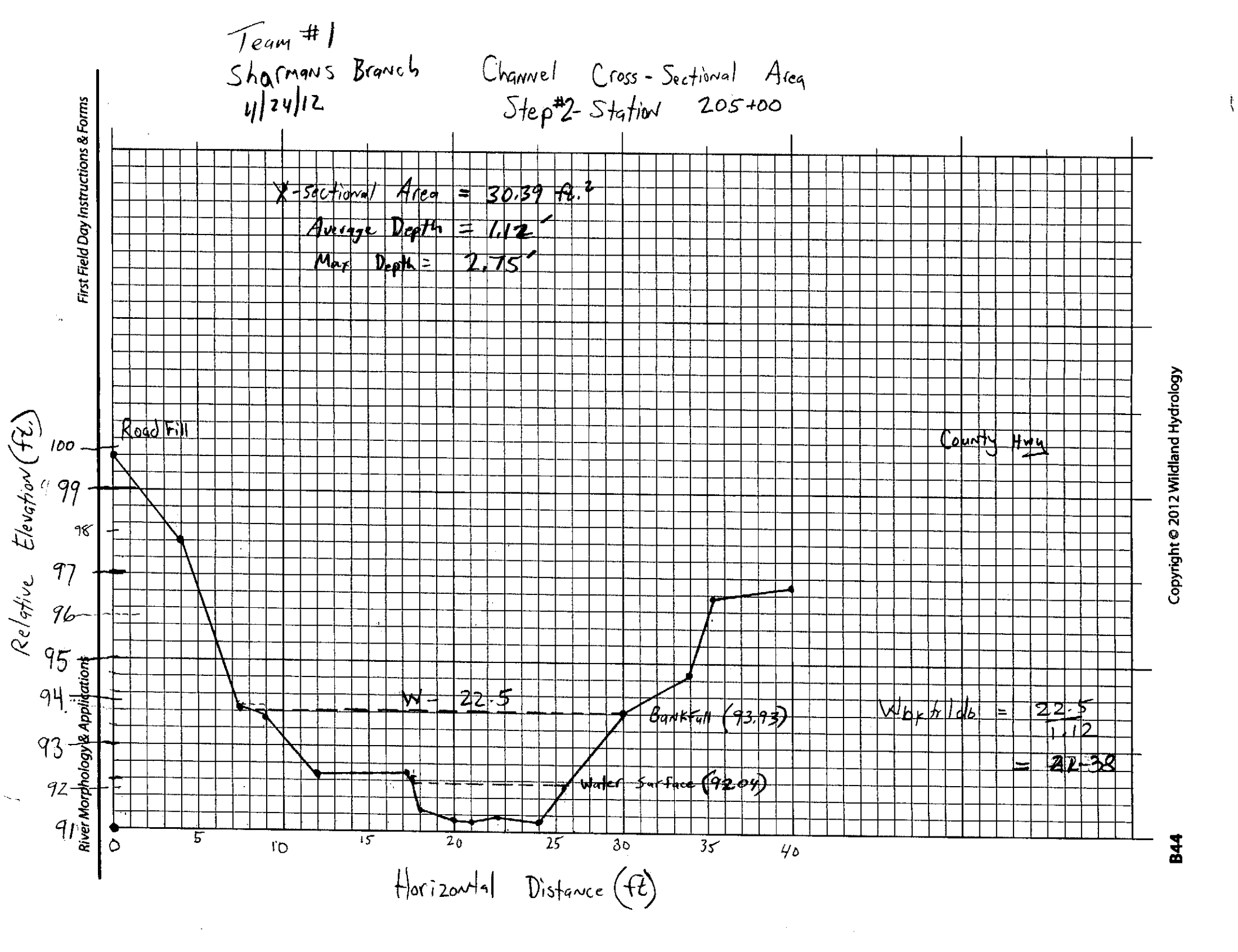
Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES / COMMENTS / REMARKS
29	[redacted]	2.27	96.25		93.98	Backs
30	0+00			0.6	95.65	GS
31	0+03			2.58	93.67	GS
32	0+08			5.05	91.20	Slope break
33	14.5			7.31	88.94	waters edge
34	9.3			5.29	90.96	slope break BF??
35	10.4			6.48	89.77	slope break
36	17.8			7.66	88.59	channel
37	20.5			7.70	88.55	channel
38	22.0			7.38	88.87	
39	24			7.8	88.45	
40	[redacted]27			7.82	88.43	
41	30			7.85	88.40	
42	32			7.36	88.89	channel / waters edge RDB
43	35			6.96	89.29	GS
44	42			6.56	89.69	GS
45	45			5.87	90.38	[redacted] GS
46	45.3			5.34	90.91	bankfull
47	48			4.86	91.39	GS
48	52			4.8	91.45	GS
49	56			4.28	91.97	GS
50	61			3.9	92.35	GS
51	80			2.5	93.75	flow prone
52						
53						
54						
55						
56						
57						
58						
59						

7.85
5.34
2.51

Copyright © 2012 Wildland Hydrology

Team #1
Sharmans Branch
4/24/12

Channel Cross-Sectional Area
Step #2 - Station 205+00



First Field Day Instructions & Forms
River Morphology & Application
Copyright © 2012 Wildland Hydrology

SURVEY DATA → **CROSS-SECTION 8**

SITE: Date:

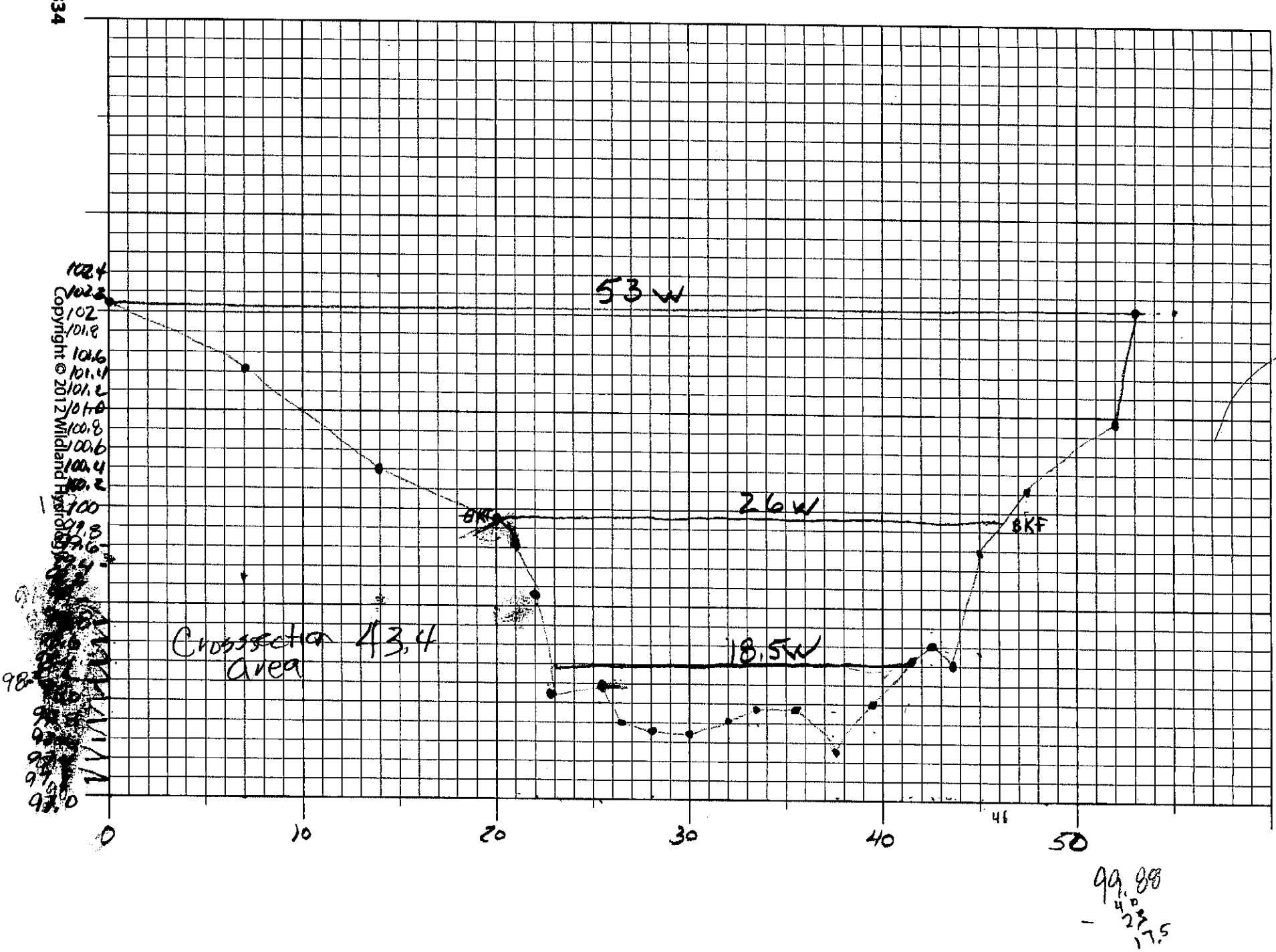
Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES / COMMENTS / REMARKS
29	0		104.78	5.05	99.73	GS
30	4			6.95	97.83	GS
31	7.5			10.20	94.58	GS
32	12			12.10	92.68	GS
33	17.3			11.83	92.95	stone
34	17.5			12.74	92.04	waters edge
35	18.0			12.86	91.92	channel
36	20.0			13.0	91.78	channel
37	21.0			13.6	91.18	channel
38	22.6			12.83	91.95	channel
39	24.0			12.89	91.89	channel
40	25.5			12.65	92.13	Waters edge
41	30.0			10.93	93.85	Rock / G slope
42	34.0			10.21	94.57	Rock / G slope
43	35.2			8.20	96.58	Rock / G. slope
44	40			7.95	96.83	G Slope
45	9.			10.85	93.93	BF ??
46		10.75				back sight to bridge
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						

stone

WE

Copyright © 2012 Wildland Hydrology

Sherman's Branch 4/24/12 Step (Run) #1 TEAM 1



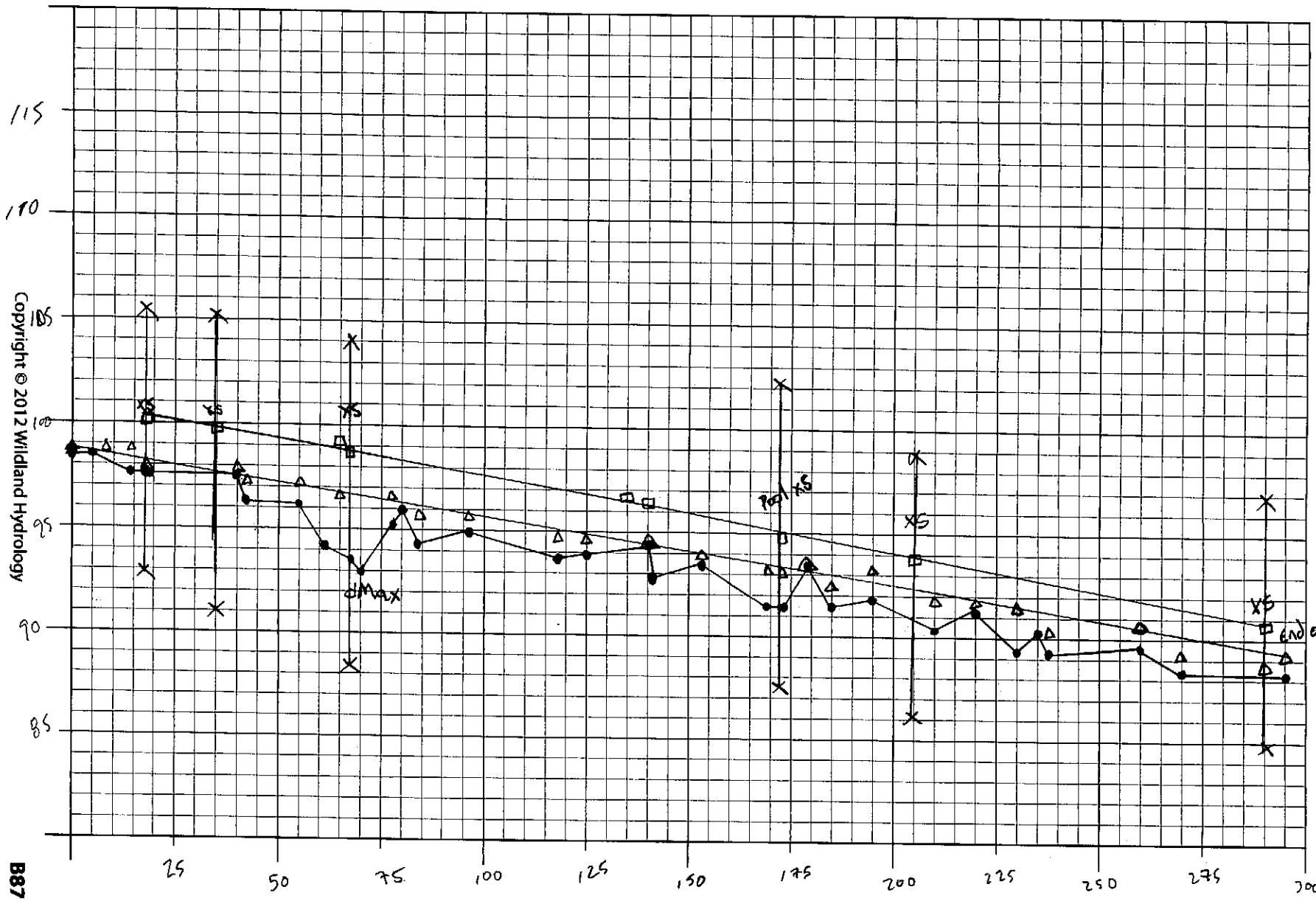
Copyright © 2012 Wildland Hydrology

SURVEY DATA ⟶ **CROSS - SECTION** 3

SITE: Step upstream end 35.0 LP #1 Date: 4/27/12

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES / COMMENTS / REMARKS
29		4.44			100.00	BM
30	0.00	2.32		2.32	102.12	
31	7.0	3.03		3.03	101.41	
32	14.0	4.04		4.04	100.40	
33	20.0	4.66		4.66	99.88	BF
34	21.0	4.81		4.81	99.63	
35	22.0	5.27		5.27	99.17	
36	23.2	5.92		5.92	98.08	
37	25.4	6.24		6.24	98.20	LWE
38	26.5	6.61		6.61	97.83	
39	28			6.77	97.67	
40	30			6.70	97.74	
41	32			6.63	97.81	
42	33.5			6.49	97.95	
43	35.5			6.51	97.93	
44	37.5			6.89	97.55	
45	39.0			7.09	97.35	100
46	39.7			6.23	98.21	1.39
47	41.3			6.10	98.44	
48	42.3			5.83	98.61	
49	42.8			5.79	98.65	RWE
50	43.4			6.05	98.39	RWE
51	45.6			4.90	99.64	
52	48.4			4.20	100.24	
53	52			3.5	100.94	
54						
55						
56						
57						
58						
59						

Copyright © 2012 Wildland Hydrology



Copyright © 2012 Wildland Hydrology

Sharman's Branch, Fernrock Lane, Keedysville, MD
Reach 1, Team 1
April 24, 2012
Sunny +55°

- Thalweg
- △ Water Surface=slope .032
- □ Bankfull=slope .035

SURVEY DATA ⟶ LONGITUDINAL PROFILE 1

SITE: SHARMAN'S BRANCH Date: 24 Apr 12

Location: Fernrock Lane, Keedysville, MD

Party / Notes: HUC:

	Distance, Point, or STATION ft	Back-Sight BS ft	Height of Instrument HI ft	Thalweg Fore-Sight FS ft	Thalweg Elevation Elev. ft	Water Surface Fore-Sight FS ft	Water Surface Elevation Elev. ft	Bankfull Fore-Sight FS ft	Bankfull Elevation Elev. ft	Low Bank HI Fore-Sight FS ft	Low Bank HI Elevation Elev. ft	NOTES e.g. Riffle Run Pool Glide
1	BM1	2.63	100.63									
2	80	4.52	103	4.32	98.31	1.78	98.85					TR
3	5'			4.13	98.50							
4	8'					3.90	98.73					
5	14'			4.89	97.74							
6	17.6			4.79	97.84	4.12	98.51	2.39	100.24			X-S Rapid up 24'
7	17.2 35 XS			5.40	97.23	5.40	97.23		99.88			Pool Pocket Pool Top
8	39.0			5.16	97.47	4.83	97.76					End Pool Bottom (Pocket)
9	43.4			6.33	96.28 (96.3)	5.39	97.24	97.14				Bottom of Riffle/Cascade
10	52.0			6.37	96.26	5.47	97.16					Top Cascade
11	62.0			8.58	94.05	5.98	96.65	4.30	98.33			Bottom Cascade Top Pool
12	64.0 67.0			9.05	93.58				98.43	XS		Pool XS up pool XS 67'
13	70.0			9.63	93.00							Pool D max
14	78.7			7.38	95.25	6.09	96.59					Top Cascade
15	80.0			6.65	95.98							Top Cascade
16	84.0			8.43	94.20	6.80	95.83					Top Pool (Pocket)
17	96.0			7.66	94.97	6.85	95.78					Top Cascade
18	118.0			8.74	93.89	7.79	94.84					Top Pocket Pool
19	125.0			8.68	93.95	7.90	94.73					Top Pool Middle Pool
20	127.0							5.97	96.66			BF
21	140.0			8.30	94.33	8.03	94.60	6.12	96.51			Top Cascade
22	141.8			9.74	92.89							Top pocket Pool
23	153.0			9.09	93.54	8.71	93.92					Top Cascade
24	169.0			11.20	91.43	9.60	93.03	7.68	94.95			Top Pocket Pool Pool X-S (9.0)
25	173.0 XS 179.0			11.23 9.25	91.40 93.38	9.60	93.03					Top Cascade
26	185.0			11.15	91.48	10.04	92.59					Top Pocket Pool
27	~~194.0~~			~~11~~								Top cascade

Pool X-S (14')

Copyright © 2012 Wildland Hydrology

SURVEY DATA → LONGITUDINAL PROFILE 2

SITE: SHARMAN'S BRANCH **Date:** 24 Apr 12

Location: Fernrock Lane, Keedysville, MD

Party / Notes: HUC:

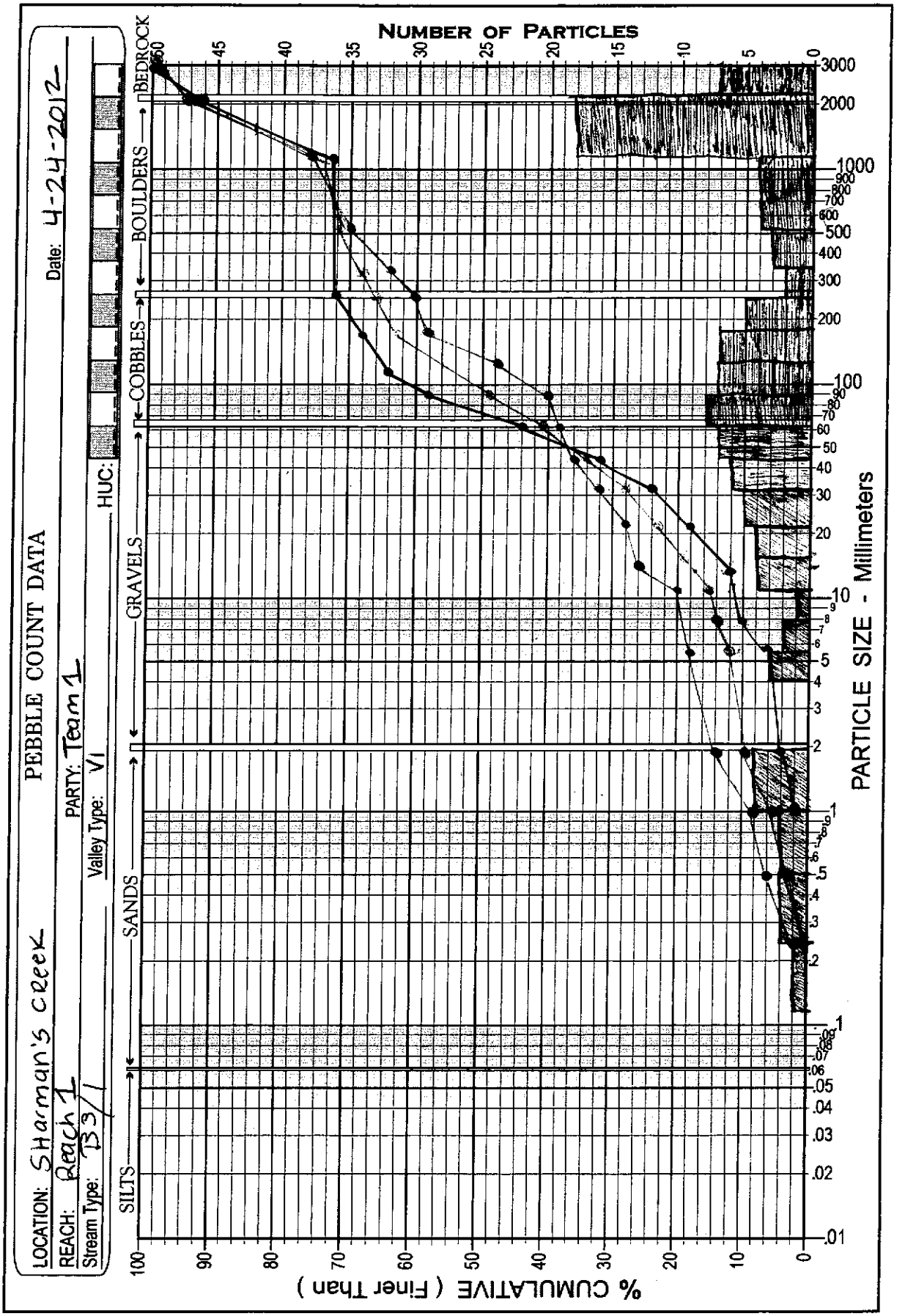
	Distance, Point, or	Back-Sight	Height of Instru-ment	Thalweg		Water Surface		Bankfull		Low Bank HI		NOTES
				Fore-Sight	Elevation	Fore-Sight	Elevation	Fore-Sight	Elevation	Fore-Sight	Elevation	e.g. Riffle Run Pool Glide
	STATION	BS	HI	FS	Elev.	~~FS~~ HS 2	Elev.	FS	Elev.	FS	Elev.	
	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	
28	TP 1	FS 7.84	9.97	7.84	94.79	HS 2 9.97	104.76					Turning Point
29	194.0	9.97		12.86	91.90	12.38	92.40		93.93			Top Cascade — XS 205'
30	210.0			14.28	90.48	12.88	91.88					Top Pocket Pool
31	222.0			13.45	91.31	13.09	91.67					Top Cascade
32	230.0			15.33	89.43	13.03	91.73					Top Pocket Pool
33	235.0			14.49	90.27							Top Cascade
34	237.0			15.60	89.16	14.38	90.38					Top PP
35	265.0			15.17	89.59	14.48	90.28	12.				Top ~~Cascade~~ Rapid
36	271.0			16.56	88.20	15.61	89.15					Middle Rapid
37	287.0					16.~~00~~	88.76	14.~~00~~	90.91			DS ~~R~~-5
38												
39												
40												
41	300									10.78	93.98	BM @ End of Reach
42												
43												
44												
45												
46												
47												
48												
49												
50												
51												
52												
53												
54												

102.63 − 7.84 = 94.79

94.79 + 9.97 = 104.76

15.87 − 14.03 = 1.84

Copyright © 2012 Wildland Hydrology



Copyright © 2012 Wildland Hydrology

downstream riffle protrusion

upstream riffle x-sec PC

DS RIFFLE PC

Site:

Date:

Location:

HUC:

Party: Kristy & Rachele (Team 1)

RIFFLE (1)	POOL (2)	COMPOSITE (3)
Reach:	Reach: upstream protru	Reach:
Date:	Date:	Date:

Inches	PARTICLE	Millimeters		Rep. Dot Count for RIFFLE 1	POOL 2	COMP. 3	Riffle TOT #	ITEM %	% CUM	Pool TOT #	ITEM %	% CUM	Composite TOT #	ITEM %	% CUM
	Silt / Clay	< .062	S/C												
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25	SAND			1									
	Medium	.25 - .50	SAND			2									
	Coarse	.50 - 1.0	SAND			2									
.04 - .08	Very Coarse	1.0 - 2	SAND			4									
.08 - .16	Very Fine	2 - 4	GRAVEL												
.16 - .22	Fine	4 - 5.7	GRAVEL			3									
.22 - .31	Fine	5.7 - 8	GRAVEL			2									
.31 - .44	Medium	8 - 11.3	GRAVEL			1									
.44 - .63	Medium	11.3 - 16	GRAVEL			4									
.63 - .89	Coarse	16 - 22.6	GRAVEL			4									
.89 - 1.3	Coarse	22.6 - 32	GRAVEL			5									
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL			6									
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL			7									
2.5 - 3.5	Small	64 - 90	COBBLE			8									
3.5 - 5.0	Small	90 - 128	COBBLE			7									
5.0 - 7.1	Large	128 - 180	COBBLE			7									
7.1 - 10.1	Large	180 - 256	COBBLE			3									
10.1 - 14.3	Small	256 - 362	BOULDER			2									
14.3 - 20	Small	362 - 512	BOULDER			3									
20 - 40	Medium	512 - 1024	BOULDER			4									
40 - 80	Large-Vry Large	1024 - 2048	BOULDER			18									
	Bedrock		BDRK			7									

Stream Type:	**Valley Type:** 50	50	TOTAL → 106

Chute 1

rapids ||||

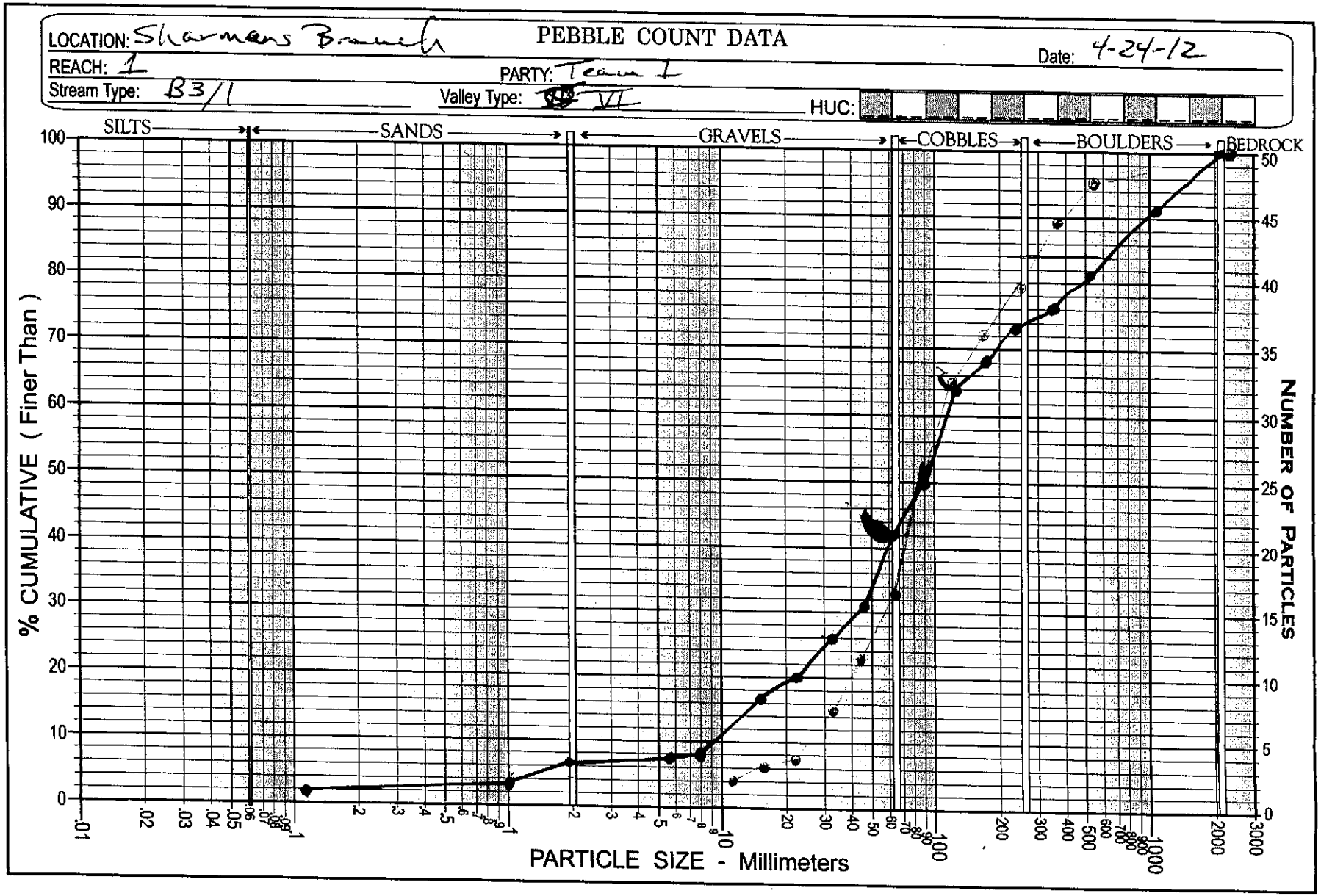
• ~~Constriction pool~~

• ~~Step pool~~

• SCOUR pool

Copyright © 2012 Wildland Hydrology

XS 1 — UPSTREAM RIFFLE



Copyright © 2012 Wildland Hydrology

upstream riffle
X-sec #1

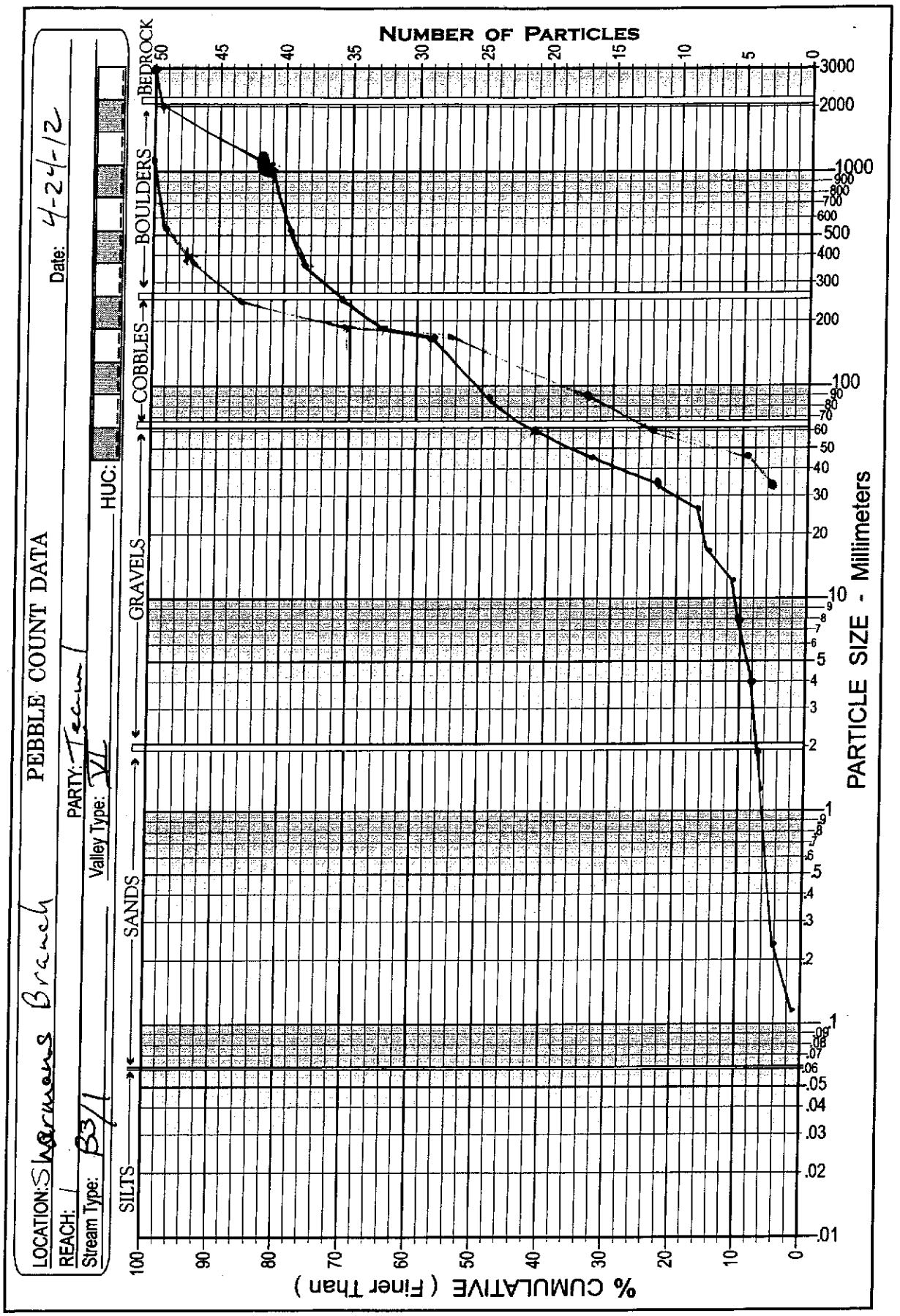
Site: Date:

Location: HUC:

Party:

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) Reach: Protrusion Date: TOT #	ITEM %	% CUM	POOL (2) Reach: Pebble Date: Count TOT #	ITEM %	% CUM	COMPOSITE (3) Reach: Date: TOT #	ITEM %	% CUM
	Silt / Clay	< .062	S/C												
	Very Fine	.062 - .125	SAND							2	1.85	1.85			
	Fine	.125 - .25										1.85			
	Medium	.25 - .50									0.93	2.78			
	Coarse	.50 - 1.0								1	1.85	4.63			
.04 - .08	Very Coarse	1.0 - 2								2	1.85	6.48			
.08 - .16	Very Fine	2 - 4	GRAVEL							1	0.93	7.41			
.16 - .22	Fine	4 - 5.7								1	0.93	8.34			
.22 - .31	Fine	5.7 - 8										8.34			
.31 - .44	Medium	8 - 11.3					4	4	4	9	8.33	16.67			
.44 - .63	Medium	11.3 - 16					2	2	6	3	2.78	19.45			
.63 - .89	Coarse	16 - 22.6					1	1	7	7	6.48	25.93			
.89 - 1.3	Coarse	22.6 - 32					8	8	15	5	4.63	30.56			
1.3 - 1.8	Very Coarse	32 - 45					8	8	23	12	11.11	41.67			
1.8 - 2.5	Very Coarse	45 - 64					10	10	33	9	8.33	50.00			
2.5 - 3.5	Small	64 - 90	COBBLE				19	19	52	14	12.96	62.96			
3.5 - 5.0	Small	90 - 128					13	13	65	5	4.63	67.59			
5.0 - 7.1	Large	128 - 180					7	7	72	6	5.56	73.15			
7.1 - 10.1	Large	180 - 256					7	7	79	3	2.78	75.93			
10.1 - 14.3	Small	256 - 362	BOULDER				10	10	89	6	5.56	81.49			
14.3 - 20	Small	362 - 512					6	6	95	10	9.26	90.75			
20 - 40	Medium	512 - 1024								10	9.26	100.01			
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		DRK				5	5	100	0	0				
Stream Type:			**Valley Type:**			TOTAL→	100	100	100	108	100				

Copyright © 2012 Wildland Hydrology



Protrusion
Pebble Count

Downstream riffle
X-sec 2

Copyright © 2012 Wildland Hydrology

downstream riffle
X-sec 2

Site:
Location: HUC:
Party: Date:

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) Reach: Robinson Date: TOT #	ITEM %	% CUM	POOL (2) Reach: Pebble Date: Count TOT #	ITEM %	% CUM	COMPOSITE (3) Reach: Date: TOT #	ITEM %	% CUM
	Silt / Clay	< .062	S/C												
	Very Fine	.062 - .125	SAND							1	1.02	1.02			
	Fine	.125 - .25								3	3.06	4.08			
	Medium	.25 - .50													
	Coarse	.50 - 1.0													
.04 - .08	Very Coarse	1.0 - 2								3	3.06	7.14			
.08 - .16	Very Fine	2 - 4	GRAVEL							1	1.02	8.16			
.16 - .22	Fine	4 - 5.7													
.22 - .31	Fine	5.7 - 8								2	2.04	10.2			
.31 - .44	Medium	8 - 11.3								1	1.02	11.22			
.44 - .63	Medium	11.3 - 16								4	4.08	15.30			
.63 - .89	Coarse	16 - 22.6								1	1.02	16.32			
.89 - 1.3	Coarse	22.6 - 32					6	5.83	5.83	7	7.14	23.46			
1.3 - 1.8	Very Coarse	32 - 45					3	2.91	8.74	10	10.20	33.66			
1.8 - 2.5	Very Coarse	45 - 64					12	11.65	20.39	8	8.16	41.82			
2.5 - 3.5	Small	64 - 90	COBBLE				14	13.59	33.98	7	7.14	48.96			
3.5 - 5.0	Small	90 - 128					22	21.36	55.34	8	8.16	57.12			
5.0 - 7.1	Large	128 - 180					16	15.53	70.87	8	8.16	65.28			
7.1 - 10.1	Large	180 - 256					16	15.53	86.40	6	6.12	71.40			
10.1 - 14.3	Small	256 - 362	BOULDER				8	7.77	94.17	5	5.10	76.50			
14.3 - 20	Small	362 - 512					4	3.88	98.05	1	1.02	77.52			
20 - 40	Medium	512 - 1024					2	1.94	99.99	5	5.10	82.62			
40 - 80	Large-Vry Large	1024 - 2048								16	16.32	98.94			
	Bedrock		BDRK							1	1.02	99.96			
Stream Type:			**Valley Type:**			TOTAL→	103			98					

Copyright © 2012 Wildland Hydrology

upstr. X-sec 1
PC D84

Worksheet B-2. Computations of velocity and discharge using various methods (*First Field Day*).

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	SHARMANS BRANCH	Location:	KEEDYSVILLE, MD
Date:	04/24/12 Stream Type: B3/1	Valley Type:	V1
Observers:	TEAM 1	HUC:	-- -- -- -- -- -- -- -- -- -- --

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	44.2	A_{bkf} (ft²)	Bankfull Riffle Mean DEPTH	1.51	d_{bkf} (ft)
Bankfull Riffle WIDTH	31.5	W_{bkf} (ft)	Wetted PERMIMETER ~ (2 * d_{bkf}) + W_{bkf}	34.52	W_p (ft)
D_{84} at Riffle	620	Dia. (mm)	D_{84} (mm) / 304.8	2.03	D_{84} (ft)
Bankfull SLOPE	.035	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.28	R (ft)
Gravitational Acceleration	32.2	g (ft / sec²)	Relative Roughness R(ft) / D_{84} (ft)	0.63	R / D_{84}
Drainage Area	3.6	DA (mi²)	Shear Velocity $u^* = (gRS)^{1/2}$	1.20	u^* (ft/sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $u = [2.83 + 5.66 * Log\{R / D_{84}\}] u^*$	2.03	ft / sec	89.73	cfs
2. Roughness Coefficient: a) Manning's *n* from Friction Factor / Relative Roughness (Figs. B-34, B-35) $u = 1.49*R^{2/3}*S^{1/2}/n$ n = 0.09	3.65	ft / sec	161.34	cfs
2. Roughness Coefficient: b) Manning's *n* from Stream Type (Fig. B-36) $u = 1.49*R^{2/3}*S^{1/2}/n$ n = 0.058	5.66	ft / sec	250.3	cfs
2. Roughness Coefficient: c) Manning's *n* from Jarrett (USGS): $u = 1.49*R^{2/3}*S^{1/2}/n$ $n = 0.39*S^{0.38}*R^{-0.16}$ n = 0.105 Note: This equation is applicable to steep, step/pool, high boundary roughness, cobble- and boulder-dominated stream systems; i.e., for Stream Types A1, A2, A3, B1, B2, B3, C2 & E3	3.13	ft / sec	138.35	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.)		ft / sec		cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.)		ft / sec		cfs
4. Continuity Equations: a) USGS Gage Data u = Q / A Return Period for Bankfull Discharge Q = 1 year		ft / sec		cfs
4. Continuity Equations: b) Regional Curves u = Q / A	2.58	ft / sec	114	cfs

Protrusion Heights Options for the Dominant Roughness Relation (R/D84) Estimation Method

Option 1.	For **sand-bed** channels: Measure 100 **"protrusion heights"** of sand dunes from the downstream side of feature to the top of feature. Substitute the D_{84} sand dune protrusion height in ft for the D_{84} term in method 1.
Option 2.	For **boulder-dominated** channels: Measure 100 **"protrusion heights"** of boulders on the sides from the bed elevation to the top of the rock on that side. Substitute the D_{84} boulder protrusion height in ft for the D_{84} term in method 1.
Option 3.	For **bedrock-dominated** channels: Measure 100 **"protrusion heights"** of rock separations, steps, joints or uplifted surfaces above channel bed elevation. Substitute the D_{84} bedrock protrusion height in ft for the D_{84} term in method 1.
Option 4.	For **log-influenced** channels: Measure **"protrustion heights"** proportionate to channel width of log diameters or the height of the log on upstream side if embedded. Substitute the D_{84} protrusion height in ft for the D_{84} term in method 1.

Copyright © 2012 Wildland Hydrology

X-sec 1 Protrusion D84

Worksheet B-2. Computations of velocity and discharge using various methods (*First Field Day*).

Stream:	SHARMAN'S BRANCH	Location:	KEEDYSVILLE, MD
Date:	04/24/2012 Stream Type:	Valley Type:	6
Observers:	TEAM 1	HUC:	

Bankfull Riffle Cross-Sectional AREA	44.2	A_{bkf} (ft^2)	Bankfull Riffle Mean DEPTH	1.51	d_{bkf} (ft)
Bankfull Riffle WIDTH	31.5	W_{bkf} (ft)	Wetted PERMIMETER ~ $(2 * d_{bkf}) + W_{bkf}$	34.52	W_p (ft)
D_{84} at Riffle	300	Dia. (mm)	D_{84} (mm) / 304.8	.98	D_{84} (ft)
Bankfull SLOPE	.035	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.28	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R(ft) / D_{84} (ft)	1.31	R / D_{84}
Drainage Area	3.6	DA (mi^2)	Shear Velocity $u^* = (gRS)^{1/2}$	1.20	u^* (ft/sec)

ESTIMATION METHODS	Velocity		Discharge	
1. Friction Factor / Relative Roughness $u = [2.83 + 5.66 * Log(R / D_{84})] u^*$	4.19	ft / sec	185.20	cfs
2. Roughness Coefficient: a) Manning's n from Friction Factor / Relative Roughness (Figs. B-34, B-35) $u = 1.49 * R^{2/3} * S^{1/2} / n$ $n =$ .065	5.08	ft / sec	224.54	cfs
2. Roughness Coefficient: b) Manning's n from Stream Type (Fig. B-36) $u = 1.49 * R^{2/3} * S^{1/2} / n$ $n =$ .058	5.69	ft / sec	251.50	cfs
2. Roughness Coefficient: c) Manning's n from Jarrett (USGS): $n = 0.39 * S^{0.38} * R^{-0.16}$ Note: This equation is applicable to steep, step/pool, high boundary roughness, cobble- and boulder-dominated stream systems, i.e., for Stream Types A1, A2, A3, B1, B2, B3, C2 & E3 $n =$ .045	3.14	ft / sec	138.79	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.)		ft / sec		cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.)		ft / sec		cfs
4. Continuity Equations: a) USGS Gage Data $u = Q / A$ Return Period for Bankfull Discharge $Q =$ year		ft / sec		cfs
4. Continuity Equations: b) Regional Curves $u = Q / A$	2.58	ft / sec	114	cfs

Option 1.	For **sand-bed** channels: Measure 100 **"protrusion heights"** of sand dunes from the downstream side of feature to the top of feature. Substitute the D_{84} sand dune protrusion height in ft for the D_{84} term in method 1.
Option 2.	For **boulder-dominated** channels: Measure 100 **"protrusion heights"** of boulders on the sides from the bed elevation to the top of the rock on that side. Substitute the D_{84} boulder protrusion height in ft for the D_{84} term in method 1.
Option 3.	For **bedrock-dominated** channels: Measure 100 **"protrusion heights"** of rock separations, steps, joints or uplifted surfaces above channel bed elevation. Substitute the D_{84} bedrock protrusion height in ft for the D_{84} term in method 1.
Option 4.	For **log-influenced** channels: Measure **"protrusion heights"** proportionate to channel width of log diameters or the height of the log on upstream side if embedded. Substitute the D_{84} protrusion height in ft for the D_{84} term in method 1.

Copyright © 2012 Wildland Hydrology

XS 2 (DOWNSTREAM) D84 PROTRUSION

Worksheet B-2. Computations of bankfull mean velocity and discharge using various methods.

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	SHARMANS BRANCH	Location:	KEEDYSVILLE
Date:	04/24/12	Stream Type:	B3/1
Observers:	TEAM 1	Valley Type:	V1
		HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	67.7	A_{bkf} (ft^2)	Bankfull Riffle Mean DEPTH	1.94	d_{bkf} (ft)
Bankfull Riffle WIDTH	36	W_{bkf} (ft)	Wetted PERIMETER ~ (2 * d_{bkf}) + W_{bkf}	39.9	W_p (ft)
D_{84} at Riffle	230	Dia. (mm)	D_{84} (mm) / 304.8	0.75	D_{84} (ft)
Bankfull SLOPE	0.035	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.7	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R(ft) / D_{84} (ft)	2.26	R / D_{84}
Drainage Area	3.6	DA (mi^2)	Shear Velocity $u^* = (gRS)^{½}$	1.38	u^* (ft/sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $\bar{u} = [\ 2.83 + 5.66 * Log\ \{ R / D_{84} \}\ ]\ u^*$	6.68	ft / sec	452.2	cfs
2. Roughness Coefficient: a) Manning's n from Friction Factor / Relative Roughness (Figs. B-34, B-35) $\bar{u} = 1.49 * R^{2/3} * S^{1/2} / n$ $n =$ 0.045	8.84	ft / sec	598.5	cfs
2. Roughness Coefficient: b) Manning's n from Stream Type (Fig. B-36) $\bar{u} = 1.49 * R^{2/3} * S^{1/2} / n$ $n =$ 0.06	6.63	ft / sec	448.8	cfs
2. Roughness Coefficient: c) Manning's n from Jarrett (USGS): $n = 0.39 * S^{0.38} * R^{-0.16}$ **Note:** This equation is applicable to **steep, step/pool, high boundary roughness, cobble- and boulder-dominated stream systems**; i.e., for Stream Types A1, A2, A3, B1, B2, B3, C2 & E3 $n =$ 0.100	3.98	ft / sec	269.3	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.)		ft / sec		cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.)		ft / sec		cfs
4. Continuity Equations: a) USGS Gage Data $\bar{u} = Q / A$ Return Period for Bankfull Discharge Q = ____ year		ft / sec		cfs
4. Continuity Equations: b) Regional Curves $\bar{u} = Q / A$	1.68	ft / sec	114	cfs

Protrusion Height Options for the D_{84} Term in the Relative Roughness Relation (R/D_{84}) – Estimation Method 1

Option 1.	For **sand-bed** channels: Measure 100 **"protrusion heights"** of sand dunes from the downstream side of feature to the top of feature. Substitute the D_{84} sand dune protrusion height in ft for the D_{84} term in method 1.
Option 2.	For **boulder-dominated** channels: Measure 100 **"protrusion heights"** of boulders on the sides from the bed elevation to the top of the rock on that side. Substitute the D_{84} boulder protrusion height in ft for the D_{84} term in method 1.
Option 3.	For **bedrock-dominated** channels: Measure 100 **"protrusion heights"** of rock separations, steps, joints or uplifted surfaces above channel bed elevation. Substitute the D_{84} bedrock protrusion height in ft for the D_{84} term in method 1.
Option 4.	For **log-influenced** channels: Measure **"protrusion heights"** proportionate to channel width of log diameters or the height of the log on upstream side if embedded. Substitute the D_{84} protrusion height in ft for the D_{84} term in method 1.

Copyright © 2012 Wildland Hydrology

Worksheet B-2. Computations of bankfull mean velocity and discharge using various methods.

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	SHARMANS BRANCH	Location:	KEEDYSVILLE, MD
Date:	04/24/12	Stream Type:	B3/1
Valley Type:	VI		
Observers:	TEAM 1	HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	67.66	A_{bkf} (ft^2)	Bankfull Riffle Mean DEPTH	1.94	d_{bkf} (ft)
Bankfull Riffle WIDTH	36	W_{bkf} (ft)	Wetted PERIMETER ~ (2 * d_{bkf}) + W_{bkf}	39.9	W_p (ft)
D_{84} at Riffle	~~1018~~	Dia. (mm)	D_{84} (mm) / 304.8	3.31	D_{84} (ft)
Bankfull SLOPE	.035	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.7	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R(ft) / D_{84} (ft)	0.51	R / D_{84}
Drainage Area	3.6	DA (mi^2)	Shear Velocity $u^* = (gRS)^{1/2}$	1.38	u^* (ft/sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $\bar{u} = [\,2.83 + 5.66 * Log\{R / D_{84}\}\,] u^*$	1.64	ft / sec	111.4	cfs
2. Roughness Coefficient: a) Manning's n from Friction Factor / Relative Roughness (Figs. B-34, B-35) $\bar{u} = 1.49 * R^{2/3} * S^{1/2} / n$ $n =$ .13	3.06	ft / sec	207.2	cfs
2. Roughness Coefficient: b) Manning's n from Stream Type (Fig. B-36) $\bar{u} = 1.49 * R^{2/3} * S^{1/2} / n$ $n =$ 0.06	6.63	ft / sec	448.6	cfs
2. Roughness Coefficient: c) Manning's n from Jarrett (USGS): $n = 0.39 * S^{0.38} * R^{-0.16}$ Note: This equation is applicable to **steep, step/pool, high boundary roughness, cobble- and boulder-dominated stream systems**; i.e., for Stream Types A1, A2, A3, B1, B2, B3, C2 & E3 $n =$ 0.10	3.98	ft / sec	269.2	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.)	[illegible]	ft / sec		cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.)		ft / sec		cfs
4. Continuity Equations: a) USGS Gage Data $\bar{u} = Q / A$ Return Period for Bankfull Discharge Q = ____ year		ft / sec		cfs
4. Continuity Equations: b) Regional Curves $\bar{u} = Q / A$	[illegible]	ft / sec	114	cfs

Protrusion Height Options for the D_{84} Term in the Relative Roughness Relation (R/D_{84}) – Estimation Method 1

Option 1.	For **sand-bed** channels: Measure 100 **"protrusion heights"** of sand dunes from the downstream side of feature to the top of feature. Substitute the D_{84} sand dune protrusion height in ft for the D_{84} term in method 1.
Option 2.	For **boulder-dominated** channels: Measure 100 **"protrusion heights"** of boulders on the sides from the bed elevation to the top of the rock on that side. Substitute the D_{84} boulder protrusion height in ft for the D_{84} term in method 1.
Option 3.	For **bedrock-dominated** channels: Measure 100 **"protrusion heights"** of rock separations, steps, joints or uplifted surfaces above channel bed elevation. Substitute the D_{84} bedrock protrusion height in ft for the D_{84} term in method 1.
Option 4.	For **log-influenced** channels: Measure **"protrusion heights"** proportionate to channel width of log diameters or the height of the log on upstream side if embedded. Substitute the D_{84} protrusion height in ft for the D_{84} term in method 1.

Copyright © 2012 Wildland Hydrology

Worksheet B-1. Field Form for Level II Stream Classification (*First Field Day*).

Stream:	SHARMANS BRANCH
Basin: ANTIETAM CREEK	Drainage Area: 2,304 acres 3.6 mi²
Location:	KEEDYSVILLE, MD / FERNROCK LN + BURNSIDE BRIDGE ROAD
Twp.&Rge:	Sec.&Qtr.:
Cross-Section Monuments (Lat./Long.):	Date: 04/24/12
Observers: TEAM 1	Valley Type:

Bankfull WIDTH (W_{bkf}) WIDTH of the stream channel at bankfull stage elevation, in a riffle section.	31.5	ft
Bankfull DEPTH (d_{bkf}) Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A_{bkf} / W_{bkf}$).	1.51	ft
Bankfull X-Section AREA (A_{bkf}) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	44.2	ft^2
Width/Depth Ratio (W_{bkf} / d_{bkf}) Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section.	20.8	ft/ft
Maximum DEPTH (d_{max}) Maximum depth of the bankfull channel cross-section, or distance between the bankfull stage and Thalweg elevations, in a riffle section.	2.58	ft
WIDTH of Flood-Prone Area (W_{fpa}) Twice maximum DEPTH, or ($2 \times d_{mbkf}$) = the stage/elevation at which flood-prone area WIDTH is determined in a riffle section.	57.5	ft
Entrenchment Ratio (ER) The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH (W_{fpa} / W_{bkf}) (riffle section).	1.83	ft/ft
Channel Materials (Particle Size Index) D_{50} The D_{50} particle size index represents the median or dominant diameter of channel materials, as sampled proportionately from the channel surface, between the bankfull stage and Thalweg elevations.	93	mm
Water Surface SLOPE (S) Channel slope = "rise over run" for a reach approximately 20–30 bankfull channel widths in length, with the "riffle-to-riffle" water surface slope representing the gradient at bankfull stage.	0.032	ft/ft
Channel SINUOSITY (k) Sinuosity is an index of channel pattern, determined from a ratio of stream length divided by valley length (SL / VL); or estimated from a ratio of valley slope divided by channel slope (S_{val} / S). 300 / 263 = 1.14	1.14	

Stream Type [redacted] **See Classification Key (Figure B-2)**

Copyright © 2012 Wildland Hydrology

B 3/1

Worksheet B-3a. Morphological relations, including dimensionless ratios (*First Field Day*).

Stream: SHARMANS BRANCH Location: KEEDYSVILLE, MD FERNROCK RD.

Observers: TEAM 1 Date: APRIL 24, 2012 Valley Type: LO-BEDROCK Stream Type:

Riffle #1

River Reach Dimension Summary Data.....1

Riffle Dimensions*, **, *

Riffle Width (W_{bkf})	31.5			ft	Riffle Cross-Sectional Area (A_{bkf}) (ft^2)	44.2			
Riffle Mean Depth (d_{bkf})	1.51			ft	Riffle Width/Depth Ratio (W_{bkf} / d_{bkf})	20.8			
Riffle Maximum Depth (d_{max})	2.58			ft	Riffle Max Depth to Riffle Mean Depth (d_{max} / d_{bkf})	1.71			
Width of Flood-Prone Area (W_{fpa})	57.8			ft	Entrenchment Ratio (W_{fpa} / W_{bkf})	1.83			
Riffle Inner Berm Width (W_{ib})	/			ft	Riffle Inner Berm Width to Riffle Width (W_{ib} / W_{bkf})	/			
Riffle Inner Berm Depth (d_{ib})	/			ft	Riffle Inner Berm Depth to Mean Depth (d_{ib} / d_{bkf})	/			
Riffle Inner Berm Area (A_{ib})	/			ft^2	Riffle Inner Berm Area to Riffle Area (A_{ib} / A_{bkf})	/			
Riffle Inner Berm W/D Ratio (W_{ib} / d_{ib})	/								

Pool Dimensions*, **, *

Pool Width (W_{bkfp})	30.5	29	32	ft	Pool Width to Riffle Width (W_{bkfp} / W_{bkf})	0.96	0.92	1.02	
Pool Mean Depth (d_{bkfp})	2.46	2.32	2.6	ft	Pool Mean Depth to Riffle Mean Depth (d_{bkfp} / d_{bkf})	1.63	1.53	1.72	
Pool Cross-Sectional Area (A_{bkfp})	83.6	80.1	87.1	ft	Pool Area to Riffle Area (A_{bkfp} / A_{bkf})	1.90	1.81	1.97	
Pool Maximum Depth (d_{maxp})	4.185	3.68	4.69	ft	Pool Max Depth to Riffle Mean Depth (d_{maxp} / d_{bkf})	2.77	2.43	3.10	
Pool Inner Berm Width (W_{ibp})	/	0	0	ft	Pool Inner Berm Width to Pool Width (W_{ibp} / W_{bkfp})	/	/	/	
Pool Inner Berm Depth (d_{ibp})	/	0	0	ft	Pool Inner Berm Depth to Pool Depth (d_{ibp} / d_{bkfp})	/	/	/	
Pool Inner Berm Area (A_{ibp})	/	0	0	ft^2	Pool Inner Berm Area to Pool Area (A_{ibp} / A_{bkfp})	/	/	/	
Point Bar Slope (S_{pb})	/	Pool2	Pool1	ft/ft	Pool Inner Berm Width/Depth Ratio (W_{ibp} / d_{ibp})	/	Pool2	Pool1	

Run Dimensions*

Run Width (W_{bkfr})				ft	Run Width to Riffle Width (W_{bkfr} / W_{bkf})				
Run Mean Depth (d_{bkfr})				ft	Run Mean Depth to Riffle Mean Depth (d_{bkfr} / d_{bkf})				
Run Cross-Sectional Area (A_{bkfr})				ft	Run Area to Riffle Area (A_{bkfr} / A_{bkf})				
Run Maximum Depth (d_{maxr})				ft	Run Max Depth to Riffle Mean Depth (d_{maxr} / d_{bkf})				
Run Width/Depth Ratio (W_{bkfr} / d_{bkfr})				ft					

Glide Dimensions*

Glide Width (W_{bkfg})				ft	Glide Width to Riffle Width (W_{bkfg} / W_{bkf})				
Glide Mean Depth (d_{bkfg})				ft	Glide Mean Depth to Riffle Mean Depth (d_{bkfg} / d_{bkf})				
Glide Cross-Sectional Area (A_{bkfg})				ft	Glide Area to Riffle Area (A_{bkfg} / A_{bkf})				
Glide Maximum Depth (d_{maxg})				ft	Glide Max Depth to Riffle Mean Depth (d_{maxg} / d_{bkf})				
Glide Width/Depth Ratio (W_{bkfg} / d_{bkfg})				ft/ft	Glide Inner Berm Width/Depth Ratio (W_{ibg} / d_{ibg})				
Glide Inner Berm Width (W_{ibg})				ft	Glide Inner Berm Width to Glide Width (W_{ibg}/W_{bkfg})				
Glide Inner Berm Depth (d_{ibg})				ft	Glide Inner Berm Depth to Glide Depth (d_{ibg} / d_{bkfg})				
Glide Inner Berm Area (A_{ibg})				ft^2	Glide Inner Berm Area to Glide Area (A_{ibg} / A_{bkfg})				

Step**

Step Width (W_{bkfs})	21.75	22.5	21.0	ft	Step Width to Riffle Width (W_{bkfs} / W_{bkf})	0.69	0.66	0.714	
Step Mean Depth (d_{bkfs})	1.22	1.12	1.32	ft	Step Mean Depth to Riffle Mean Depth (d_{bkfs} / d_{bkf})	0.81	0.741	0.874	
Step Cross-Sectional Area (A_{bkfs})	36.9	30.39	43.4	ft	Step Area to Riffle Area (A_{bkfs} / A_{bkf})	0.83	0.687	0.98	
Step Maximum Depth (d_{maxs})	2.64	2.75	2.53	ft	Step Max Depth to Riffle Mean Depth (d_{maxs} / d_{bkf})	1.75	1.67	1.82	
Step Width/Depth Ratio (W_{bkfs} / d_{bkfs})	18.65	21.38	15.91						

*Riffle–Pool system (i.e., C, E, F stream types) bed features include riffles, runs, pools and glides.

**Step–Pool system (i.e., A, B, G stream types) bed features include riffles, rapids, chutes, pools and steps (note: include rapids and chutes in riffle category).

***Convergence-Divergence system (i.e., D stream types) bed features include riffles and pools; cross-sections taken at riffles for classification purposes.

Pool2 Pool1 Step1

Copyright © 2012 Wildland Hydrology

Worksheet B-3b. Morphological relations, including dimensionless ratios (*First Field Day*).

Stream: SHARMAN'S BRANCH Location: KEEDYSVILLE, MD, FERNROCK RD.

Observers: TEAM 1 Date: 04/24/2012 Valley Type: VI Stream Type: B3/1

River Reach Summary Data.....2

Hydraulics

Streamflow: Estimated Mean Velocity at Bankfull Stage (u_{bkf})	3.14	ft/sec	Estimation Method	Jarrods	
Streamflow: Estimated Discharge at Bankfull Stage (Q_{bkf})	138.79	cfs	Drainage Area	3.6	mi^2

Channel Pattern

~~Linear Wavelength (λ)~~				ft	~~Linear Wavelength to Riffle Width (λ / W_{bkf})~~			
~~Stream Meander Length (L_m)~~				ft	~~Stream Meander Length Ratio (L_m / W_{bkf})~~			
~~Radius of Curvature (R_c)~~				ft	~~Radius of Curvature to Riffle Width (R_c / W_{bkf})~~			
~~Belt Width (W_{blt})~~				ft	~~Meander Width Ratio (W_{blt} / W_{bkf})~~			
~~Arc Length (L_a)~~				ft	~~Arc Length to Riffle Width (L_a / W_{bkf})~~			
Riffle Length (L_r)	12.62	2.0	22.0	ft	Riffle Length to Riffle Width (L_r / W_{bkf})	0.40	0.06	0.70
Individual Pool Length (L_p)	14.4	5.0	29.0	ft	Individual Pool Length to Riffle Width (L_p / W_{bkf})	0.46	0.16	0.92
Pool to Pool Spacing (P_s)	23.2	17.5	30	ft	Pool to Pool Spacing to Riffle Width (P_s / W_{bkf})	0.74	0.56	0.95

Channel Profile

Valley Slope (S_{val})	0.036	ft/ft	Average Water Surface Slope (S)	0.032	ft/ft	Sinuosity (S_{val} / S)	1.14	
Stream Length (SL)	300	ft	Valley Length (VL) 265	263	ft	Sinuosity (SL / VL)	1.14	
Low Bank Height (LBH)	start	ft	Max Depth (d_{max})	start	ft	Bank-Height Ratio (BHR) (LBH / d_{max})	start	
	end	ft		end	ft		end	

~~Riffle Slope (S_{rif})~~	~~0.127~~	~~0.01~~	~~0.24~~	ft/ft	~~Riffle Slope to Average Water Surface Slope (S_{rif} / S)~~	~~4.21~~	~~1.56~~	~~17.5~~
~~Run Slope (S_{run})~~				ft/ft	~~Run Slope to Average Water Surface Slope (S_{run} / S)~~			
Pool Slope (S_p)	0.026	0.004	0.069	ft/ft	Pool Slope to Average Water Surface Slope (S_p / S)	0.81	0.125	2.16
~~Glide Slope (S_g)~~				ft/ft	~~Glide Slope to Average Water Surface Slope (S_g / S)~~			
Step Slope (S_s)	0.149	0.07	0.56	ft/ft	Step Slope to Average Water Surface Slope (S_s / S)	4.66	1.56	17.5

~~Max Riffle Depth (d_{maxrif})~~				ft	~~Max Riffle Depth to Mean Riffle Depth (d_{maxrif} / d_{bkf})~~			
~~Max Run Depth (d_{maxrun})~~				ft	~~Max Run Depth to Mean Riffle Depth (d_{maxrun} / d_{bkf})~~			
Max Pool Depth (d_{maxp})	4.185	3.60	4.69	ft	Max Pool Depth to Mean Riffle Depth (d_{maxp} / d_{bkf})	2.77	2.44	3.11
~~Max Glide Depth (d_{maxg})~~				ft	~~Max Glide Depth to Mean Riffle Depth (d_{maxg} / d_{bkf})~~			
Max Step Depth (d_{maxs})	2.64	2.58	2.75	ft	Max Step Depth to Mean Riffle Depth (d_{maxs} / d_{bkf})	1.75	1.67	1.82

Channel Materials

% Silt/Clay	0	U/S	D/S	N/S	D_{16}	11	14	18	N/S	31	51	mm
% Sand	0%	5%	7.1%	N/S	D_{35}	43	51	47	N/S	64	91	mm
% Gravel	32%	34	25%	N/S	D_{50}	93	90	91	N/S	83	110	mm
% Cobble	25%	32	20%	N/S	D_{84}	1070	920	1010	N/S	300	230	mm
% Boulder	27%	27	28	N/S	D_{95}	2000	1040	1010	N/S	512	450	mm
% Bedrock	7%	0	1	N/S	D_{100}	2090	2000	3000	N/S	2048	1024	mm

[a] Min, max & mean depths are measured from Thalweg to bankfull at mid-point of feature for riffles, runs & steps, the deepest part of pools, & at the tail-out of glides. DOWN

[b] Composite sample of riffles and pools within the designated reach. [c] Active bed of a riffle. [d] Height of roughness feature above bed.

Pool to Pool Spacing

100 max 27 min 55.7 mean

3.17 .86 1.77

Pool to Pool to Rifle Width

Copyright © 2012 Wildland Hydrology