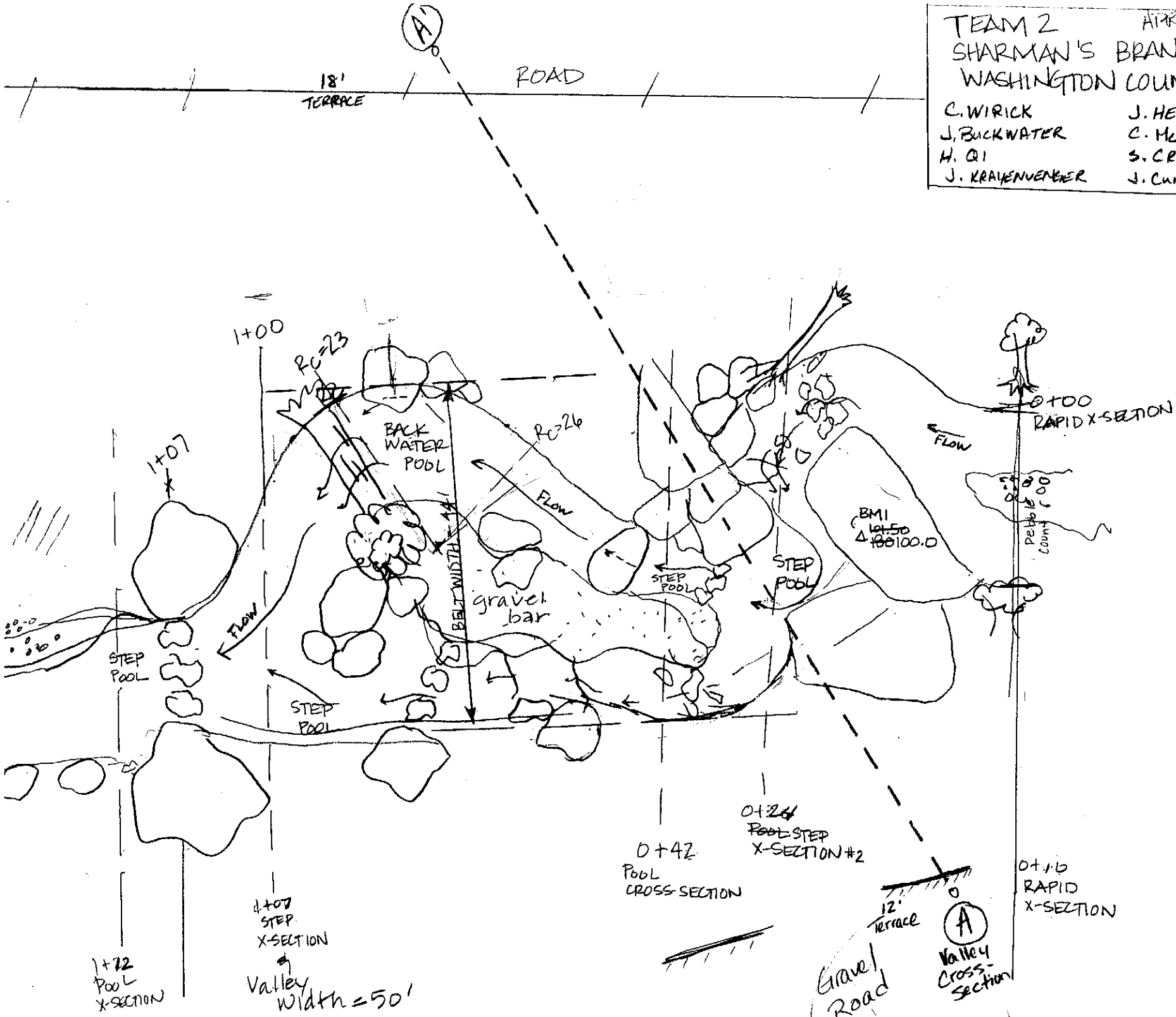
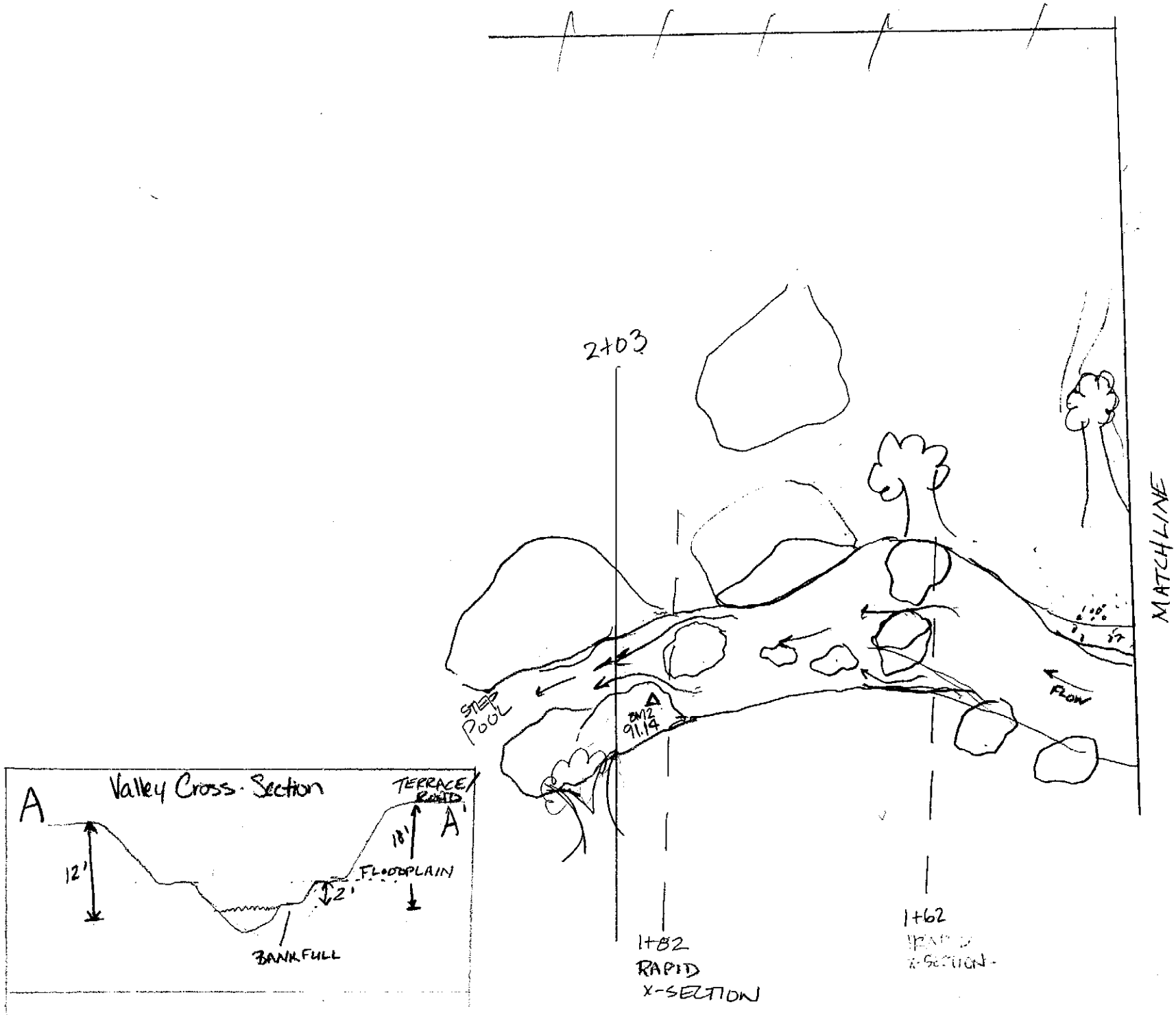
TEAM 2 APRIL 24, 2002
SHARMAN'S BRANCH, REACH 2
WASHINGTON COUNTY, MD

C. WIRICK
J. BUCKWATER
H. QI
J. KRAUENVENGER
J. HELMICH
C. McMUNIGAL
S. CRAIG
J. CUMMINGS



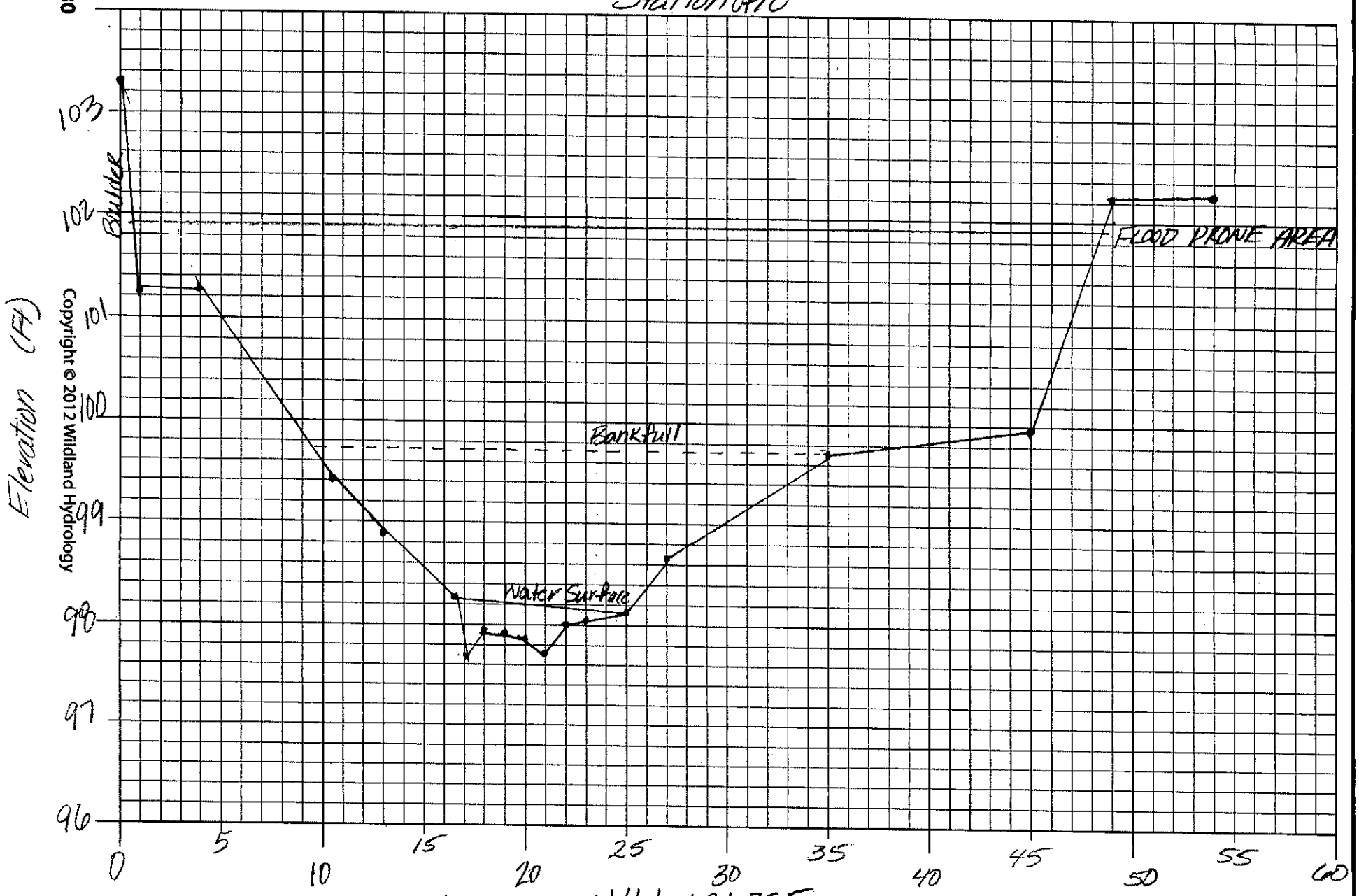

2+03
MATCHLINE
STEP POOL
BM2
91.19
FLOW
1+82
RAPID
X-SECTION
1+62
Valley Cross-Section
A
A'
TERRACE
12'
18'
2'
FLOODPLAIN
BANKFULL

Sharman Branch

Rapid : Cross Section

Station 0+10'

Team 2
4/24/12



Width of Flood Prone Area = 37.7

Cross Section Area = 27.5

Dmean = 1.1 Dmax 2.1

width bankfull 25.5

Entrench 1.9

Width/depth Ratio 23.7

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Station 0+10

SURVEY DATA ⟹ **CROSS - SECTION** 1

SITE: Date:

Location: Rapid #2

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			105.03			
2	0			3.72	101.31	Ground
3	1			3.79	101.24	Bould edge
4	4			3.76	101.27	Top boulder
5	10.5			5.62	99.41	Edge lower boulder
6	13			6.14	98.87	Top boulder
7	16.5			6.77	98.26	LEW
8	17			7.39	97.64	
9	18			7.1	97.93	
10	19			7.13	97.90	
11	20			7.21	97.82	
12	21			7.33	97.70	THL
13	22			7.03	98.00	
14	23			6.97	98.06	
15	25			6.87	98.16	REW
16	27			6.41	98.62	Long Pro station 10
17	35			5.33	99.70	Bankfull
18	45			5.15	99.88	Break point ↑
19	49			2.78	102.25	
20	54			2.75	102.28	
21						
22						
23		5.03	105.03	~~105.03~~	100.00	BENCHMARK
24						
25						
26						
27						
28						

large Boulder @ pin prevented us from going higher ~2' lateral → 0.5' elev

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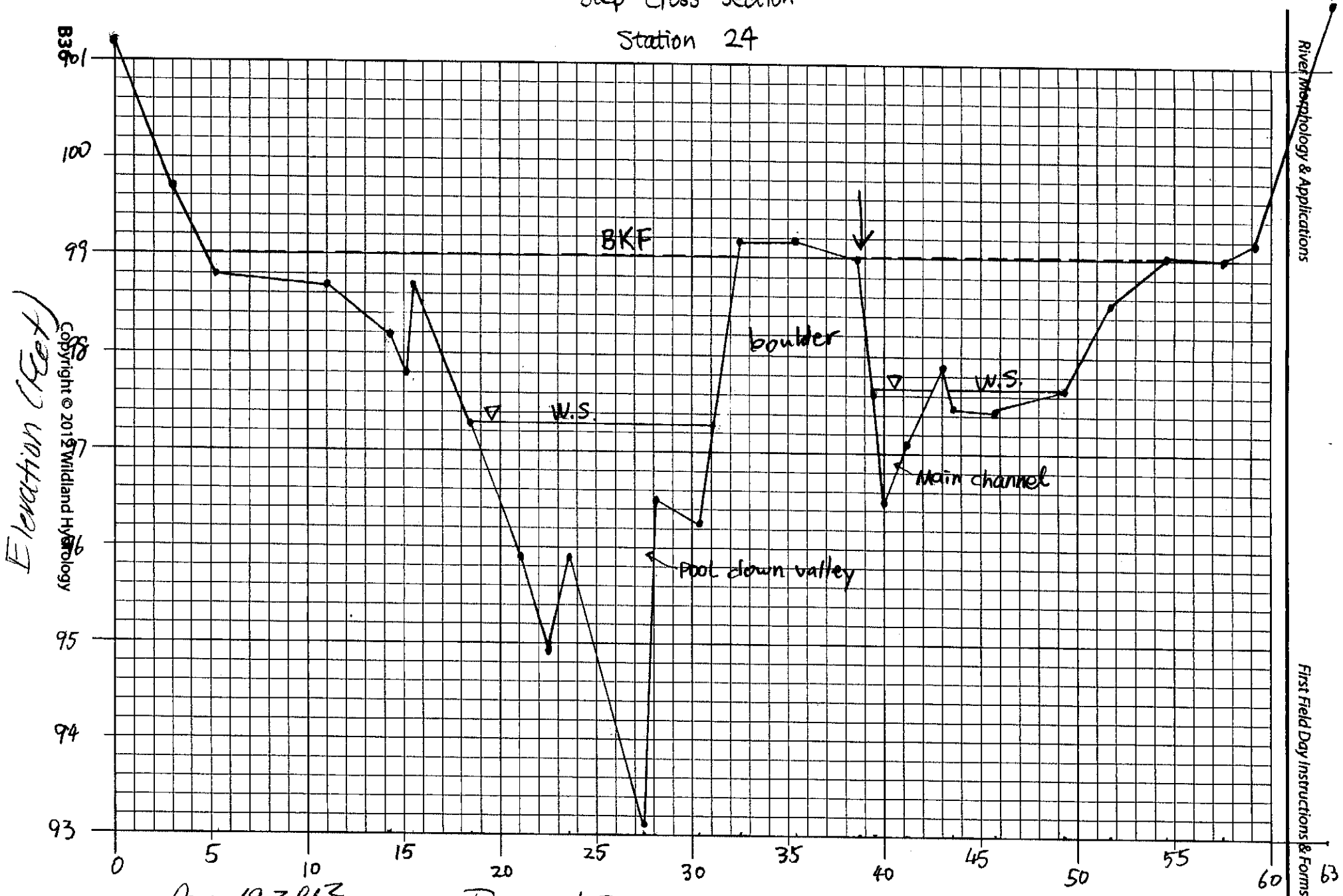
Sharman's Branch

Step Cross Section

Station 24

Team 2 4/24/12



$A = 19.3 ft^2$

$W_{BF} = 18.7 ft$

$D_{max} = 1.9$

$D_{mean} = 1.0$

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Upstream step @ Station 24

SURVEY DATA ⟹ **CROSS - SECTION 3**

SITE: Sharman's Branch Date: 4/24/12

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
29	BM1	3.69	103.69		100.0	Ground
30	0			2.45	101.24	
31	3			4.0	99.69	
32	5.2			4.90	98.79	
33	11			4.96	98.73	Top bank
34	14.2			5.52	98.17	
35	15.1			5.91	97.78	Edge Boulder
36	15.5			4.97	98.72	Top boulder
37	18.4			6.41	97.28	LEW - Pool area
38	21.1			7.80	95.89	
39	22.5			8.76	94.93	
40	23.6			7.80	95.89	
41	27.4			10.54	93.15	
42	28.1			7.24	96.45	
43	30.2			7.44	96.25	Edge of boulder in water
44	32.5			4.51	99.18	Top edge boulder
45	35.3			4.48	99.21	Bankfull - Top of boulder
46	38.7			4.71	98.98	Top edge of boulder
47	39.4			6.09	97.60	LEW @ step
48	39.9			7.20	96.49	
49	41.1			6.57	97.12	
50	43			5.79	97.90	
51	43.6			6.24	97.45	
52	45.8			6.27	97.42	
53	49.2			6.04	97.65	REW
54	51.8			5.13	98.56	Slope break
55	54.7			4.65	99.04	Bankfull
56	57.5			4.72	98.97	
57	59.1			4.52	99.17	
58	63			1.97	101.72	Top of bank
59						

XS Area: 19.3 ft²

BKF Width: 18.7 ft hy radius: 1.0

Mindepth: 1.0 width ratio: 18.0

Max depth: 1.9

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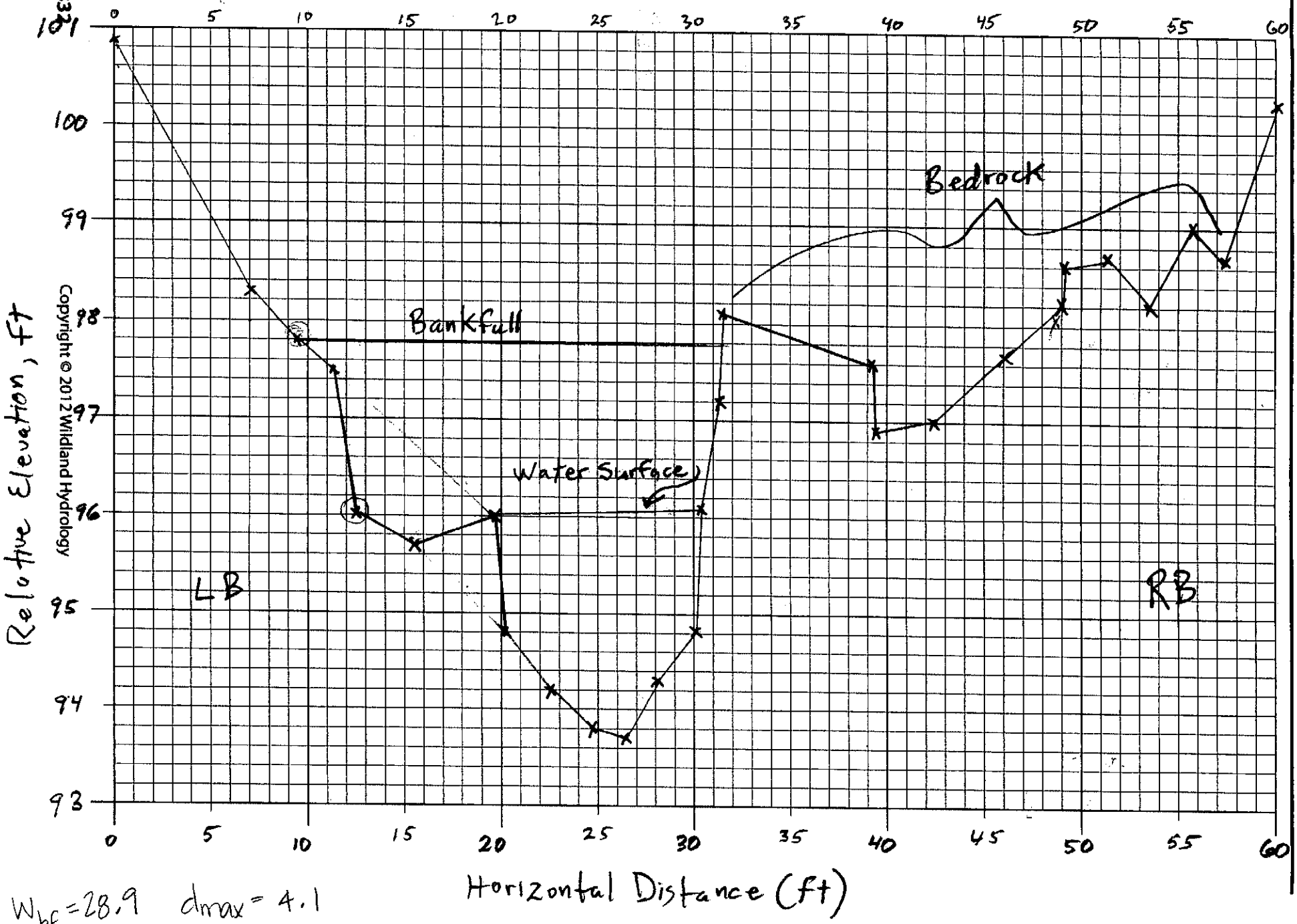
Team 2 4/24/12 Sharman's Branch (Reach 2), Washington Co., MD

Pool X-section at Station 42.

Joe & Trevor



$W_{bf} = 28.9$ $d_{max} = 4.1$

$\bar{d} = 2.0$ $W_{fpa} = 32.4$ $\frac{W}{D} = 14.3$ $A_{bkf} = 58.1 ft^2$ ER =

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upstream pool at ~~begi~~ start of reach (Station 42)

SURVEY DATA ⟹ **CROSS - SECTION 2**

SITE: Sharman's Branch Date: 4/24/12

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
29	—	1.80	101.80		100.0	benchmark 1
30	0			0.93	100.87	GS (LBP)
31	7.0			3.47	98.33	GS
32	9.5			4.02	97.78	~ LBF
33	11.2			4.34	97.46	SB
34	12.4			5.77	96.03	LEW
35	15.5			6.10	95.70	CS
36	19.8			5.85	95.95	CS
37	20.1			7.02	94.78	CS
38	22.6			7.62	94.18	CS
39	24.7			8.01	93.79	CS
40	26.4			8.08	93.72	TW
41	28.0			7.52	94.28	CS
42	30.0			7.01	94.79	CS
43	30.3			5.70	96.10	REW (edge of bedrock)
44	31.3			4.56	97.24	bedrock
45	31.4			3.68	98.12	"
46	39.1			4.20	97.60	"
47	39.4			4.92	96.88	"
48	42.4			4.82	96.98	"
49	46.0			4.10	97.70	"
50	48.8			3.61	98.19	"
51	49.1			3.25	98.55	"
52	51.2			3.09	98.71	"
53	53.6			3.56	98.24	"
54	55.8			2.78	99.02	"
55	57.4			3.10	98.70	SB
56	60.0			0.26	101.54	LBP, top of LB

57 Bankfull Dimensions

58 $W_{BF} = 28.9'$ X-section area $= 58.1\ ft^2$

59 $\bar{d} = 2.0'$, $d_{max} = 4.1'$, $W_p = 32.4'$, $R_h = 1.8'$

$w/D = 14.3$

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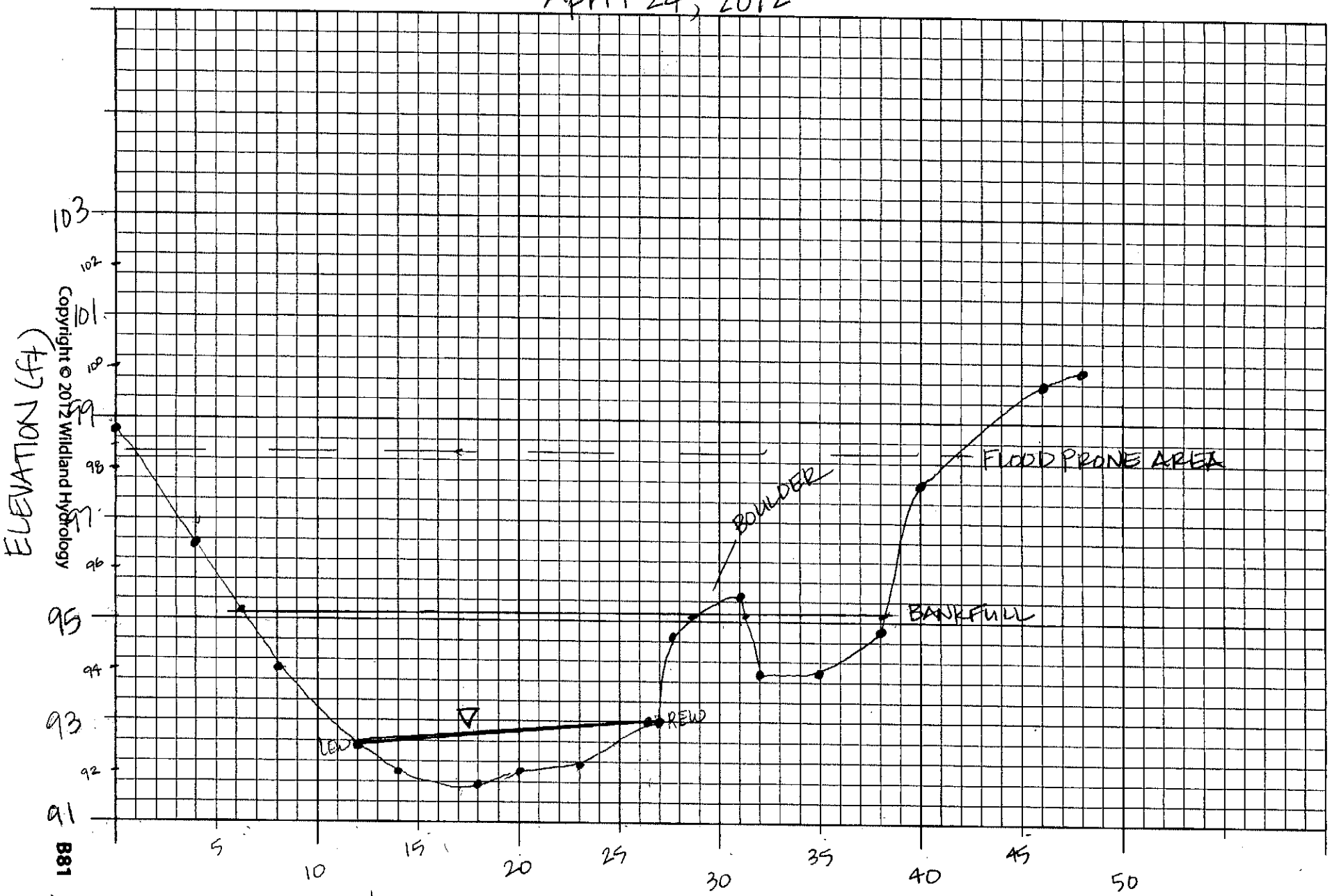
Sharman's Branch
Step #1 - Team 2
Station 107 - Cross section
April 24, 2012



$A_{bkf} = 57.3\ ft^2$
$W_{bkf} = 26.9\ ft$
mean $d_{bkf} = 2.1\ ft$

$d_{max} = 3.2$
W/d ratio = 12.8
ER = 1.5

$W_{fpa} = 41$

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SURVEY DATA ⟹ **CROSS - SECTION 5**

SITE: SKP #1 Group 2 **Date:**

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
29	0+00'			3.01	98.75	L Pin
30	0+04'			5.09	96.67	GS Break
31	0+08'			7.78	93.98	GS Break
32	0+12'			9.28	92.48	LEW
33	0+14'			9.59	92.17	
34	0+18'			9.91	91.85	
35	0+20'			9.72	92.04	Deepest
36	0+23'			9.60	92.16	
37	0+24.5			8.70	93.06 WS@	Edge Boulder
38	0+27'			8.56	93.2	REW
39	0+27½			6.99	94.77	Edge Boulder
40	0+31'			6.23	95.53	Top Boulder
41	0+32			7.42	94.34	Edge Boulder
42	0+35			7.42	94.34	GS Break
43	0+38			6.98	94.78	GS
44	0+40			4.09	97.67	GS
45	0+46			1.88	99.88	GS
46	0+49			0.86	100.9	GS Closest to Pin
47						
48						
49		1.76	101.76		100.00	BENCHMARK
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						

Station 101 Rapid

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$A_{bkf} = 57.3\ ft^2$
$W_{bkf} = 26.9$
$d_{bkf} = 2.1$

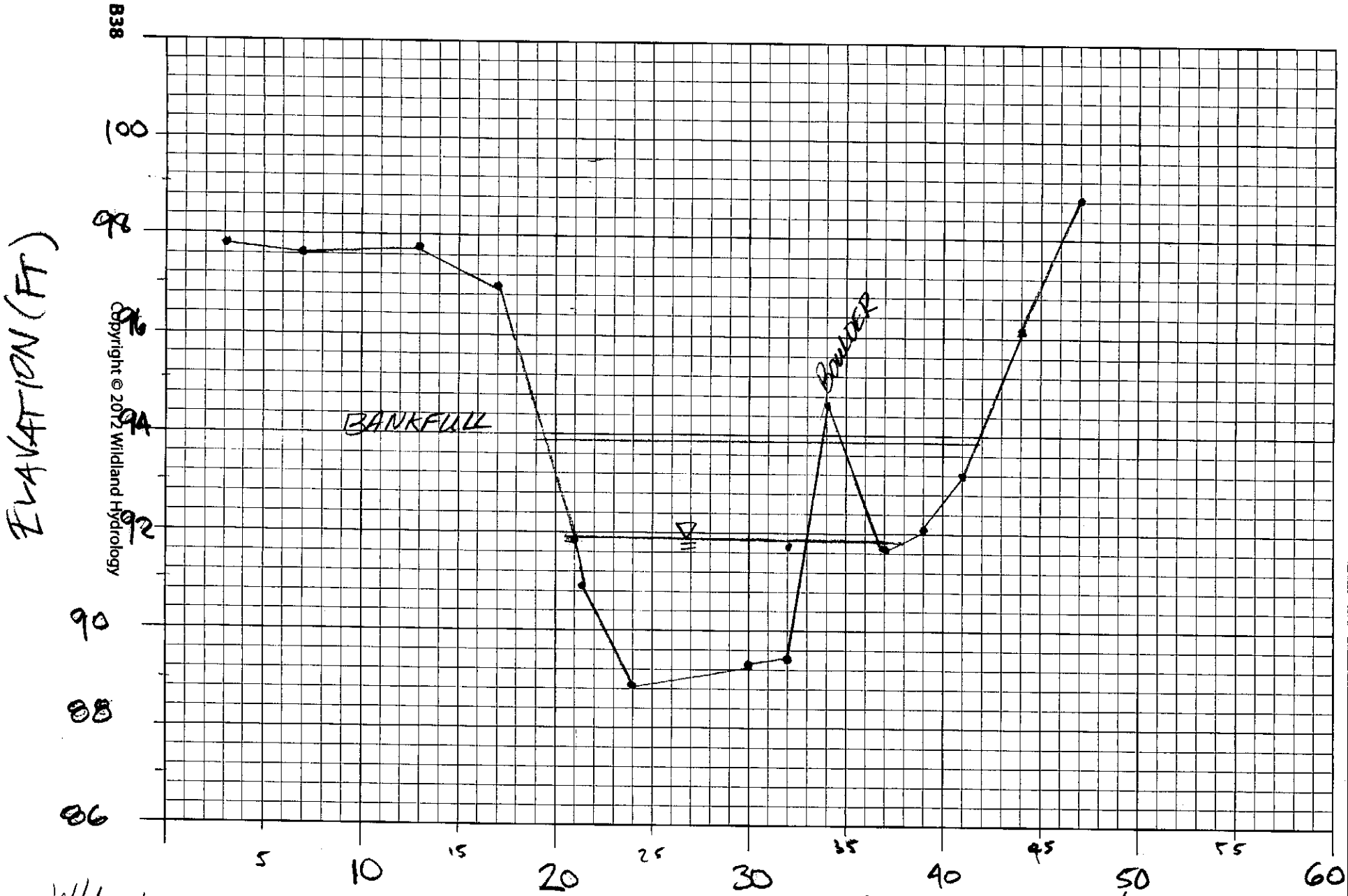
$d_{max} = 3.2$
W/d ratio = 12.6
entrenchment ratio = 1.5

$Elev_{fpa} = 6.4$

Pool Cross Section

Team 2

STATION 1+12'



W/d ratio =

A_{bkf} = 64.1 d_{max} = 5.2

W_{bkf} = 19.9 d_{mean} = 3.2

width depth Ratio 6.2 Entrench 1.8

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Station 1+12'

SURVEY DATA ⟹ *CROSS - SECTION* 4

SITE: Pool #1 Date:

0+00 2.53' Bank Pin

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29	0+03'			3.58	97.85	
30	0+07'			3.73	97.70	Edge of Boulder
31	0+13'			3.61	97.82	Boulder
32	0+17'			4.65	96.78	Boulder
33	0+21'			9.55	91.88	LEW WSurface
34	0+21.2			10.72	90.71	Left Edge Pool-CS
35	0+24.2"			12.66	88.77	Max Depth
36	0+30'			12.08	89.35	
37	0+32'			11.61	89.82	
38	0+32'			9.61	91.82	Water Surface
39	0+34'			6.91	94.52	Edge of Boulder
40	0+37'			9.61	91.82	REW (behind boulder)
41	0+39'			9.41	92.02	GS
42	0+41'			8.14	93.29	GS Break
43	0+44'			5.13	96.30	GS
44	0+47'			2.65	98.78	GS
45	0+52'			0.00		GS (RBank Pin close)
46						
47						
48		1.43'		101.43	100.00	Bench Mark
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						

100.00 ~~101.00~~ Blue Mark Sharpie

Station 1+12'

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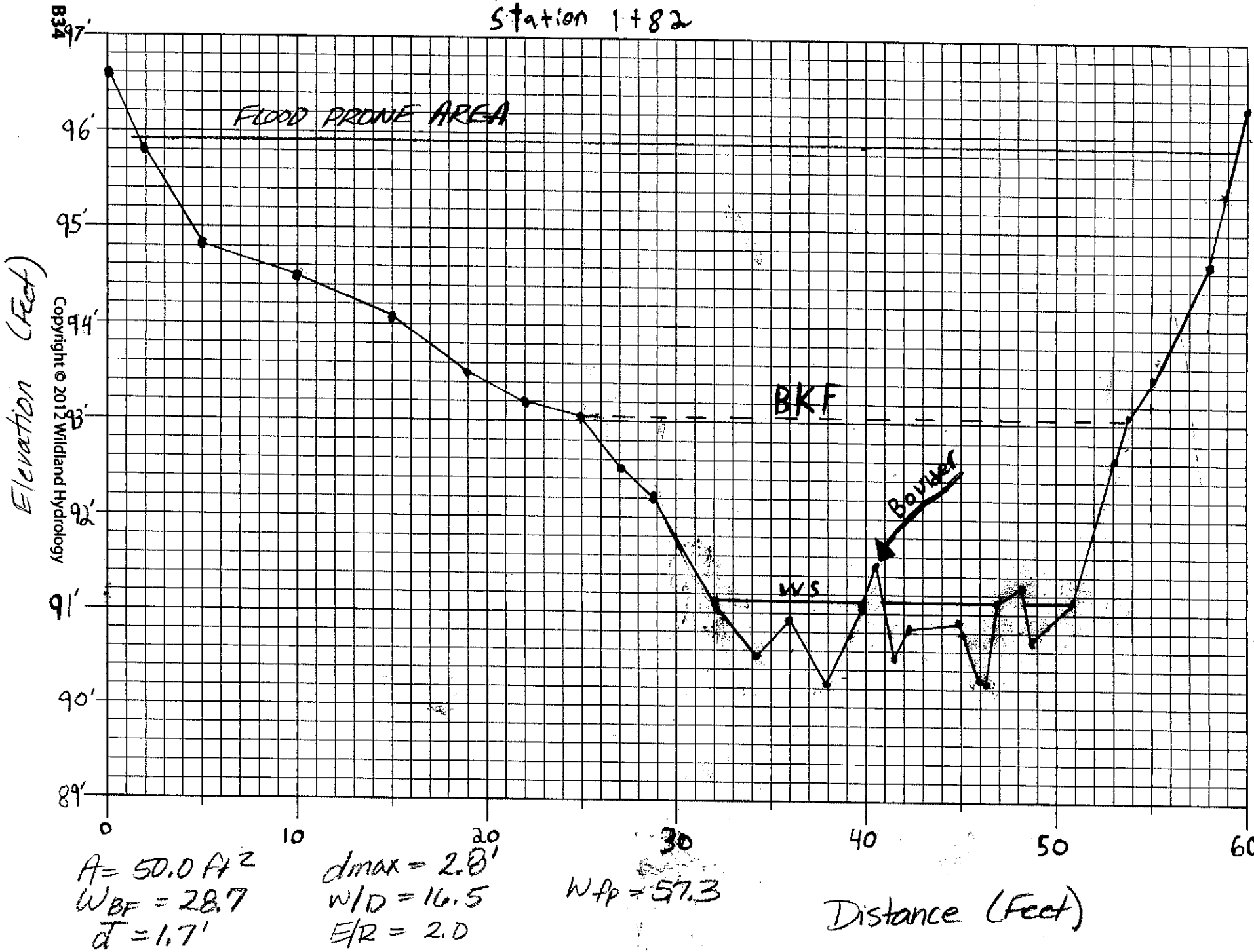
Sharmans Branch

Rapid Cross Section

Station 1+82

Team 2

4/24/12



$A = 50.0\ ft^2$

$W_{BF} = 28.7$

$\bar{d} = 1.7'$

$d_{max} = 2.8'$

$W/D = 16.5$

$E/R = 2.0$

$W_{fp} = 57.3$

B34

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River Morphology & Applications

First Field Day Instructions & Forms

Downstream rapid at end of reach. (station 182)

SURVEY DATA ⟹ **CROSS - SECTION** 1

SITE: Sharman's Branch — Date: 4/24/12

Location: Washington Co., MD

Party / Notes: Joe Trevor (Team 2) — HUC:

Item	Distance, Point, or STATION (ft)	Back-Sight BS (ft)	Height of Instrument HI (ft)	Fore-Sight FS (ft)	Elevation (ft)	NOTES / COMMENTS / REMARKS
1	—	7.94	99.08	—	91.14	BM2
2	0.0			2.49	96.59	LBP
3	2.0			3.28	95.8	GS
4	5.0			4.27	94.81	GS
5	10.0			4.61	94.47	GS
6	15.0			5.03	94.05	GS
7	19.0			5.61	93.47	GS
8	22.0			5.98	93.10	GS
9	25.0			6.06	93.02	GS BKF
10	27.1			6.59	92.49	~~BKF~~ (LB) pin
11	28.7			6.89	92.19	slp brk
12	30.9			7.71	91.37	slp brk
13	32.4			7.98	91.10	LEW
14	34.2			8.49	90.59	CS
15	36.0			8.13	90.95	CS
16	38.1			8.84	90.24	TW
17	39.7			8.05	91.03	boulder edge
18	40.5			7.60	91.48	" top
19	41.4			8.55	90.53	" edge
20	42.3			8.23	90.85	CS
21	44.8			8.19	90.89	CS - boulder 2 edge
22	45.9			8.78	90.30	CS
23	46.3			8.80	90.28	CS
24	46.8			7.92	91.16	CS
25	48.1			7.84	91.24	CS
26	48.6			8.45	90.62	CS
27	50.6			7.91	91.17	REW
28	53.0			6.46	92.62	GS
	53.8			6.01	93.07	GS
	55.4			5.63	93.45	GS
	57.9			4.39	94.69	GS
	60.0			2.72	96.35	RBP

LBP left bank pin
GS groundshot
Slp Brk
BKF
LB top
LEW left edge water
CS (channel shot)
TW thalweg

BM1 (blue "X" = elev. = 100.0')

A = 50.0 ft²
W_{BF} = 28.7'
d = 1.7'
d_{max} = 2.8'

w/d = 16.5
Entrenchment = 2.0
W_{fp} = 57.3

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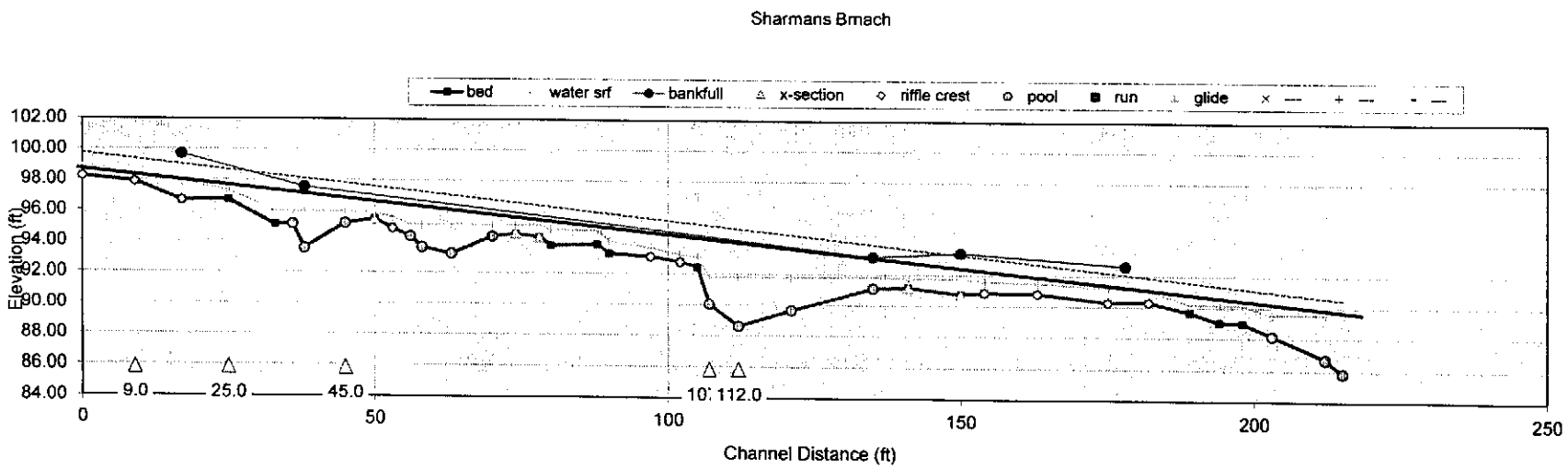
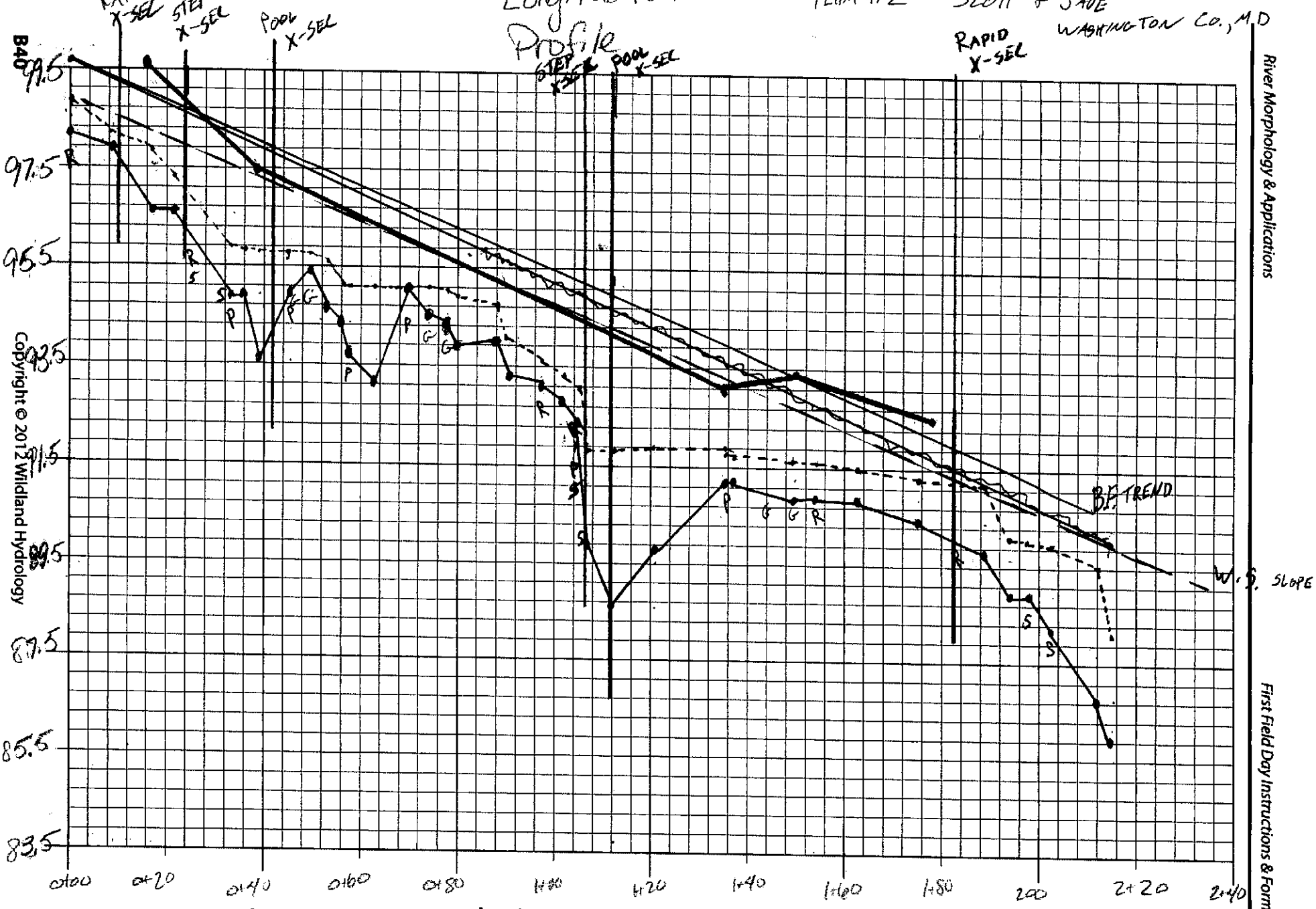
Longitudinal Slope Profile



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	4.30	---	215.0 (8.6 channel widths)	—	—	—
riffle	#DIV/0!	—	5.1 (0 - 21)	0.2 (— - 0.8)	—	—
pool	#DIV/0!	---	1.4 (0 - 6)	0.1 (--- - 0.2)	13.8 (2 - 68)	0.6 (0.1 - 2.7)
	—	—	—	—	—	—
glide	#DIV/0!	—	6.5 (0 - 19)	0.3 (— - 0.8)	—	—

SHARMAN'S BRANCH REACH #2 4/24/12
TEAM #2 SCOTT + JADE
WASHINGTON CO., MD

Longitudinal Profile



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SURVEY DATA → LONGITUDINAL PROFILE 1

SITE: Sharman's Branch, Reach 2 Date: 4-24-12

Location: Washington County, MD Page 1 of 2

Party / Notes: Team 2 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		1.50	10.15		16	Foot		Left Bank				Bed Rock	
2	0			3.27		2.70						R	
3	9			3.63		3.26						R	
4	17			4.04		3.61		1.80				R	Class
5	25			4.81		4.20						S	
6	33			6.41		5.54						S	
7	36			6.35		5.57						P	
8	38			7.93		5.57		3.95				P	Thal class
9	45			6.31		5.59						G	
10	50			6.02		5.65						G	
11	53			6.62		5.90						R	
12	56			7.15		6.38						R	
13	58			7.85		6.40						P	
14	63			8.27		6.37						P	
15	70			7.13		6.39						P	
16	74			6.95		6.40						G	
17	78			7.17		6.40						G	Nice gravel
18	80			7.70		6.68						Sh	
19	86			7.62		6.73		Small log across				Sh	
20	90			8.20		7.40						Sh	
21	97			8.39		7.83						R	
22	102			8.72		8.25		Flag				R	Start step
23	105			9.06		8.40						Step	
24	107			11.44		9.70		Pool	XS			Step	Drop
25	112			12.06		9.69		Pool	XS			P	
26	121			11.84		9.68						P	
27	135			10.37		9.67		8.34				P	Class

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S = shote

SURVEY DATA → LONGITUDINAL PROFILE 2

SITE: Sharman's Branch, Reach 2 Date: 4-24-12

Location: Washington County, MD Page 2 of 2

Party / Notes: Team 2 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
28	141			10.31		9.72						G
29	150			10.72		9.74		8.06				G
30	154			10.64		9.90						R
31	163			10.66		10.00						R
32	175			11.20		10.26						R
33	182			11.17		10.41						R
34	188			11.83		11.22						S or Step
35	194			12.45		11.[illegible]						Shute
36	198			12.5		11.[illegible]		End	Flag	LB		
37	203			13.32		11.95						Shute end
38	212			14.80			-2.90 feet					P
39	215			15.63		11.95						P
40												
41												
42		10.36	Bench	2			91.14					
43												
44												
45	178							8.86			Station 182 Team 2	
46												
47												
48												
49												
50												
51												
52												
53												
54												

147.5
0
Reach 1

101.5

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△ RIFFLE

● POOL

□ COMPOSITE D_{50} = 52 mm D_{84} = 230 mm

PEBBLE COUNT DATA

LOCATION: REFERENCE REACH PEBBLE COUNT

REACH: SHERMAN'S BRANCH

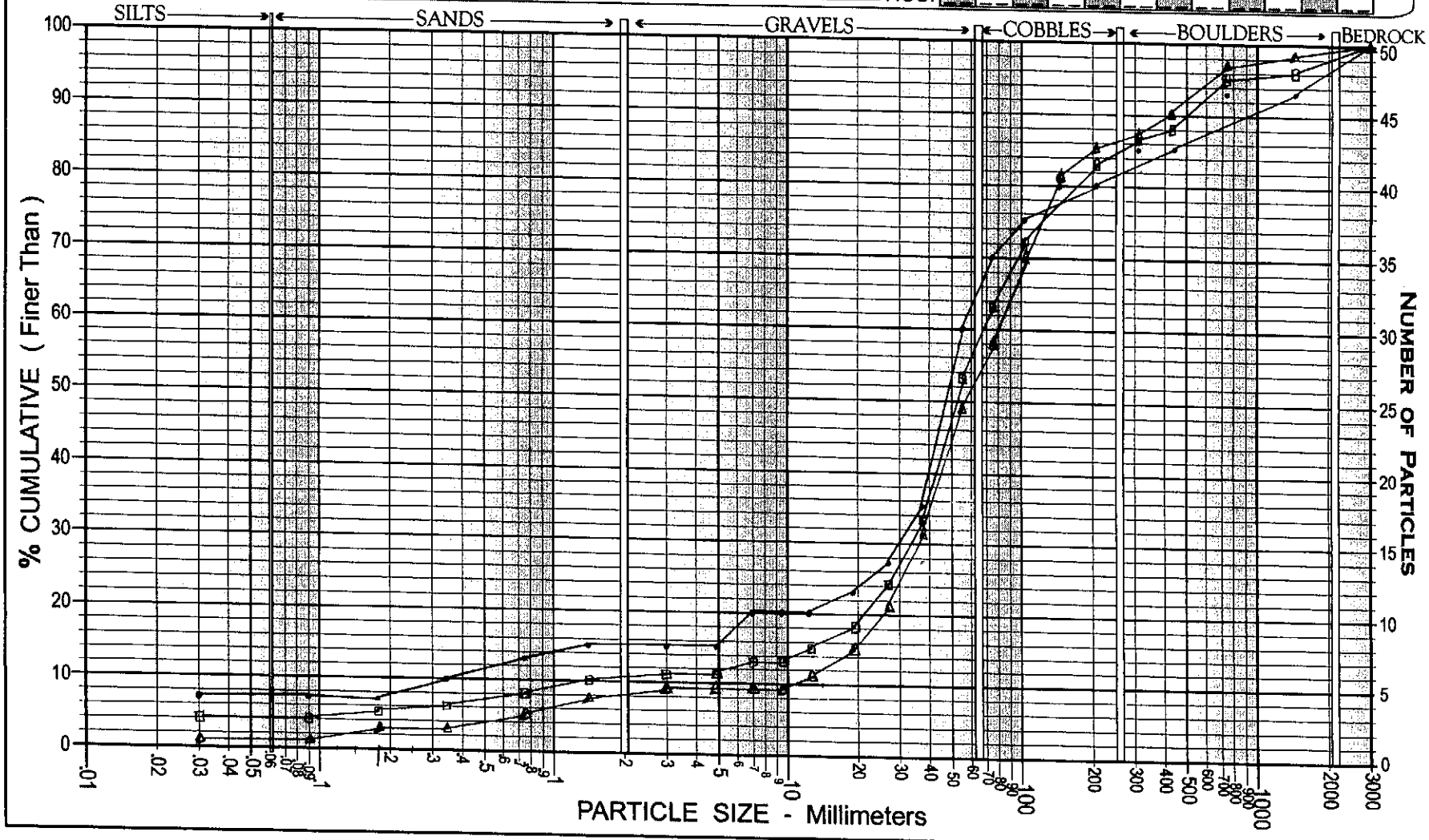
PARTY: TEAM #2

Date: 4/24/12

Stream Type: B4/1a

Valley Type: 6

HUC:



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Site: REFERENCE REACH PEBBLE COUNT Date: 4/24/12

Location: SHERMAN'S BRANCH HUC:

Party: TEAM #2

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) TOT #	RIFFLE (1) ITEM %	RIFFLE (1) % CUM	POOL (2) TOT #	POOL (2) ITEM %	POOL (2) % CUM	COMPOSITE (3) TOT #	COMPOSITE (3) ITEM %	COMPOSITE (3) % CUM
							Reach:			Reach:			Reach:		
							Date:			Date:			Date:		
	Silt / Clay	< .062	S/C	•	••	••	1	1.67	1.67	3	7.5	7.5	4	4	4
	Very Fine	.062 - .125	SAND				0	0	1.67	0	0	7.5	0	0	4
	Fine	.125 - .25		•		•	1	1.67	3.34	0	0	7.5	1	1	5
	Medium	.25 - .50			•	•	0	0	3.34	1	2.5	10.0	1	1	6
	Coarse	.50 - 1.0		•	•	••	1	1.67	5.01	1	2.5	12.5	2	2	8
.04 - .08	Very Coarse	1.0 - 2		•	•	••	1	1.67	6.68	1	2.5	15.0	2	2	10
.08 - .16	Very Fine	2 - 4	GRAVEL	•		•	1	1.67	8.35	0	0	15.0	1	1	11
.16 - .22	Fine	4 - 5.7					0	0	8.35	0	0	15.0	0	0	11
.22 - .31	Fine	5.7 - 8			••	••	0	0	8.35	2	5.0	20.0	2	2	13
.31 - .44	Medium	8 - 11.3					0	0	8.35	0	0	20.0	0	0	13
.44 - .63	Medium	11.3 - 16		••		••	2	3.33	11.68	0	0	20.0	2	2	15
.63 - .89	Coarse	16 - 22.6		••	•	•••	2	3.33	15.01	1	2.5	22.5	3	3	18
.89 - 1.3	Coarse	22.6 - 32		•••	••	⌶	4	6.67	21.68	2	5.0	27.5	6	6	24
1.3 - 1.8	Very Coarse	32 - 45		⌶	•••	⌧	6	10	31.68	3	7.5	35.0	9	9	33
1.8 - 2.5	Very Coarse	45 - 64		⌧	⌧	⌧ ⌧	10	16.67	48.35	10	25.0	60.0	20	20	53
2.5 - 3.5	Small	64 - 90	COBBLE	⌶	•••	⌧	6	10	58.35	4	10.0	70.0	10	10	63
3.5 - 5.0	Small	90 - 128		⌶	••	⌧	7	11.67	70.02	2	5.0	75.0	9	9	72
5.0 - 7.1	Large	128 - 180		⌶	••	⌧	7	11.67	81.69	2	5.0	80.0	9	9	81
7.1 - 10.1	Large	180 - 256		••		••	2	3.33	85.02	0	0	80.0	2	2	83
10.1 - 14.3	Small	256 - 362	BOULDER	•	••	•••	1	1.67	86.69	2	5.0	85.0	3	3	86
14.3 - 20	Small	362 - 512		••		••	2	3.33	90.02	0	0	85.0	2	2	88
20 - 40	Medium	512 - 1024		•••	•••	⌶	4	6.67	96.69	3	7.5	92.5	7	7	95
40 - 80	Large-Vry Large	1024 - 2048		•		•	1	1.67	98.36	0	0	92.5	1	1	96
	Bedrock		DR	•	•••	•••	1	1.67	100	3	7.5	100	4	4	100
Stream Type:			**Valley Type:**			TOTAL→	60		100	40		100	100		100

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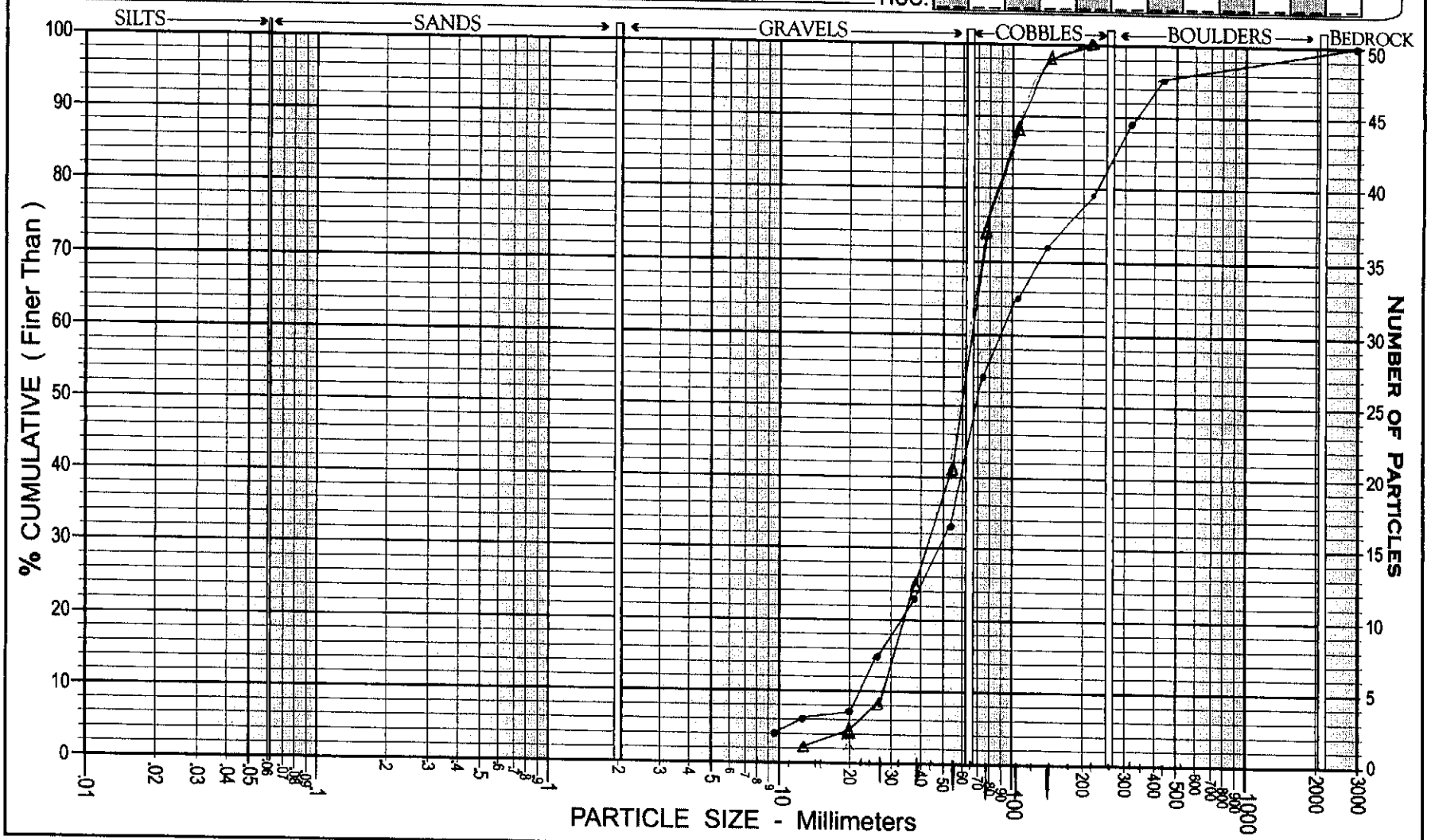
D_{84} ~ 96mm △ = US STA: 0+10 D_{50} 60mm
~ 256mm ● = DS STA: 1+82 66mm

PROTRUSION HEIGHTS

PEBBLE COUNT DATA

LOCATION: SHERMAN'S BRANCH US & DS ACTIVE BED
REACH: SHERMAN'S BRANCH
Date: 4/24/12
PARTY: TEAM 2
Stream Type: B4/1a
Valley Type: 6
HUC:



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Site: ACTIVE BED PROTRUSION HEIGHT Date: 4/24/12

Location: SHARMAN'S BRANCH HUC:

Party: TEAM #2

Inches	PARTICLE	Millimeters		US RIFFLE 1	~~POOL~~ DS RIFFLE	COMP. 3	US RIFFLE (1) TOT #	ITEM %	% CUM	DS ~~POOL~~ RIFFLE (2) TOT #	ITEM %	% CUM	COMPOSITE (3) TOT #	ITEM %	% CUM
				Dot Count for			Reach:			Reach:			Reach:		
							Date:			Date:			Date:		
	Silt / Clay	< .062	S/C												
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25													
	Medium	.25 - .50													
	Coarse	.50 - 1.0													
.04 - .08	Very Coarse	1.0 - 2													
.08 - .16	Very Fine	2 - 4	GRAVEL												
.16 - .22	Fine	4 - 5.7													
.22 - .31	Fine	5.7 - 8													
.31 - .44	Medium	8 - 11.3								4	4	4			
.44 - .63	Medium	11.3 - 16					2	2	2	2	2	6			2
.63 - .89	Coarse	16 - 22.6					2	2	4	1	1	7			4
.89 - 1.3	Coarse	22.6 - 32					4	4	8	8	8	15			8
1.3 - 1.8	Very Coarse	32 - 45					17	17	25	8	8	23			23
1.8 - 2.5	Very Coarse	45 - 64					16	16	41	10	10	33			41
2.5 - 3.5	Small	64 - 90	COBBLE				33	33	74	19	19	52			74
3.5 - 5.0	Small	90 - 128					14	14	88	13	13	65			88
5.0 - 7.1	Large	128 - 180					10	10	98	7	7	72			98
7.1 - 10.1	Large	180 - 256					2	2	100	7	7	79			100
10.1 - 14.3	Small	256 - 362	BOULDER							10	10	89			
14.3 - 20	Small	362 - 512								6	6	95			
20 - 40	Medium	512 - 1024													
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		DRK							5	5	100			
Stream Type:			**Valley Type:**			TOTAL→	100		100	100		100			

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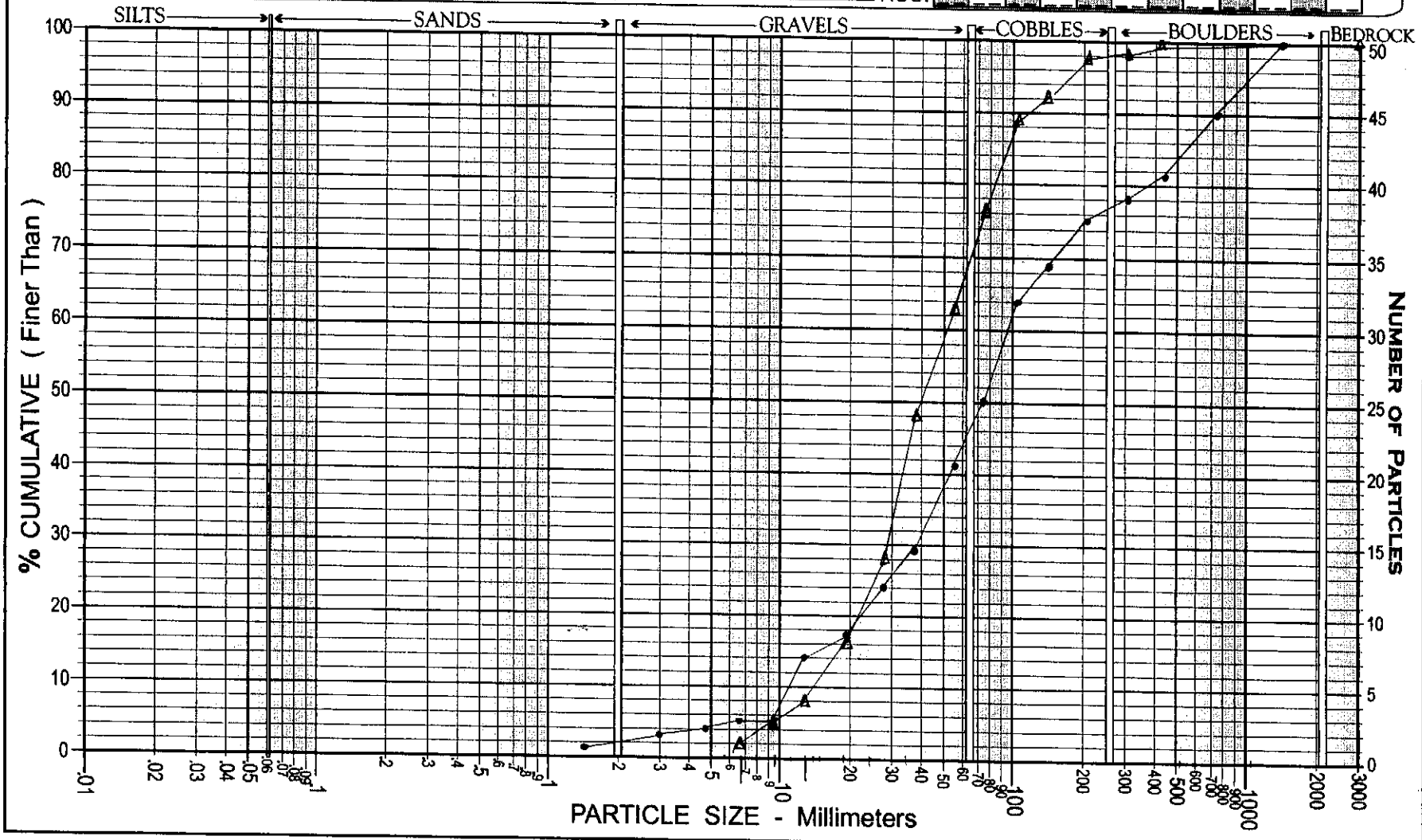
D_{84} ~92mm △ = US STA: 0+10 D_{50} 40 mm
~500mm ● = DS STA: 1+82 74 mm

PEBBLE COUNT DATA

LOCATION: US & DS ACTIVE BED
REACH: SHERMAN'S BRANCH
Stream Type: B4/1a
PARTY: TEAM #2
Valley Type: 6
Date: 4/24/12
HUC:



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Site: ACTIVE BED PEBBLE COUNT Date: 4/24/12

Location: SHAFMAN'S BRANCH HUC:

Party: TEAM #2

US Dot Count for RIFFLE 1 / ~~POOL~~ DS 2 RIFFLE / COMP. 3

Inches	PARTICLE	Millimeters		US RIFFLE (1) TOT #	US RIFFLE (1) ITEM %	US RIFFLE (1) % CUM	DS ~~POOL~~ RIFFLE (2) TOT #	DS ~~POOL~~ RIFFLE (2) ITEM %	DS ~~POOL~~ RIFFLE (2) % CUM	COMPOSITE (3) TOT #	COMPOSITE (3) ITEM %	COMPOSITE (3) % CUM
	Silt / Clay	< .062	S/C									
	Very Fine	.062 - .125	SAND									
	Fine	.125 - .25	SAND									
	Medium	.25 - .50	SAND									
	Coarse	.50 - 1.0	SAND									
.04 - .08	Very Coarse	1.0 - 2	SAND				1		1			
.08 - .16	Very Fine	2 - 4	GRAVEL				2		3			
.16 - .22	Fine	4 - 5.7	GRAVEL				1		4			
.22 - .31	Fine	5.7 - 8	GRAVEL	2		2	1		5			
.31 - .44	Medium	8 - 11.3	GRAVEL	3		5	0		5			
.44 - .63	Medium	11.3 - 16	GRAVEL	3		8	9		14			
.63 - .89	Coarse	16 - 22.6	GRAVEL	8		16	3		17			
.89 - 1.3	Coarse	22.6 - 32	GRAVEL	12		28	7		24			
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL	20		48	5		29			
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL	15		63	12		41			
2.5 - 3.5	Small	64 - 90	COBBLE	13		76	9		50			
3.5 - 5.0	Small	90 - 128	COBBLE	13		89	14		64			
5.0 - 7.1	Large	128 - 180	COBBLE	3		92	5		69			
7.1 - 10.1	Large	180 - 256	COBBLE	5		97	6		75			
10.1 - 14.3	Small	256 - 362	BOULDER	1		98	3		78			
14.3 - 20	Small	362 - 512	BOULDER	1		99	3		81			
20 - 40	Medium	512 - 1024	BOULDER				9		90			
40 - 80	Large-Vry Large	1024 - 2048	BOULDER				10		100			
	Bedrock		DRK	1		100						
			TOTAL→	100		100	100		100			

Stream Type: **Valley Type:**

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

Stream:	Sharman's Branch	Location:	Washington Co., MD
Date:	4/24/12	Stream Type:	
Observers:	Team 2	Valley Type:	~~III~~ VI
		HUC:	

Bankfull Riffle Cross-Sectional AREA	50.0	A_{bkf} (ft^2)	Bankfull Riffle Mean DEPTH	1.7	d_{bkf} (ft)
Bankfull Riffle WIDTH	28.7	W_{bkf} (ft)	Wetted PERMIMETER ~ $(2 * d_{bkf}) + W_{bkf}$	32.1	W_p (ft)
Pebble D_{84} at Riffle	500	Dia. (mm)	D_{84} (mm) / 304.8	1.64	D_{84} (ft)
Bankfull SLOPE	.043	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.56	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R(ft) / D_{84} (ft)	0.951	R / D_{84}
Drainage Area	3.6	DA (mi^2)	Shear Velocity $u^* = (gRS)^{1/2}$	1.47	u^* (ft/sec)

ESTIMATION METHODS	VELOCITY		DISCHARGE	
1. Friction Factor / Relative Roughness $u = [2.83 + 5.66 * Log(R / D_{84})] u^*$	3.98	ft / sec	198.97	cfs
2. Roughness Coefficient: a) Manning's *n* from Friction Factor / Relative Roughness (Figs. B-34, B-35) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.088	5.07	ft / sec	253	cfs
2. Roughness Coefficient: b) Manning's *n* from Stream Type (Fig. B-36) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.056	7.42	ft / sec	371	cfs
2. Roughness Coefficient: c) Manning's *n* from Jarrett (USGS): $u = 1.49*R^{2/3}*S^{1/2}/n$ $n = 0.39*S^{0.38}*R^{-0.16}$ 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 $n =$ .1099	3.78	ft / sec	189	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 $u = Q / A$	2.28	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.

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Team 2 Upstream Cross Section Pebble Count / Protrusion
4/24/12

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

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	Sharman's Branch	Location:	Washington County, MD
Date:	4-24-12 Stream Type: B4	Valley Type:	II
Observers:	Team 2	HUC:	-- -- -- -- -- -- -- -- -- -- --

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	27.5	A_{bkf} (ft²)	Bankfull Riffle Mean DEPTH	1.1	d_{bkf} (ft)
Bankfull Riffle WIDTH	25.5	W_{bkf} (ft)	Wetted PERMIMETER ~ (2 * d_{bkf}) + W_{bkf}	27.7	W_p (ft)
D_{84} at Riffle	92/96	Dia. (mm)	D_{84} (mm) / 304.8	.302/.315	D_{84} (ft)
Bankfull SLOPE	.043	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	0.993	R (ft)
Gravitational Acceleration	32.2	g (ft / sec²)	Relative Roughness R(ft) / D_{84} (ft)	3.29/3.15	R / D_{84}
Drainage Area	3.6	DA (mi²)	Shear Velocity $u^* = (gRS)^{1/2}$	1.173	u* (ft/sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $u = [2.83 + 5.66 * Log\{R / D_{84}\}] u^*$	6.75/6.63	ft / sec	185.6/182.3	cfs
2. Roughness Coefficient: a) Manning's *n* from Friction Factor / Relative Roughness (Figs. B-34, B-35) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ .040/.042	7.69/7.32	ft / sec	211.5/201.3	cfs
2. Roughness Coefficient: b) Manning's *n* from Stream Type (Fig. B-36) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ .057	5.395	ft / sec	148.4	cfs
2. Roughness Coefficient: c) Manning's *n* from Jarrett (USGS): $u = 1.49*R^{2/3}*S^{1/2}/n$ $n = 0.39*S^{0.38}*R^{-0.16}$ 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 $n =$ .118	2.606	ft / sec	71.7	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		ft / sec	113.9	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 **"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.

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

Stream: Sharman's Branch	
Basin:	Drainage Area: 2304 acres 3.6 mi^2
Location: Washington Co., MD	
Twp.&Rge:	Sec.&Qtr.:
Cross-Section Monuments (Lat./Long.):	Date: 4/24/12
Observers: Team 2	Valley Type: ~~II~~ VI

Bankfull WIDTH (W_{bkf}) WIDTH of the stream channel at bankfull stage elevation, in a riffle section.	28.7	ft
Bankfull DEPTH (d_{bkf}) Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A_{bkf} / W_{bkf}$).	1.7	ft
Bankfull X-Section AREA (A_{bkf}) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	50	ft^2
Width/Depth Ratio (W_{bkf} / d_{bkf}) Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section.	16.5	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.	2.8	ft
WIDTH of Flood-Prone Area (W_{fpa}) Twice maximum DEPTH, or (2 x d_{mbkf}) = the stage/elevation at which flood-prone area WIDTH is determined in a riffle section.	57.3	ft
Entrenchment Ratio (ER) The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH (W_{fpa} / W_{bkf}) (riffle section).	2.0	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.	52	mm (v. coarse grv.)
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.	0.043	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).	1.17	

Stream Type [redacted] B4/2/1 — **See Classification Key (Figure B-2)**

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

Stream: Sharman's Branch Location: Washington Co, MD

Observers: Team 2 Date: 4/24/12 Valley Type: [illegible] Stream Type: B4/1a

River Reach Dimension Summary Data.....1

Riffle Dimensions*, **, ***	Riffle Width (W_{bkf})	29.1	25.5	28.7	ft	Riffle Cross-Sectional Area (A_{bkf}) (ft^2)	38.8	27.5	50
	Riffle Mean Depth (d_{bkf})	1.4	1.1	1.7	ft	Riffle Width/Depth Ratio (W_{bkf} / d_{bkf})	20.1	16.5	23.7
	Riffle Maximum Depth (d_{max})	2.45	2.1	2.8	ft	Riffle Max Depth to Riffle Mean Depth (d_{max} / d_{bkf})	1.75	1.6	1.8
	Width of Flood-Prone Area (W_{fpa})	52.5	47.7	57.3	ft	Entrenchment Ratio (W_{fpa} / W_{bkf})	1.95	1.9	2.0
	~~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})	24.4	19.9	28.9	ft	Pool Width to Riffle Width (W_{bkfp} / W_{bkf})	0.85	0.69	1.01
	Pool Mean Depth (d_{bkfp})	2.6	2.0	2.2	ft	Pool Mean Depth to Riffle Mean Depth (d_{bkfp} / d_{bkf})	1.53	1.18	1.88
	Pool Cross-Sectional Area (A_{bkfp})	61.1	58.1	64.1	ft	Pool Area to Riffle Area (A_{bkfp} / A_{bkf})	1.22	1.16	1.28
	Pool Maximum Depth (d_{maxp})	4.65	4.1	5.2	ft	Pool Max Depth to Riffle Mean Depth (d_{maxp} / d_{bkf})	2.74	2.41	3.06
	~~Pool Inner Berm Width (W_{ibp})~~	—	—	—	ft	~~Pool Inner Berm Width to Pool Width (W_{ibp} / W_{bkfp})~~	—	—	—
	~~Pool Inner Berm Depth (d_{ibp})~~	—	—	—	ft	~~Pool Inner Berm Depth to Pool Depth (d_{ibp} / d_{bkfp})~~	—	—	—
	~~Pool Inner Berm Area (A_{ibp})~~	—	—	—	ft^2	~~Pool Inner Berm Area to Pool Area (A_{ibp} / A_{bkfp})~~	—	—	—
	~~Point Bar Slope (S_{pb})~~	—	—	—	ft/ft	~~Pool Inner Berm Width/Depth Ratio (W_{ibp} / d_{ibp})~~	—	—	—
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_{max})				ft	Run Max Depth to Riffle Mean Depth (d_{max} / 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})	22.8	18.7	26.9	ft	Step Width to Riffle Width (W_{bkfs} / W_{bkf})	0.8	0.65	0.94
	Step Mean Depth (d_{bkfs})	1.55	1.0	2.1	ft	Step Mean Depth to Riffle Mean Depth (d_{bkfs} / d_{bkf})	0.92	0.59	1.24
	Step Cross-Sectional Area (A_{bkfs})	38.3	19.3	57.3	ft	Step Area to Riffle Area (A_{bkfs} / A_{bkf})	0.77	0.39	1.15
	Step Maximum Depth (d_{maxs})	2.55	1.9	3.2	ft	Step Max Depth to Riffle Mean Depth (d_{maxs} / d_{bkf})	1.5	1.12	1.88
	Step Width/Depth Ratio (W_{bkfs} / d_{bkfs})	15.4	12.8	18					

*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.

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

Stream: Sharman's Branch Location: Washington Co, MD

Observers: Team 2 Date: 4/24/12 Valley Type: ~~VI~~ Stream Type:

River Reach Summary Data.....2

Hydraulics

Streamflow: Estimated Mean Velocity at Bankfull Stage (u_{bkf})		ft/sec	Estimation Method	
Streamflow: Estimated Discharge at Bankfull Stage (Q_{bkf})		cfs	Drainage Area	3.6 mi²

Channel Pattern

Linear Wavelength (λ)	N/A			ft	Linear Wavelength to Riffle Width (λ / W_{bkf})		—	
Stream Meander Length (L_m)	N/A			ft	Stream Meander Length Ratio (L_m / W_{bkf})		—	
Radius of Curvature (R_c)	24.5	23	26	ft	Radius of Curvature to Riffle Width (R_c / W_{bkf})	0.854	0.801	0.906
Belt Width (W_{blt})	44			ft	Meander Width Ratio (W_{blt} / W_{bkf})	1.5	—	
Arc Length (L_a)	N/A			ft	Arc Length to Riffle Width (L_a / W_{bkf})		—	
Riffle Length (L_r)	14.3	3	32	ft	Riffle Length to Riffle Width (L_r / W_{bkf})	0.497	0.105	1.115
Individual Pool Length (L_p)	18	9	28	ft	Individual Pool Length to Riffle Width (L_p / W_{bkf})	0.627	0.314	0.976
Pool to Pool Spacing (P_s)	59	25	103	ft	Pool to Pool Spacing to Riffle Width (P_s / W_{bkf})	2.056	0.871	3.589

Not Typical →

Channel Profile

Valley Slope (S_{val})	0.055	ft/ft	Average Water Surface Slope (S)	0043	ft/ft	Sinuosity (S_{val} / S)	1.28
Stream Length (SL)	203	ft	Valley Length (VL)	173	ft	Sinuosity (SL / VL)	1.17
Low Bank Height (LBH)	start ___ end ___	ft ft	Max Depth (d_{max})	start ___ end ___	ft ft	Bank-Height Ratio (BHR) (LBH / d_{max})	start ___ end ___

N/A

Riffle Slope (S_{rif})	.050	.018	.071	ft/ft	Riffle Slope to Average Water Surface Slope (S_{rif} / S)	1.159	.424	1.657
Run Slope (S_{run})				ft/ft	Run Slope to Average Water Surface Slope (S_{run} / S)			
Pool Slope (S_p)	.005	.004	.022	ft/ft	Pool Slope to Average Water Surface Slope (S_p / S)	.129	.103	.579
Glide Slope (S_g)	~~.094~~	~~.003~~	~~.192~~	ft/ft	Glide Slope to Average Water Surface Slope (S_g / S)	~~2.165~~	~~.078~~	~~4.457~~
Step Slope (S_s)	.311	.116	.650	ft/ft	Step Slope to Average Water Surface Slope (S_s / S)	7.236	2.698	15.116
Max Riffle Depth (d_{maxrif})	2.1	1.5	2.6	ft	Max Riffle Depth to Mean Riffle Depth (d_{maxrif} / d_{bkf})	1.235	0.882	1.529
Max Run Depth (d_{maxrun}) CHUTE	2.3	2.1	2.6	ft	Max Run Depth to Mean Riffle Depth (d_{maxrun} / d_{bkf})	1.353	1.235	1.529
Max Pool Depth (d_{maxp})	3.8	2.4	6.3	ft	Max Pool Depth to Mean Riffle Depth (d_{maxp} / d_{bkf})	2.235	1.412	3.706
Max Glide Depth (d_{maxg})	~~2.2~~	~~2.0~~	~~2.5~~	ft	Max Glide Depth to Mean Riffle Depth (d_{maxg} / d_{bkf})	~~1.294~~	~~1.176~~	~~1.471~~
Max Step Depth (d_{maxs})	2.3	2.0	2.8	ft	Max Step Depth to Mean Riffle Depth (d_{maxs} / d_{bkf})	1.353	1.176	1.647

Channel Materials

% Silt/Clay	4	0	—	D_{16}	5	18	—	13	mm
% Sand	6	1	—	D_{35}	22	32	—	48	mm
% Gravel	43	40	—	D_{50}	53	74	—	66	mm
% Cobble	30	34	—	D_{84}	230	500	—	256	mm
% Boulder	13	25	—	D_{95}	750	1000	—	420	mm
% Bedrock	4	0	—	D_{100}	BDRK	1500	—	BDRK	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.

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

Long Pro

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