TEAM 4

TEAM #4

Field Day 1 Presentation Order: Reference Reach

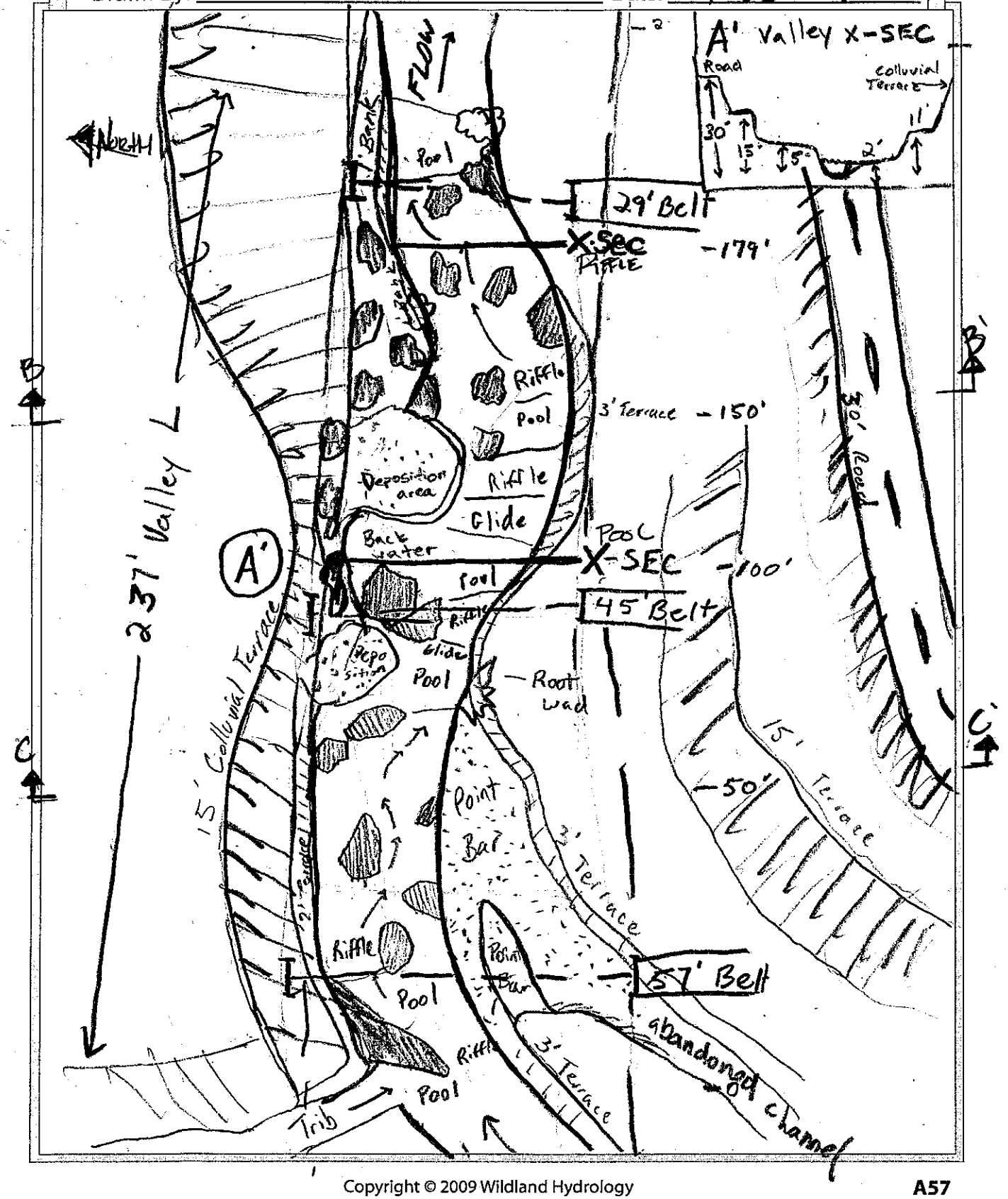
River Morphology and Applications

- Sketch Map
- Cross-sections
  - Riffle cross-section
  - Pool cross-section
- Longitudinal Profile
- Pebble Counts
  - Representative pebble count
  - Riffle pebble count
- Velocity (Worksheet A-2)
- Stream Classification (Worksheet A-1)
- Dimensionless Ratios (Worksheet A-3)

AREA-SITE LOCATION....REACH MAP

Stream: Sharmans Cr Reach: Team 4

Drawn By: _____ Date: 4-28-09



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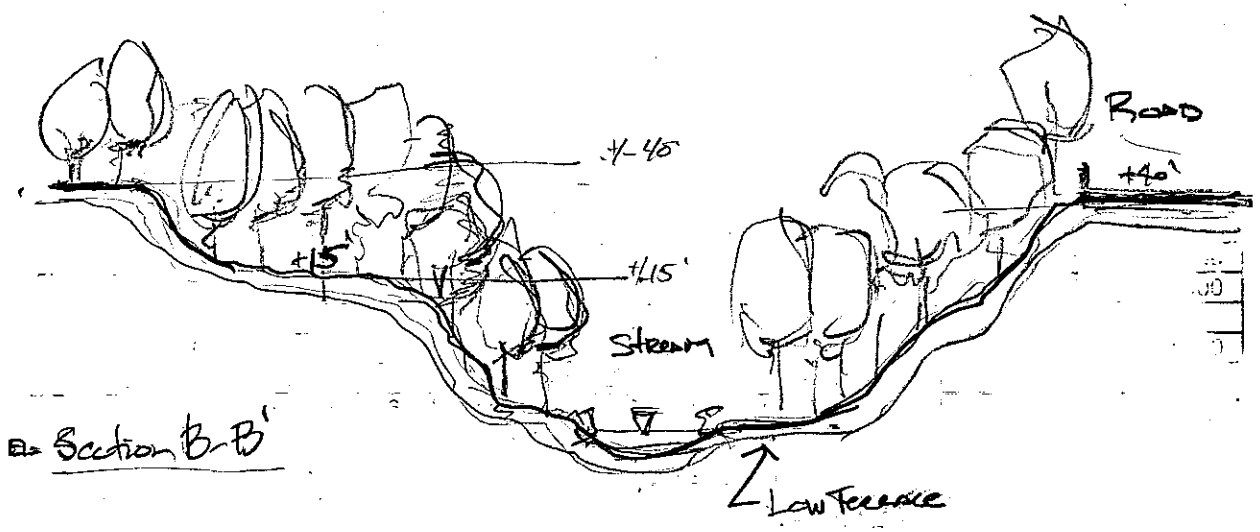
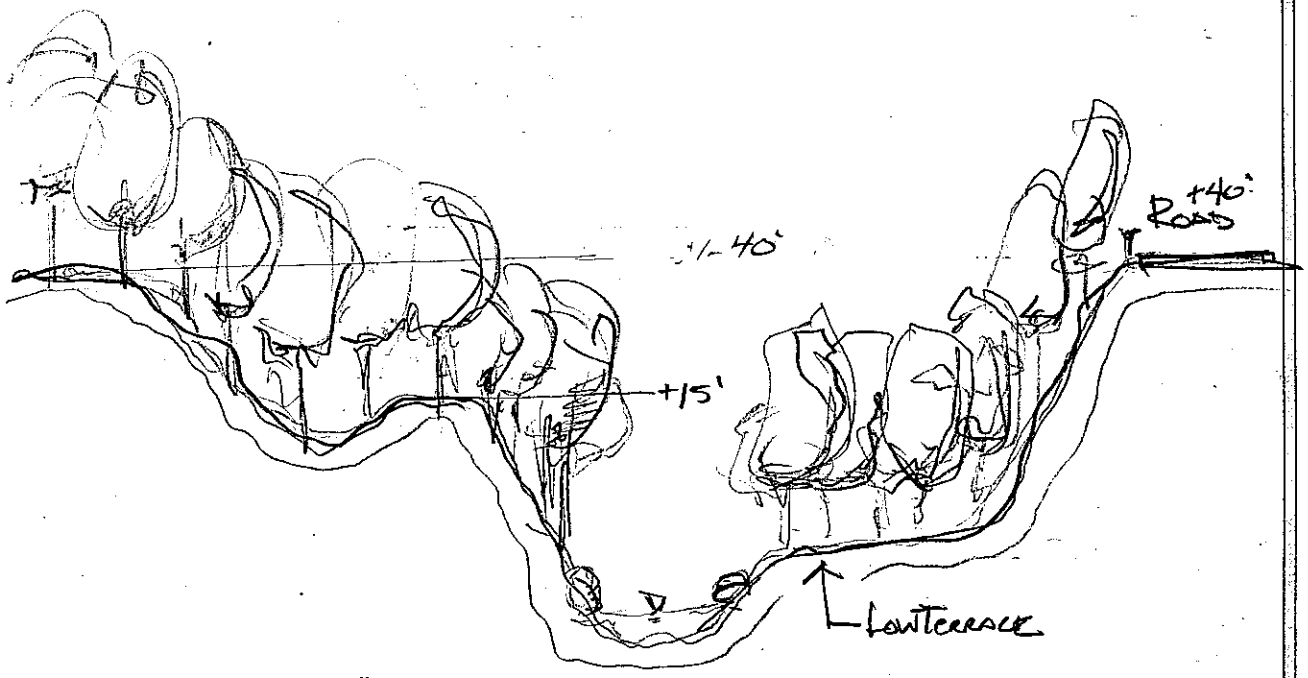
AREA-SITE LOCATION....REACH MAP

Stream: Sherman's Branch Reach: Group 4.

Drawn By: DPB Date:



Section B-B'



Section C-C'

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Worksheet A-1. Field Form for Level II Stream Classification.

Stream: SHARMANS CREEK	
Basin: POTOMAC RIVER Drainage Area:	acres 3.6 mi²
Location:	
Twp. & Rge: Washington County, MD Sec. & Qtr.:	
Cross-Section Monuments (Lat./Long.):	Date: 4/28/09
Observers: Team #4	Valley Type:

Bankfull WIDTH (W_{bkf}) WIDTH of the stream channel at bankfull stage elevation, in a riffle section.	24.06	ft
Bankfull DEPTH (d_{bkf}) Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A / W_{bkf}$).	1.61	ft
Bankfull X-Section AREA (A_{bkf}) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	38.84	ft^2
Width/Depth Ratio (W_{bkf} / d_{bkf}) Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section.	14.94	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.	2.59	ft
WIDTH of Flood-Prone Area (W_{fpa}) Twice maximum DEPTH, or (2 x d_{max}) = the stage/elevation at which flood-prone area WIDTH is determined in a riffle section.	44	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 mean diameter of channel materials, as sampled from the channel surface, between the bankfull stage and Thalweg elevations. Cobble	160	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.	0.034	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 (VS / S). 247/237	1.04 1.51*	* valley slope method

Stream Type B2/3 **See Classification Key**

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WRD = A

Worksheet A-3. Morphological relations, including dimensionless ratios of river reach sites.

Stream: SHARMANS CREEK Location:

Observers: TEAM #4 Date: 4/28/09 Valley Type: II Stream Type: B 2 3

River Reach Summary Data

Channel Dimension

Mean Riffle Depth (d_{bkf})	1.61	ft	Riffle Width (W_{bkf})	24.06	ft	Riffle Area (A_{bkf})	38.84	ft^2
Mean Pool Depth (d_{bkfp})	2.23	ft	Pool Width (W_{bkfp})	35.34	ft	Pool Area (A_{bkfp})	78.97	ft^2
Mean Pool Depth/Mean Riffle Depth	1.39	d_{bkfp}/d_{bkf}	Pool Width/Riffle Width	1.47	W_{bkfp}/W_{bkf}	Pool Area/Riffle Area	2.03	A_{bkfp}/A_{bkf}
Max Riffle Depth (d_{maxrif})	2.59	ft	Max Pool Depth (d_{maxp})	3.41	ft	Max Riffle Depth/Mean Riffle Depth	1.61	
Max Pool Depth/Mean Riffle Depth	2.12		Point Bar Slope	—	ft/ft	Inner Berm Width (W_{ib})	14	ft
Inner Berm Depth (d_{ib})	1.47	ft	Inner Berm Width/Depth Ratio	9.52	W_{ib}/d_{ib}	Inner Berm Area (A_{ib})	65.2	ft^2
Streamflow: Estimated Mean Velocity at Bankfull Stage (u_{bkf})	4.49	ft/s	Estimation Method	EQU. #1				
Streamflow: Estimated Discharge at Bankfull Stage (Q_{bkf})	174	cfs	Drainage Area	3.6	mi^2			

Corrected * data
Friction Factor
Relative Roughness

Channel Pattern

Geometry	Mean	Min	Max		Dimensionless Geometry Ratios	Mean	Min	Max
Meander Wavelength (L_m)	247	—	—	ft	Meander Length Ratio (L_m/W_{bkf})	10	—	—
Radius of Curvature (R_c)	—	—	—	ft	Radius of Curvature/Riffle Width (R_c/W_{bkf})	—	—	—
Belt Width (W_{blt})	43.66	29	57	ft	Meander Width Ratio (W_{blt}/W_{bkf})	1.81	1.2	2.3
Individual Pool Length	13	11	14	ft	Pool Length/Riffle Width	.54	.46	.58
Pool to Pool Spacing	141	—	—	ft	Pool to Pool Spacing/Riffle Width	5.86	—	—
Riffle Length	38	32	44	ft	Riffle Length/Riffle Width	1.58	1.33	1.83

Channel Profile

Valley Slope (VS)	.0225	ft/ft	Average Water Surface Slope (S)	.034	ft/ft	Sinuosity (VS/S)	1.51	
Stream Length (SL)	245	ft	Valley Length (VL)	237	ft	Sinuosity (SL/VL)	1.04	
Low Bank Height (LBH)	start 3.24 ft, end 3.38 ft		Max Riffle Depth	start 2.09 ft, end 1.71 ft		Bank-Height Ratio (BHR) (LBH/Max Riffle Depth)	start 1.55, end 1.98	

Facet Slopes	Mean	Min	Max		Dimensionless Slope Ratios	Mean	Min	Max
Riffle Slope (S_{rif})	.04	.029	.054	ft/ft	Riffle Slope/Average Water Surface Slope (S_{rif}/S)	1.18	.85	1.59
~~Run~~ Slope (S_{run}) STEP	.088	.061	.114	ft/ft	~~Run~~ STEP Slope/Average Water Surface Slope (S_{run}/S)	2.59	1.79	3.35
Pool Slope (S_p)	.015	.013	.017	ft/ft	Pool Slope/Average Water Surface Slope (S_p/S)	.44	.38	.5
Glide Slope (S_g)	—	—	—	ft/ft	Glide Slope/Average Water Surface Slope (S_g/S)	—	—	—

Feature Midpoint[a]	Mean	Min	Max		Dimensionless Depth Ratios	Mean	Min	Max
Max Riffle Depth (d_{maxrif})	2.12	2.01	2.23	ft	Max Riffle Depth/Mean Riffle Depth (d_{maxrif}/d_{bkf})	1.32	1.25	1.39
Max Run Depth (d_{maxrun})	—	—	—	ft	Max Run Depth/Mean Riffle Depth (d_{maxrun}/d_{bkf})	—	—	—
Max Pool Depth (d_{maxp})	3.47	3.14	3.68	ft	Max Pool Depth/Mean Riffle Depth (d_{maxp}/d_{bkf})	2.16	1.95	2.29
Max Glide Depth (d_{maxg})	—	—	—	ft	Max Glide Depth/Mean Riffle Depth (d_{maxg}/d_{bkf})	—	—	—

* Corrected data
* Corrected data

Channel Materials

	Reach[b]	Riffle[c]	Bar			Reach[b]	Riffle[c]	Bar	Protrusion Height[d]	
% Silt/Clay	0	0			D_{16}	38	23		125	mm
% Sand	3	7			D_{35}	85	42		175	mm
% Gravel	24	42			D_{50}	180	75		195	mm
% Cobble	38	29			D_{84}	510	380		320	mm
% Boulder	35	22			D_{95}	1050	800		500	mm
% Bedrock	0	0			D_{100}	2000	2000		1100	mm

[a] Min, max, mean depths are ave. mid-point values except pools: Taken at deepest part of pool.
[b] Composite sample of riffles and pools within the designated reach.
[c] Active bed of a riffle.
[d] Height of roughness feature above bed.

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SURVEY DATA ⟹ **CROSS - SECTION 1**

SITE: Sharmans Creek Date: April 28, '09

Location: Riffle XS @ station 180 Pg 1 of 2

Party / Notes: Andy, Keith, Alex 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	-4.0		100.00	2.73	97.27	Slope
2	-1.3			4.38	95.62	Slope Break
3	0.0			5.00	95.00	LB Pin
4	1.0			5.80	94.20	Slope Break
5	2.0			6.37	93.63	Toe of Slope
6	5.0			7.41	92.59	LEW
7	7.0			7.80	92.20	Channel
8	9.0			8.13	91.87	Channel
9	10.0			8.27	91.73	Channel
10	11.0			8.34	91.66	TW
11	12.0			8.08	91.92	Channel
12	13.0			8.05	91.95	Channel
13	14.0			7.94	92.06	Channel
14	15.0			7.94	92.06	Channel
15	16.0			7.40	92.60	Protruding Boulder - Edge of Water
16	17.3			7.73	92.27	Channel
17	18.0			7.49	92.51	REW
18	19.0			7.37	92.63	Toe of Slope
19	20.0			7.30	92.70	Slope Break
20	21.0			7.10	92.90	Slope Break
21	22.0			6.76	93.24	Slope Break
22	23.5			6.08	93.92	Slope Break
23	25.0			5.75	94.25	BKF
24	27.0			5.10	94.90	Slope Break
25	30.0			4.27	95.73	Slope Break
26	33.0			4.16	95.84	Slope Break
27	34.0			4.16	95.84	RB Pin
28	37.0			3.82	96.18	Slope

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SURVEY DATA ⟹ **CROSS - SECTION 2**

pg 20F2

SITE: Riffle XSC STATION 180 Date: 4/28/09

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES / COMMENTS / REMARKS
29	39.0		100.00	3.55	96.45	Slope
30	44.0		〃	2.13	97.87	Slope
31						
32						Floodprone Elevation =
33						(BKF) - (TW - BKF) =
34						(5.75) - (8.34 - 5.75) =
35						5.75 - 2.59 = 3.16
36						
37						
38						
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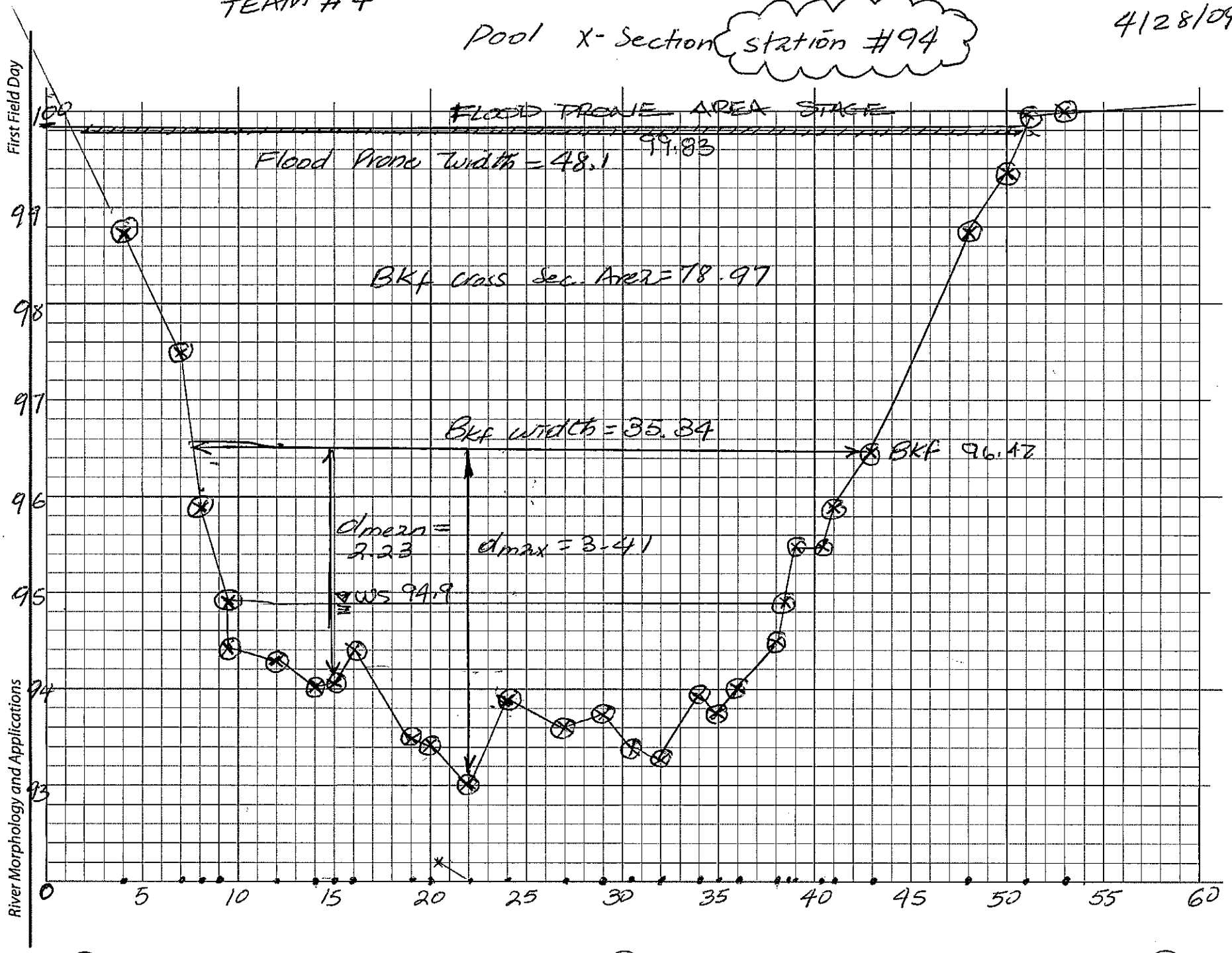
TEAM #4

Pool X-Section station #94

4/28/09



Pool X-Section

River Morphology and Applications

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SURVEY DATA ⟹ **CROSS - SECTION** 1

SITE: SHERMANS CREEK Date: 4/28/09

Location: Pool XS @ Station 94 Pg 1 of 2

Party / Notes: TEAM #4 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	4.0		100	1.22	98.78	
2	7.0			2.45	97.55	Top of Boulder
3	8.0			4.15	95.85	Slope Break on Boulder
4	9.3			5.09	94.91	LEW
5	9.3			5.86	94.14	Toe of Slope
6	12			5.65	94.35	Channel
7	14			5.97	94.03	Edge of Boulder in Channel
8	15			5.83	94.17	Channel
9	16			5.60	94.40	Channel
10	19			6.55	93.45	Channel
11	20			6.59	93.41	Channel
12	22			6.99	93.01	Pool Max
13	24			6.15	93.85	Channel
14	27			6.42	93.58	Channel
15	29			6.33	93.67	Channel
16	30.5			6.61	93.39	Channel
17	32			6.63	93.37	Channel
18	34			6.03	93.97	Channel
19	35			6.22	93.78	Channel
20	36			5.06	94.94	Edge of Water on Protruding Boulder
21	38			5.50	94.50	Channel
22	38.5			5.12	94.88	REW
23	39			4.49	95.51	Slope Break on Rock
24	40.5			4.50	95.50	Toe of Slope
25	41.0			4.12	95.88	Top of Item
26	43.0			3.58	96.42	BKF
27	48.0			1.22	98.78	Slope Break
28	50.0			0.63	99.37	Top of Bank

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Pg. 2 of 2

SURVEY DATA ⟹ **CROSS - SECTION 2**

SITE: Pool XS @ Station 94 Date: 4/28/09

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES / COMMENTS / REMARKS
29	51		100	0.38	99.62	Slope
30	53			0.00	100.0	Slope
31	67			-0.20	100.20	Slope
32	81			-0.27	100.27	Right Bank Pin - Toe of Slope
33						
34						
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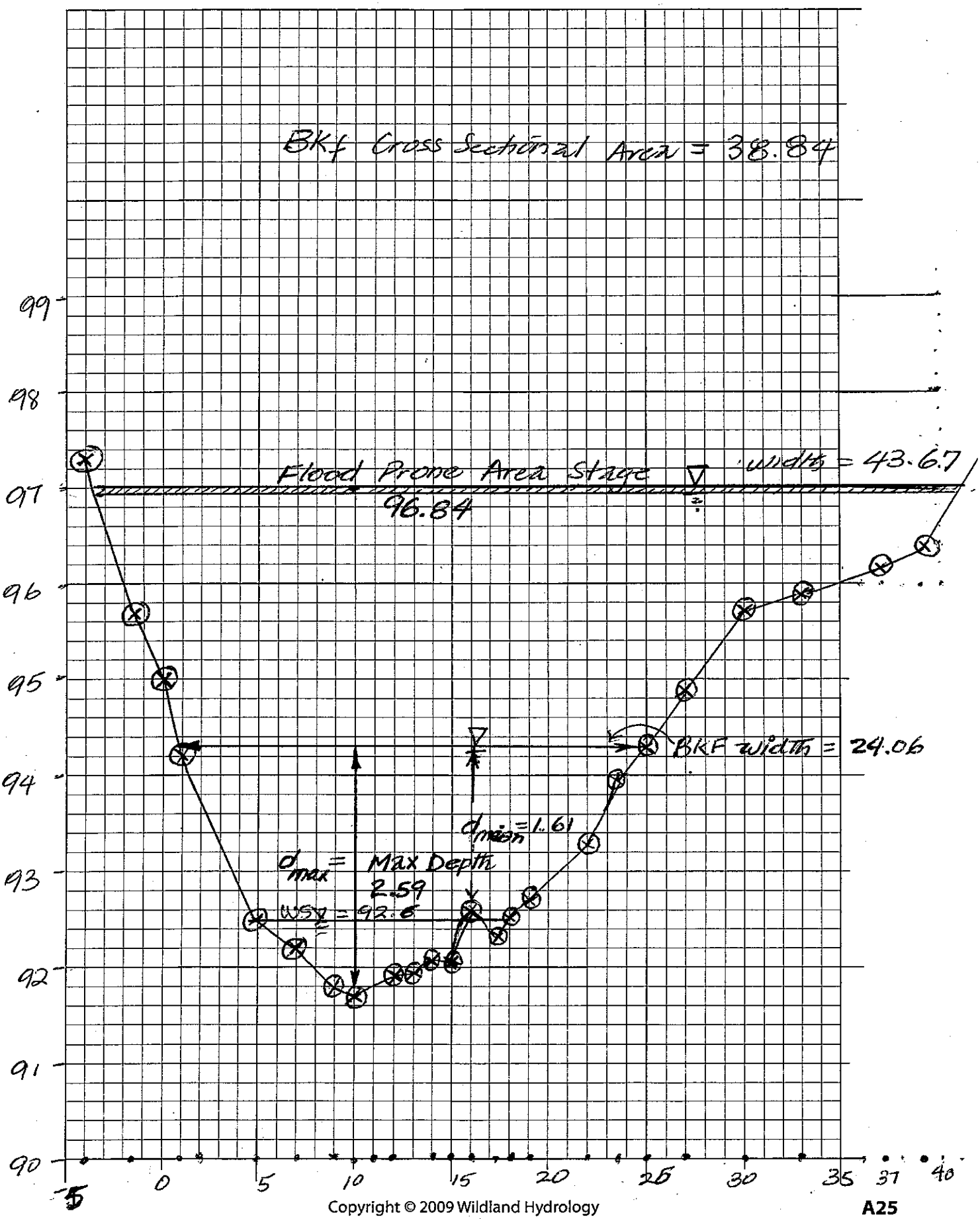
Riffle X-Section (Station #180)
TEAM #4

4/28/09
First Field Day



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SURVEY DATA → LONGITUDINAL PROFILE 1

SITE: SHARMANS BRANCH Date: 4/28/09

Location:

Party / Notes: CARRIE KRISTEN JOHN HUC:

	Distance, Point, or	Back-Sight	Height of Instrument	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	Elev.	FS	Elev.	FS	Elev.	
	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	
1												WS/bkf diff
2	TRIFF											
3	0+00			2.10	102.9	1.25	103.75					
4	BIS-RIFF											
5	0+20			2.66	102.34	1.99	103.01					
6	RIFF											
7	0+30							.50	104.5			1.49
8	RIFF			3.36								
9	0+33			↓	101.64	2.69	102.31					
10	RIFF											
11	0+50			3.75	101.25	3.03	101.97	1.38	103.62			1.65
12	BRIFF											
13	0+56			3.33	101.67	3.13	101.87					
14	TRIFF											
15	0+62.5			4.11	100.89	3.48	101.52	1.81	103.19			1.67
~~16~~	~~0+69~~									.99		
17	0+60			4.05	100.95	3.61	101.36					
18	TRUN											
19	0+69			4.31	100.69	4.13	100.87			.99	104.01	
20	T.RIFF					4.12						
21	0+77			5.19	99.81	~~4.03~~	100.88	2.43	102.57			1.69
22	BISRIFF											
23	0+82			4.70	100.3	4.29	100.71					
24	TPOOL											
25	0+89			6.03	98.97	5.09	99.91					
26	MPOOL											
27	0+97			6.63	98.31	5.15	99.85					

~~XS~~ @ 0+94

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SURVEY DATA → **LONGITUDINAL PROFILE 2**

SITE: Date:

Location:

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	Elev.	FS	Elev.	FS	Elev.	
	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	
28	TGLIDE											
29	1+50			5.95	99.05	5.17	99.83	3.55	101.45			1.62
30	TRIFF											
31	1+07			6.21	98.79	5.32	99.68					
32	RIFF											
33	1+27			6.68	98.32	5.95	99.05	4.39	100.61	2.87	102.13	1.56
34	BISRIFF											
35	1+51			7.37	97.63	6.91	98.09	5.22	99.78	5.22	99.78	1.69
36	XS@RIFF											
37	1+80			8.37	96.63	7.47	97.53	5.85	99.15			1.62
38	TPOOL											
39	1+98			9.59	95.41	8.30	96.7					
POOL 40	2+03							6.54	98.42			1.72
41	CTRPOOL											
42	2+11			9.10	95.9	8.36	96.5					
43	TRIFFLE											
44	2+20			9.11	95.89	~~8.50~~	~~95.43~~	9k.1?				
45	TPOOL											
46	2+31			10.76	94.24	9.57	95.43					
47	M POOL											
48	2+39			11.54	93.46	9.58	95.42	7.94	97.06	6.34	98.66	1.64
49	ENDPOOL											
50	2+45		11.44	~~11.44~~	93.56	9.58	95.42					
51	0+89									1.82	103.18	
52	1+28									2.50	1025	
53												
54												

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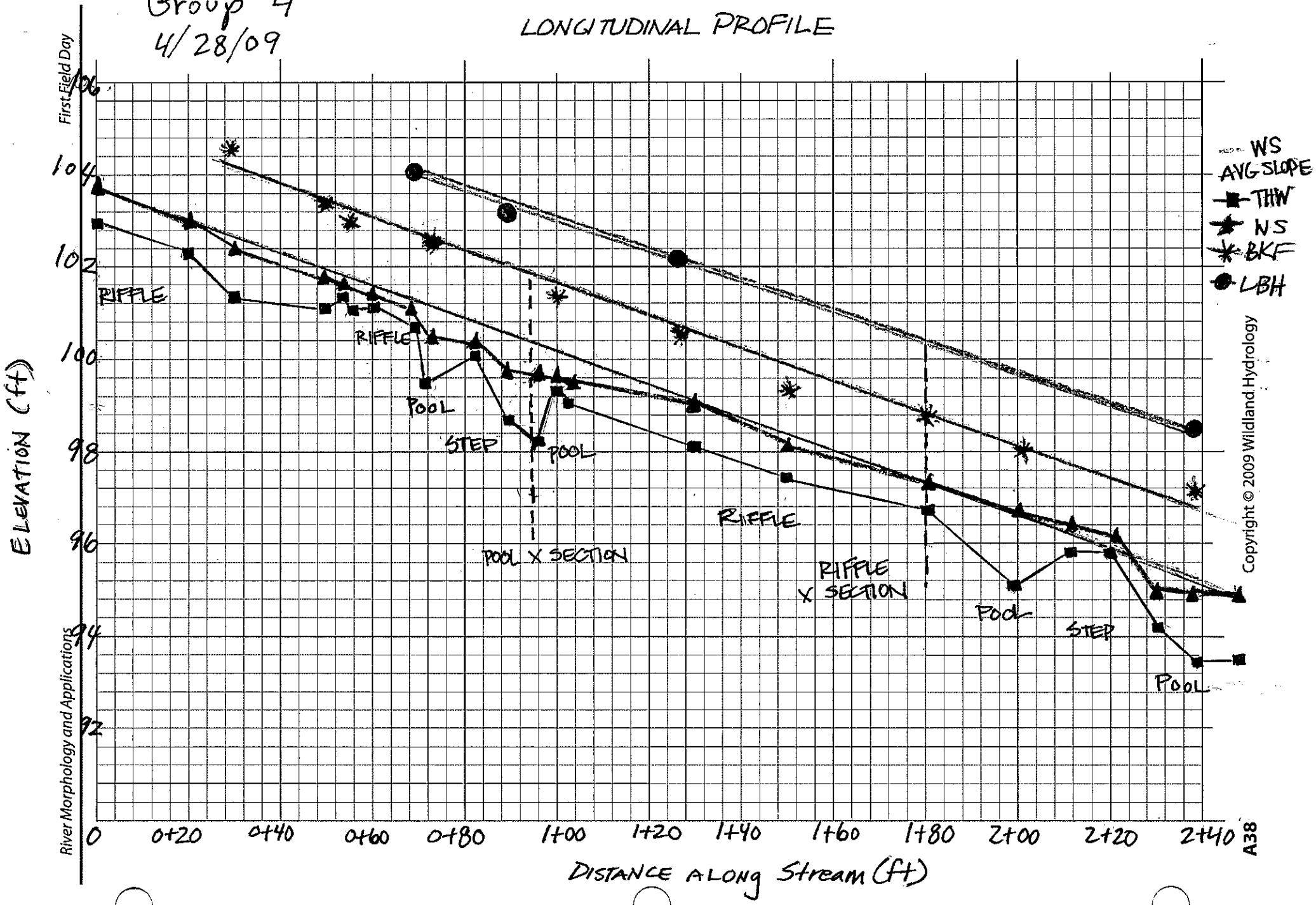
Sharman's Creek
Group 4
4/28/09

LONGITUDINAL PROFILE



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Representative Pebble Count

Site: Sharman's Creek Date: 4/28/09

Location: HUC:

Party:

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) Reach: 4 Date: 4/28/09 TOT #	ITEM %	% CUM	POOL (2) Reach: 4 Date: 4/28/09 TOT #	ITEM %	% CUM	COMPOSITE (3) Reach: 4 Date: 4/28/09 TOT #	ITEM %	% CUM
	Silt / Clay	< .062	S/C												
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25	SAND												
	Medium	.25 - .50	SAND												
	Coarse	.50 - 1.0	SAND	1	2	3	1	1/90 1.1	1.1	2	2/10 20%	20	3	3	3
.04 - .08	Very Coarse	1.0 - 2	SAND												
.08 - .16	Very Fine	2 - 4	GRAVEL												
.16 - .22	Fine	4 - 5.7	GRAVEL												
.22 - .31	Fine	5.7 - 8	GRAVEL	2	0	2	2	2.2	3.3	0	0	20	2	2	5
.31 - .44	Medium	8 - 11.3	GRAVEL	3	0	3	3	3.3	6.6	0	0	20	3	3	8
.44 - .63	Medium	11.3 - 16	GRAVEL	1	1	2	1	1.1	7.7	1	10%	30	2	2	10
.63 - .89	Coarse	16 - 22.6	GRAVEL	1	0	1	1	1.1	8.8	0	0	30	1	1	11
.89 - 1.3	Coarse	22.6 - 32	GRAVEL	2	1	3	2	2.2	11	1	10%	40	3	3	14
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL	5	0	5	5	5.6	16.6	0	0	40	5	5	19
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL	7	1	8	7	7.8	24.4	1	10%	50	8	8	27
2.5 - 3.5	Small	64 - 90	COBBLE	11	1	12	11	12.2	36.6	1	10%	60	12	12	39
3.5 - 5.0	Small	90 - 128	COBBLE	5	0	5	5	5.6	42.2	0	0	60	5	5	44
5.0 - 7.1	Large	128 - 180	COBBLE	9	1	10	9	10.0	52.2	1	10%	70	10	10	54
7.1 - 10.1	Large	180 - 256	COBBLE	11	0	11	11	12.2	64.4	0	0	70	11	11	65
10.1 - 14.3	Small	256 - 362	BOULDER	11	2	13	11	12.2	76.6	2	20%	90	13	13	78
14.3 - 20	Small	362 - 512	BOULDER	6	1	7	6	6.7	83.3	1	10%	100	7	7	85
20 - 40	Medium	512 - 1024	BOULDER	11	0	11	11	12.2	95.5	0	0	100	11	11	96
40 - 80	Large-Vry Large	1024 - 2048	BOULDER	4	0	4	4	4.5	100.0	0	0	100	4	4	100
	Bedrock		BDRK												
Stream Type:			**Valley Type:**			TOTAL→	90	100.0	100.0	10			100		

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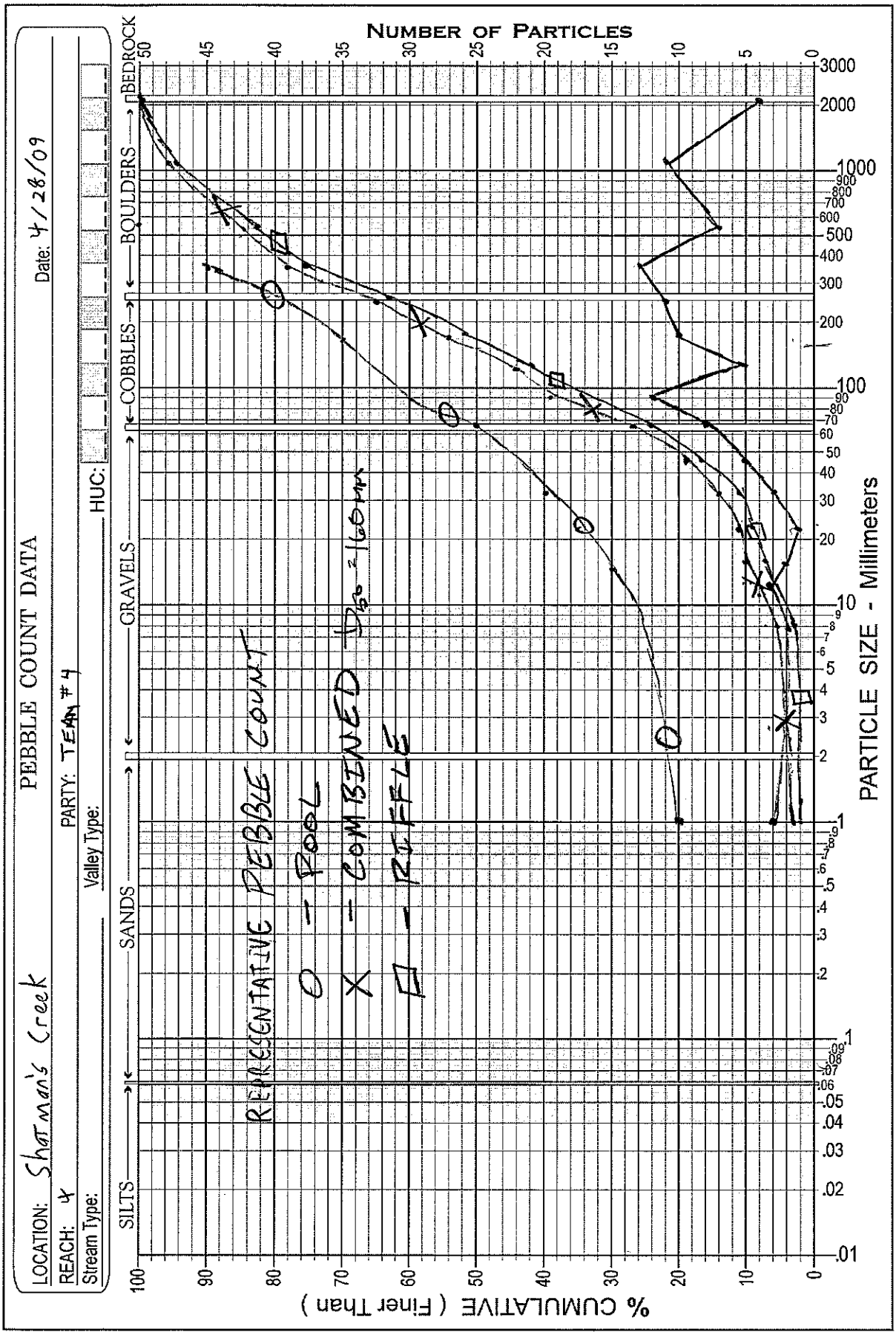

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Active Bed Riffle Pebble Count

Site: Sharman's Creek Date: 4/28/09

Location: HUC:

Party:

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) Reach: 4 Date: 4/28/09 TOT #	ITEM %	% CUM	POOL (2) Reach: 4 Date: 4/28/09 TOT #	ITEM %	% CUM	COMPOSITE (3) Reach: 4 Date: 4/28/09 TOT #	ITEM %	% CUM
	Silt / Clay	< .062	S/C												
	Very Fine	.062 - .125	SAND	1			1	1	1						
	Fine	.125 - .25	SAND	1			1	1	2						
	Medium	.25 - .50	SAND	1			1	1	3						
	Coarse	.50 - 1.0	SAND	4			4	4	7						
.04 - .08	Very Coarse	1.0 - 2	SAND						7						
.08 - .16	Very Fine	2 - 4	GRAVEL						7						
.16 - .22	Fine	4 - 5.7	GRAVEL						7						
.22 - .31	Fine	5.7 - 8	GRAVEL						7						
.31 - .44	Medium	8 - 11.3	GRAVEL	3			3	3	10						
.44 - .63	Medium	11.3 - 16	GRAVEL	1			1	1	11						
.63 - .89	Coarse	16 - 22.6	GRAVEL	5			5	5	16						
.89 - 1.3	Coarse	22.6 - 32	GRAVEL	16			16	16	32						
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL	7			7	7	39						
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL	10			10	10	49						
2.5 - 3.5	Small	64 - 90	COBBLE	6			6	6	55						
3.5 - 5.0	Small	90 - 128	COBBLE	4			4	4	59						
5.0 - 7.1	Large	128 - 180	COBBLE	9			9	9	68						
7.1 - 10.1	Large	180 - 256	COBBLE	10			10	10	78						
10.1 - 14.3	Small	256 - 362	BOULDER	5			5	5	83						
14.3 - 20	Small	362 - 512	BOULDER	7			7	7	90						
20 - 40	Medium	512 - 1024	BOULDER	8			8	8	98						
40 - 80	Large-Vry Large	1024 - 2048	BOULDER	2			2	2	100						
	Bedrock		BDRK												
Stream Type:			**Valley Type:**			TOTAL→	100	100	100						

13%

42%

23%

17%

First Field Day

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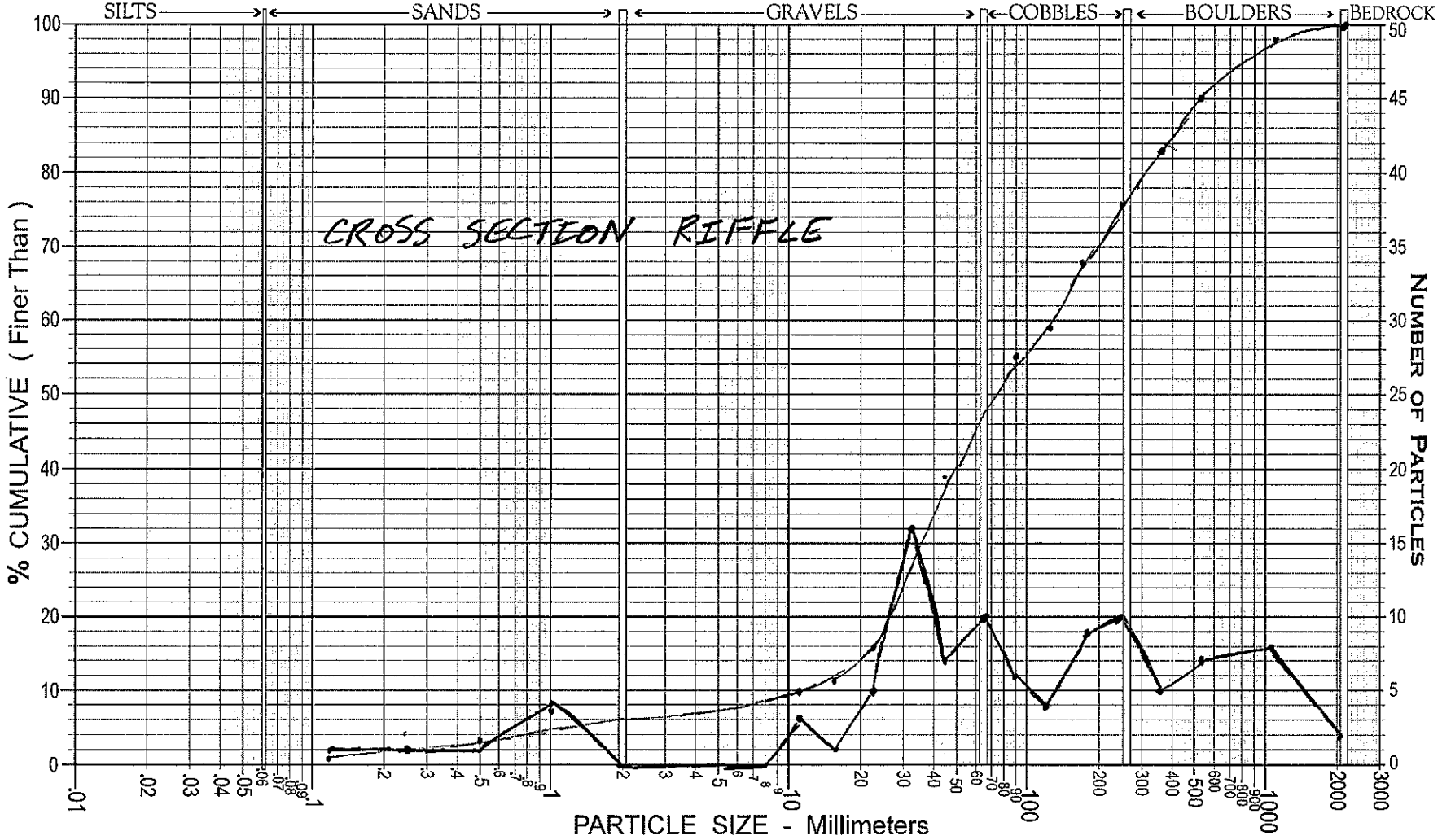
D50 = 72

PEBBLE COUNT DATA

LOCATION: Sharman's Creek Date: 4/28/09

REACH: 4 PARTY: TEAM #4

Stream Type: Valley Type: HUC:



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Belt width = 43.66 ft 0.034

 MWR = BW / BFW = 43.66/24.05 = 1.81

Worksheet A-2. Computations of velocity and discharge using various methods.

Bankfull VELOCITY / DISCHARGE Estimates

Site:	SHARMAN CR	Location:	Team 4
Date:	4-28-09	Stream Type:	B-3-2
Valley Type:	4		
Observers:		HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Cross-sectional AREA	38.84	A_{bkf} (ft²)	Bankfull Mean DEPTH	1.61	d_{bkf} (ft)
Bankfull WIDTH	24.05 ft	W_{bkf} (ft)	Wetted PERIMETER ~ 2 * d_{bkf} + W_{bkf}	27.27	W_p (ft)
D_{84} @ Riffle	380	Dia. (mm)	D_{84} mm / 304.8 =	1.25	D_{84} (ft)
Bankfull SLOPE	0.034	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p 38.84/27.27	1.42	R (ft)
Gravitational Acceleration	32.2	g (ft / sec²)	Relative Roughness R (ft) / D_{84} (ft)	1.24	
Drainage AREA	3.6	DA (mi²)	Shear Velocity $u^* = \sqrt{gRS}$	1.25	u* (ft / sec)

D50 Protru 0.65 ' D84 prot D84 1.04 ft.

(32.2)(1.42)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $u = [2.83 + 5.66 \text{ Log}\{R/D_{84}\}]u^*$	4.49	ft / sec	174	cfs
2. Roughness Coefficient: a) Manning's 'n' from friction factor / relative roughness $u = 1.4865 * R^{2/3} * S^{1/2}/n$ n = 0.065	5.32	ft / sec	206.6	cfs
2. Roughness Coefficient: $u = 1.4865 * R^{2/3} * S^{1/2}/n$ b) Manning's 'n' from Jarrett (USGS): $n = 0.39 S^{.38} R^{-.16}$ n = .102 Note: This equation is for applications involving steep, step-pool, high boundary roughness, cobble- and boulder-dominated stream systems; i.e., for stream types A1, A2, A3, B1, B2, B3, C2 and E3.	3.39	ft / sec	131.7	cfs
2. Roughness Coefficient: $u = 1.4865 * R^{2/3} * S^{1/2}/n$ c) Manning's 'n' from Stream Type n = .072	4.81	ft / sec	186.8	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) Regional Curves u = Q / A Return Period for Bankfull Discharge Q = ____ Year		ft / sec		cfs
4. Continuity Equations: b) USGS Gage Data u = Q / A		ft / sec		cfs

Options for using the D_{84} term in the relative roughness relation (R/D_{84}), when using estimation method 1.

Option 1. For **sand-bed** channels: Measure the **"protrusion height"** (h_{sd}) of sand dunes above channel bed elevations. Substitute an average sand dune protrusion height (h_{sd} in ft) for the D_{84} term in estimation method 1.

Option 2. For **boulder-dominated** channels: Measure several **"protrusion heights"** (h_{bo}) of boulders above channel bed elevations. Substitute an ave. boulder protrusion height (h_{bo} in ft) for the D_{84} term in estimation method 1.

Option 3. For **bedrock-dominated** channels: Measure several **"protrusion heights"** (h_{br}) of rock separations/steps/joints/uplifted surfaces above channel bed elevations. Substitute an average bedrock protrusion height (h_{br} in feet) for the D_{84} term in estimation method 1.

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380 mm = 380 cm = 14.96 in = 1.24

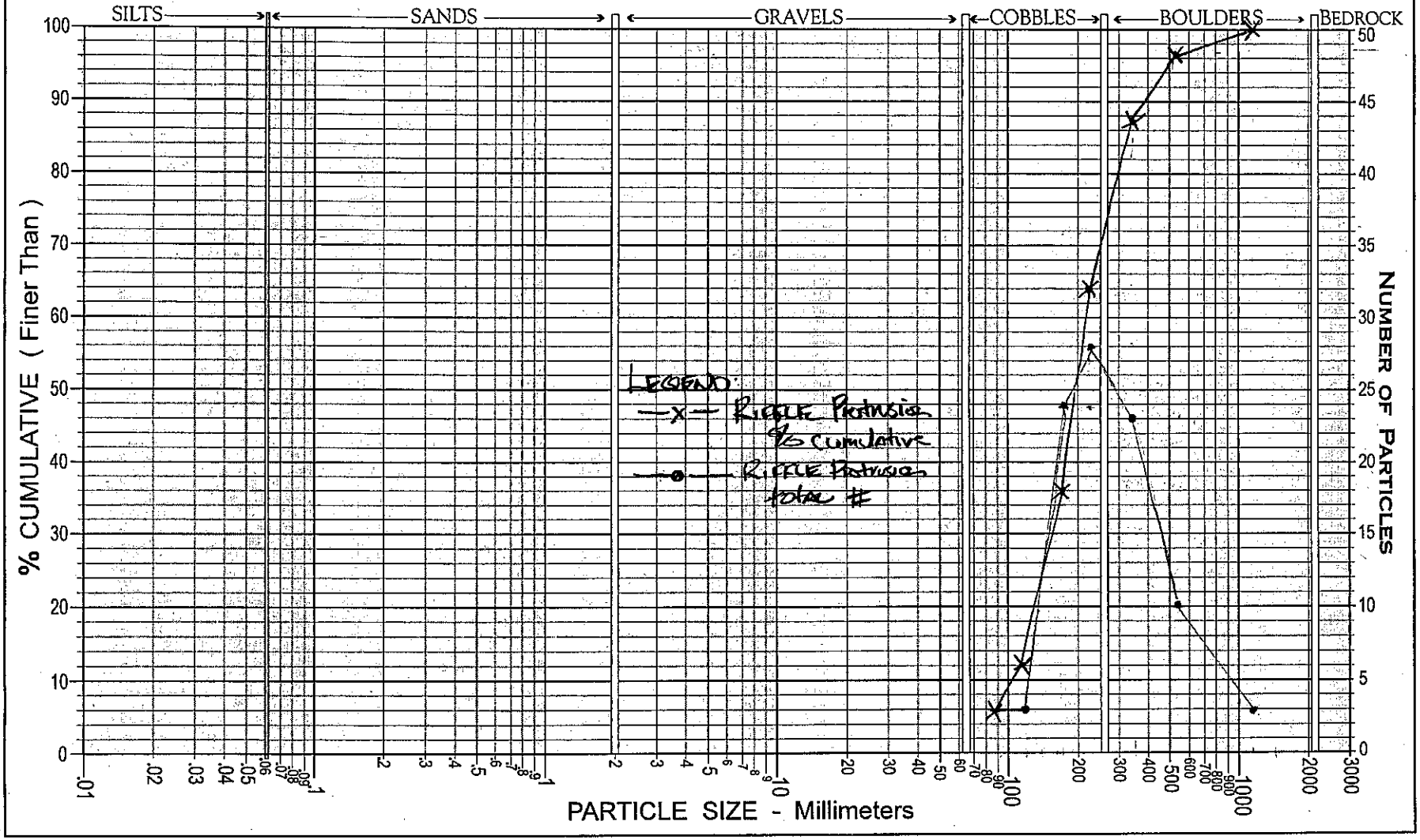
			Q
Equation 1	D_{84} protrusion	$V = 4.49$	174
	D_{84} particle	$V = 3.92$	152.3
	D_{50} Protrusion	$V = 5.9$	229.2

Riffle Protrusion Height

D84: 320mm
D50 = 200mm

PEBBLE COUNT DATA

LOCATION: Sherman Js Branch
REACH: Riffle Protrusion Height (Lower Rif) PARTY: Group 4
Date: 4/28/09
Stream Type: Valley Type: HUC:



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Site: Sherman's Branch Riffle Protrusion Height (Lower Riff) Date:

Location: HUC:

Party: Group 4.

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
	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													
.44 - .63	Medium	11.3 - 16													
.63 - .89	Coarse	16 - 22.6													
.89 - 1.3	Coarse	22.6 - 32													
1.3 - 1.8	Very Coarse	32 - 45													
1.8 - 2.5	Very Coarse	45 - 64													
2.5 - 3.5	Small	64 - 90	COBBLE	𝍸			6								
3.5 - 5.0	Small	90 - 128		𝍸			6	12							
5.0 - 7.1	Large	128 - 180		𝍸𝍸			24	36							
7.1 - 10.1	Large	180 - 256		𝍸𝍸𝍸			28	64							
10.1 - 14.3	Small	256 - 362	BOULDER	𝍸𝍸			23	87							
14.3 - 20	Small	362 - 512		𝍸			10	97							
20 - 40	Medium	512 - 1024					3	100							
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		BDRK												
Stream Type:			***Valley Type:***			TOTAL→									

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