River Morphology and Applications
National Conservation Training Center
Shepherdstown, WV
04/15/2013 - 04/19/2013

Team 4 Breakout Room 157-IW

Mark - instructor

Dillion Conner LP
Theresa Hage GS
Mark Hepner GS
Christiana Manville PC
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Anna Allie LP

Each team is responsible for identifying a **FOLDER HOLDER** and an **EQUIPMENT PERSON.**

The **FOLDER HOLDER** on each team will be responsible for collecting photo copies of raw data from field books, cross sections, longitudinal profiles, pebble counts, bank profiles and photo copies of all completed forms and finalized plots, making sure they are inserted into the appropriate team field folder, and providing the team folder to the field instructor after they present the data to the class.

The **EQUIPMENT PERSON** will be responsible for ensuring that the team's field equipment is accounted for and back on the bus at the end of each field day. Each team will have an equipment list in their team bag that the EQUIPMENT PERSON can use to inventory the field equipment.

Presentation Order – *First Field Day*

As a team, prepare to present the following items in order:

1. Sketch Map
2. Cross-Section Graphs:
   - Riffle Cross-Section(s)
   - Pool Cross-Section(s)
   - Run Cross-Section(s) (if applicable)
   - Glide Cross-Section(s) (if applicable)
3. Longitudinal Profile Graph
4. Representative Pebble Count for Stream Classification (Graph)
5. Active Bed Riffle Pebble Count for Hydraulic Calculations (Graph)
6. Velocity Computation Form (**Worksheet B-2**)
7. Stream Classification Form (**Worksheet B-1**)
8. Morphological Relations & Dimensionless Ratios Form (**Worksheet B-3**)

Checklist for Team Folder – *First Field Day*

Folder Holder: Please collect the following items from your team members and insert into your team folder in the order listed below. Please make sure all corrections have been made following your team presentation and give your completed team folder to Dave.

☐ Sketch Map

☐ Cross-Section Raw Data and Graphs for all Cross-sections Measured

☐ Longitudinal Profile Raw Data and Graph

☐ Representative Pebble Count Raw Data and Graph

☐ Active Bed Riffle Pebble Count Raw Data and Graph

☐ Stream Classification Form (**Worksheet B-1**)

☐ Velocity Computation Form (**Worksheet B-2**)

☐ Morphological Relations & Dimensionless Ratios Form (**Worksheet B-3**)

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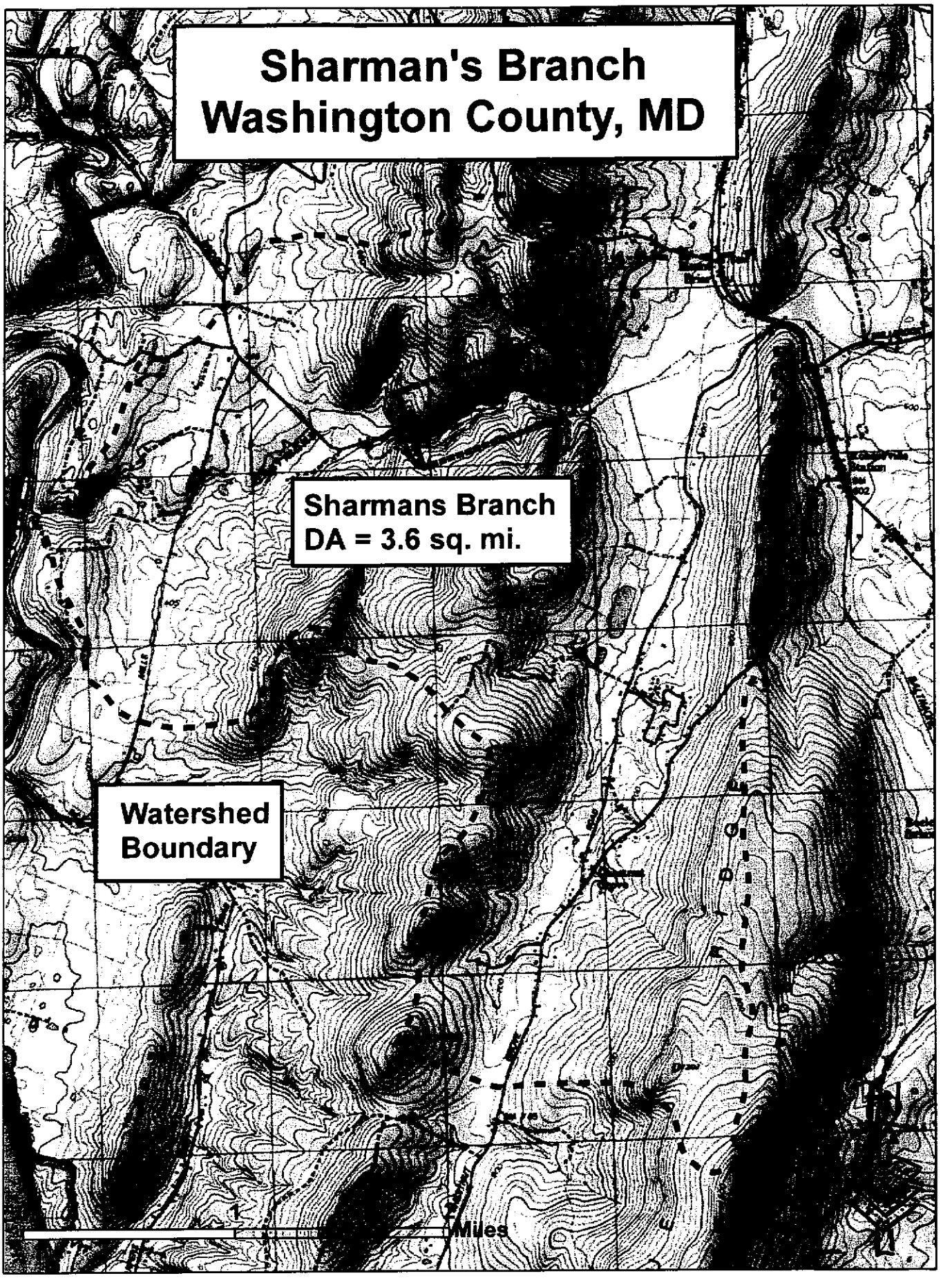
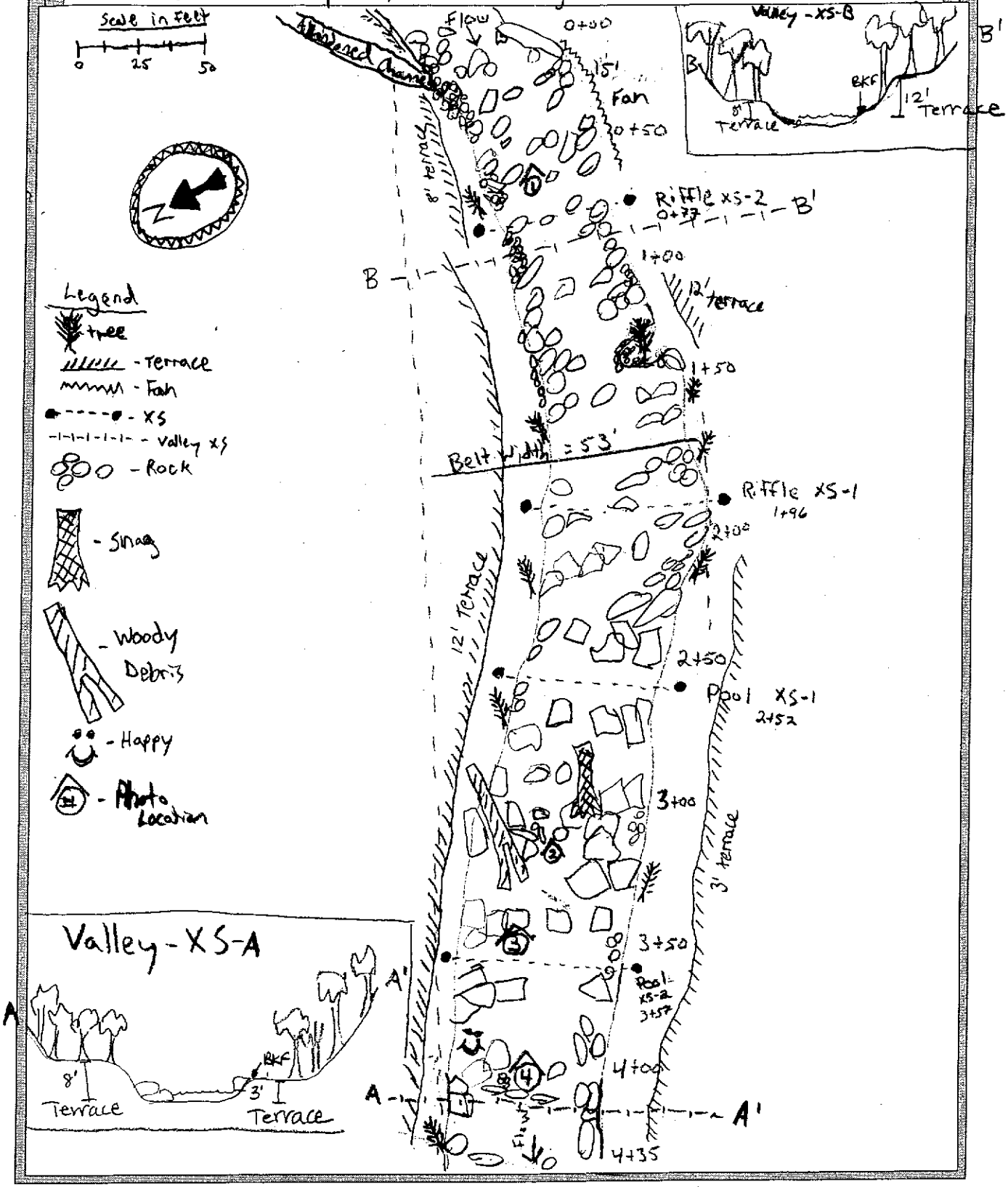

Sharman's Branch
Washington County, MD
Sharmans Branch
DA = 3.6 sq. mi.
Watershed
Boundary
1
2
Miles

AREA-SITE LOCATION....REACH MAP

Stream: Sharman's Branch Reach: #4

Drawn By: Mark Hepner, Theresa Hage Date: 4-16-13



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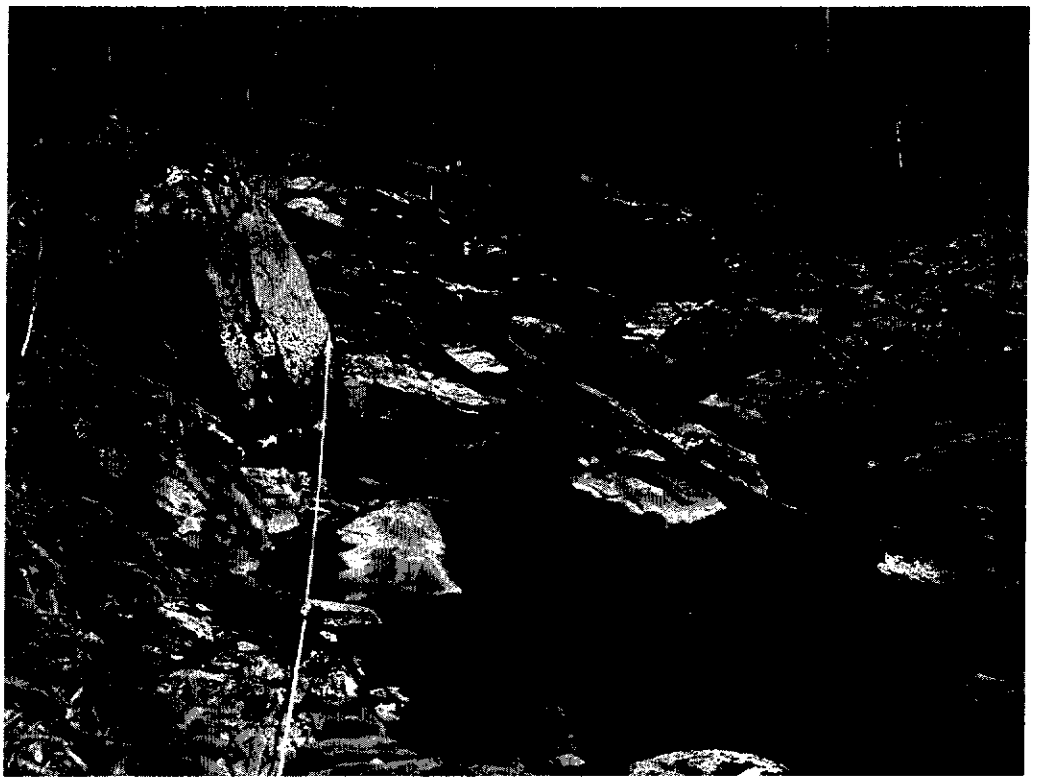

Photo 3 – Upstream at station 3+50

Photo 4 – Upstream at station 4+20

Stream Team #4
Sharman's Branch
4-16-2013

Photo 1 – Upstream at station 0+75

Photo 2 – Upstream at station 3+10

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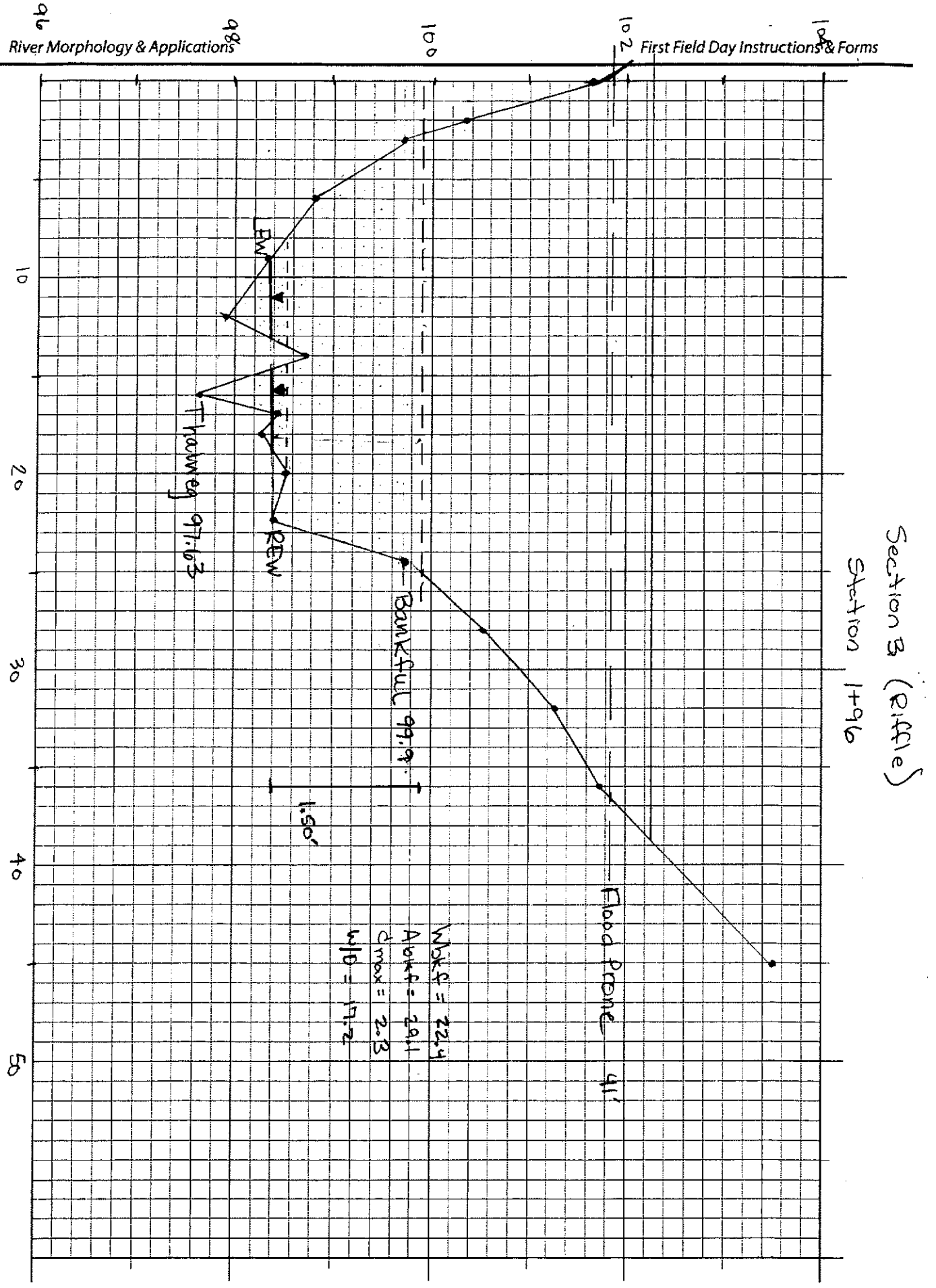

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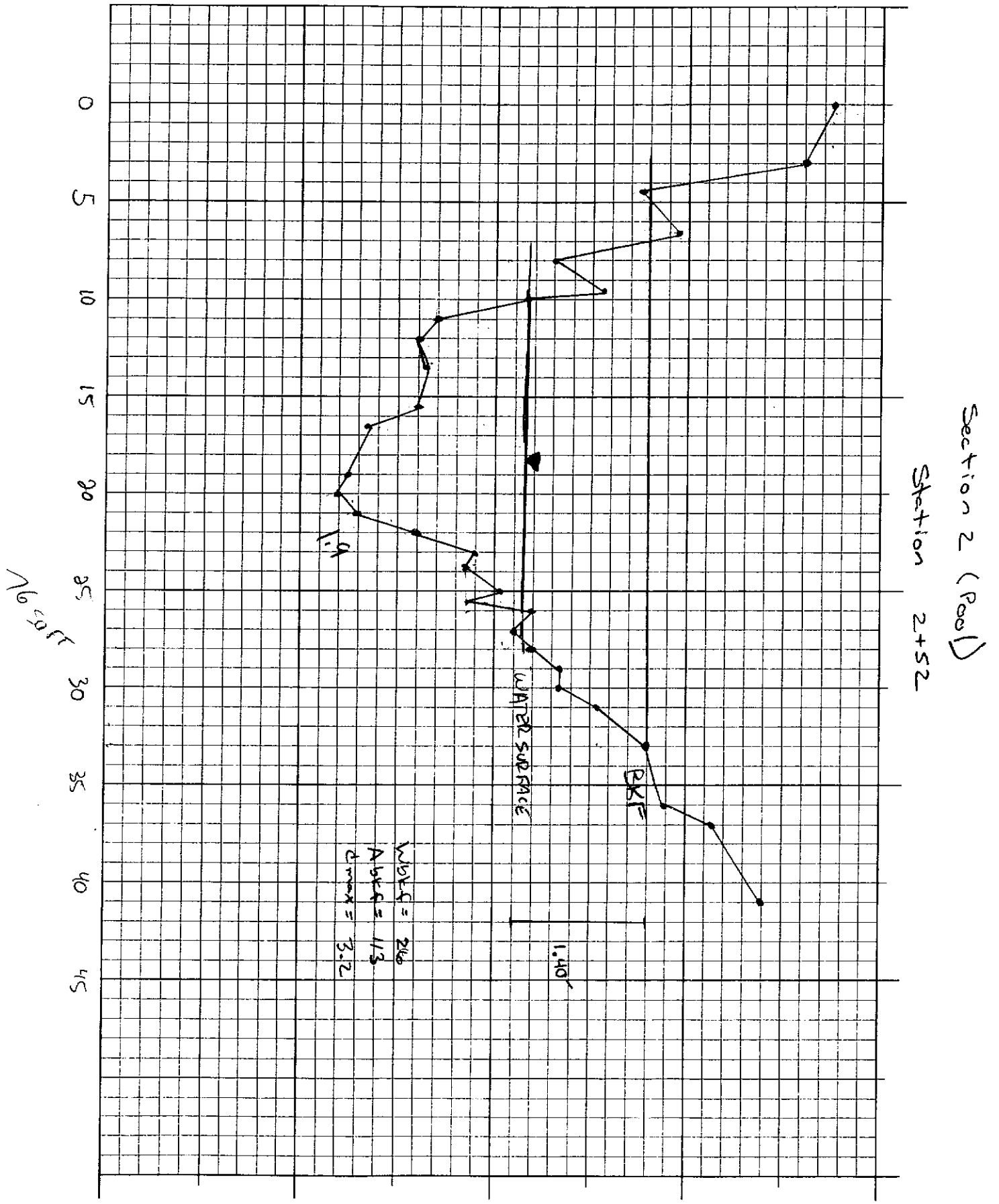

Section 2 (Pool)
Station 2+52

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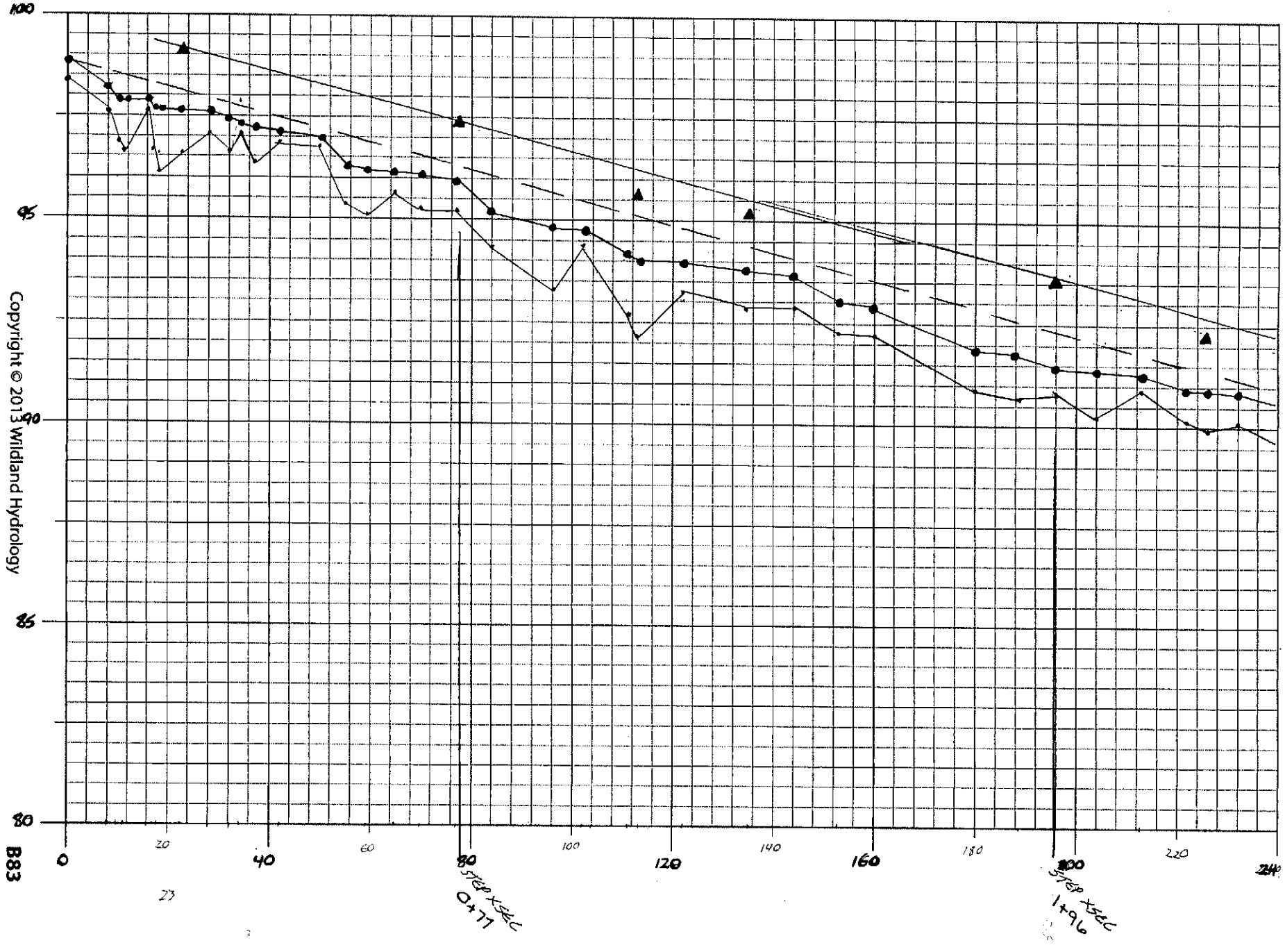
SHARMAN'S BRANCH REACH 4



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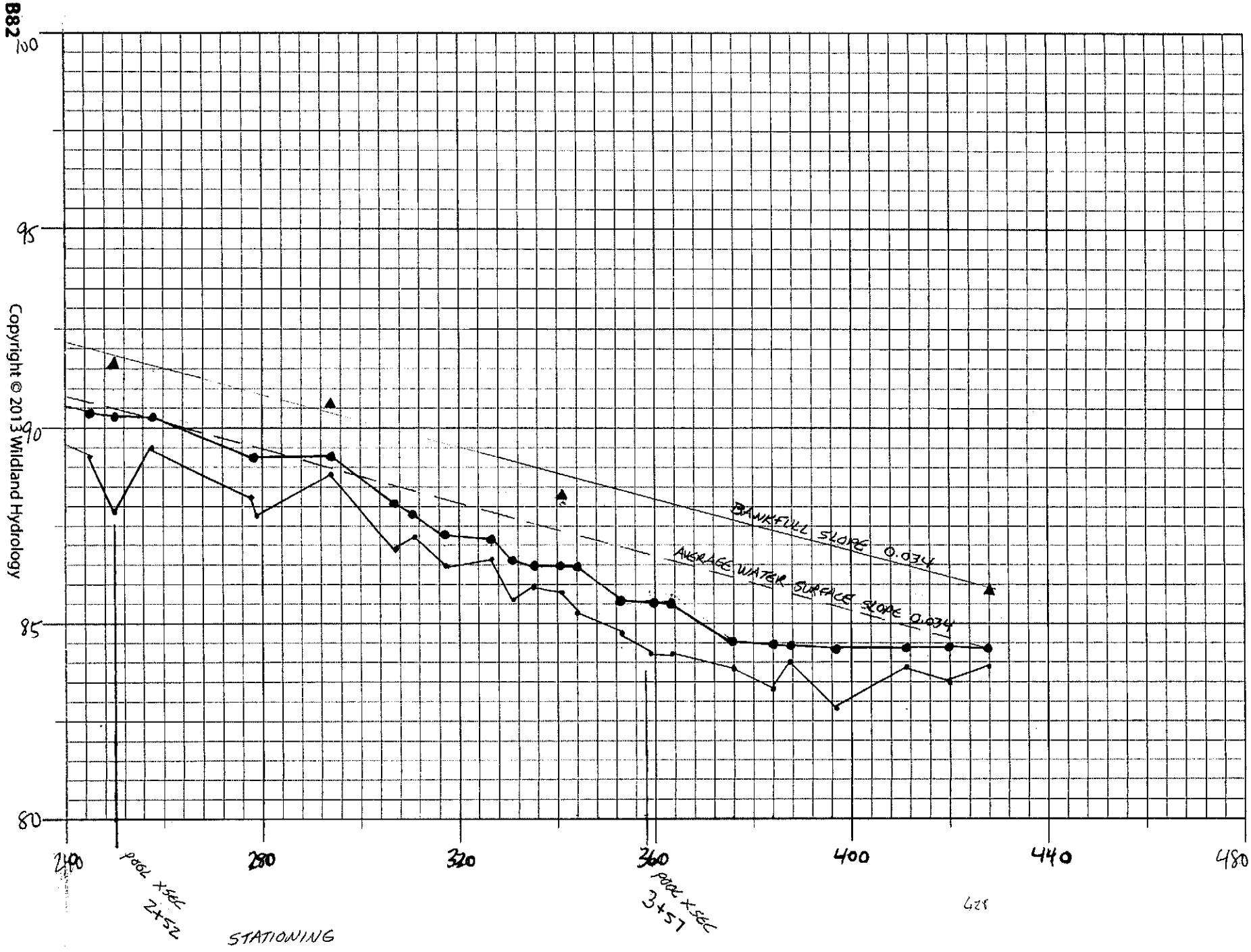

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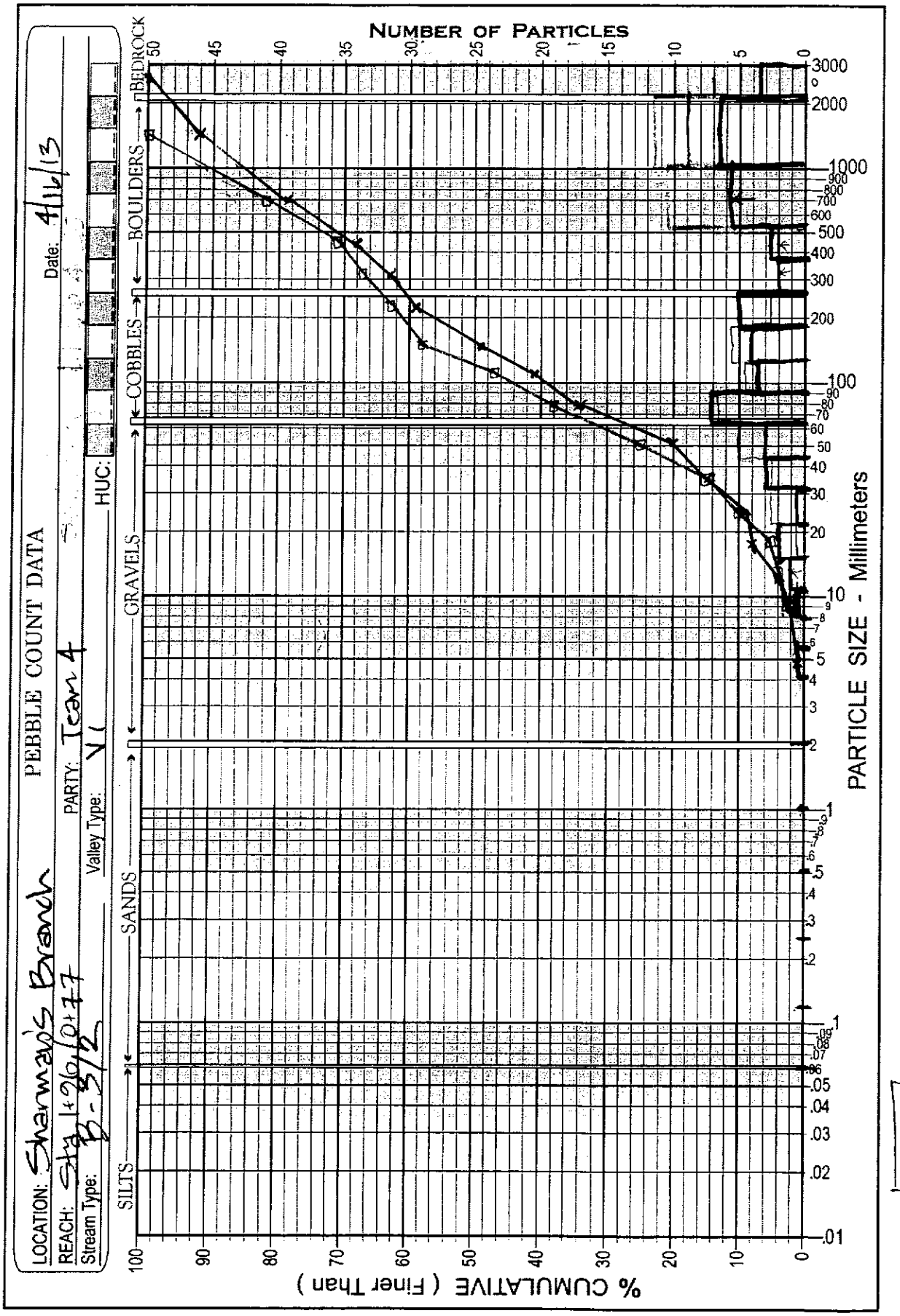

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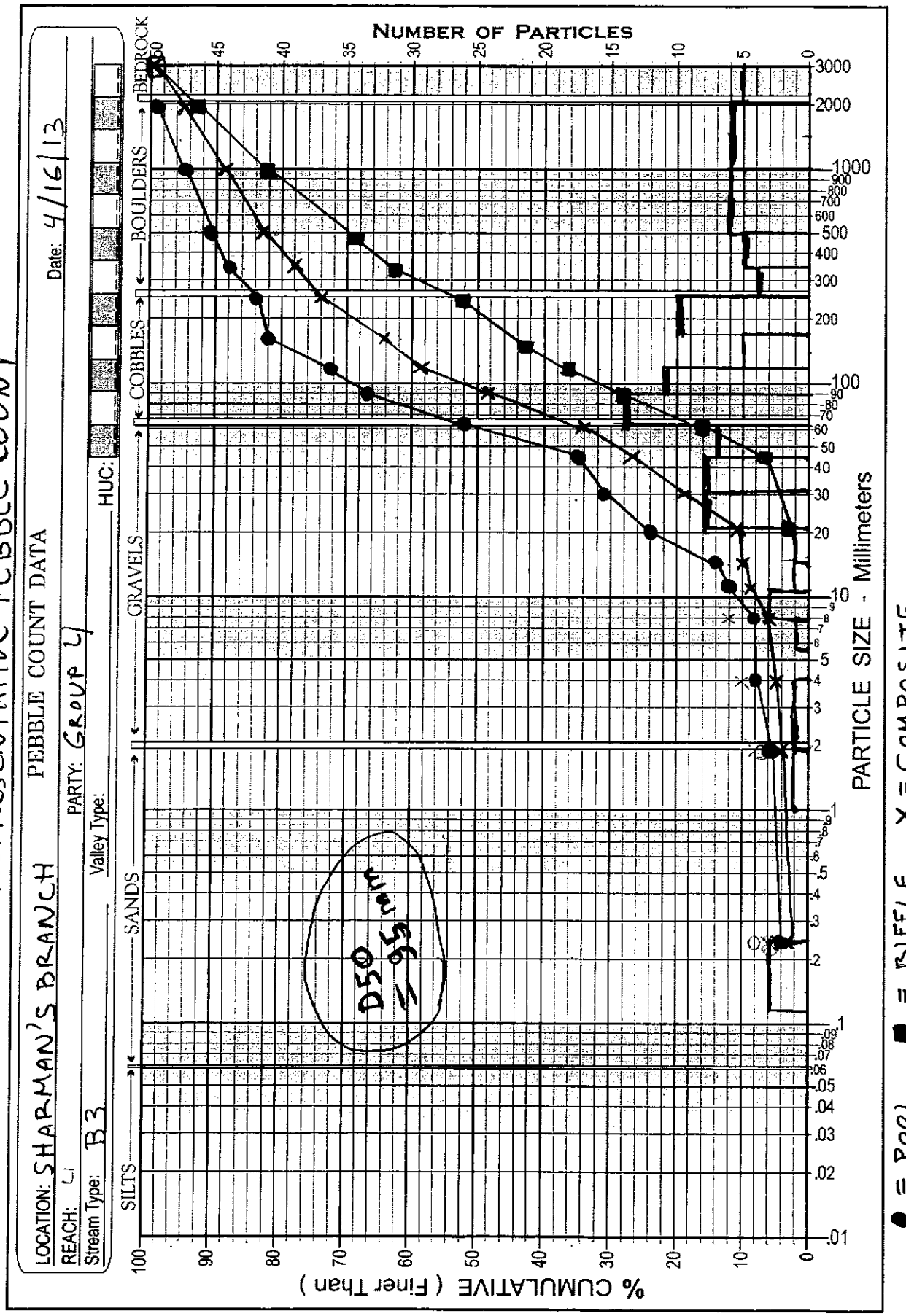

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Worksheet B-1. Field Form for Level II Stream Classification (*First Field Day*).

Stream: SHARMAN'S BRANCH	
Basin: ANTIETAM	Drainage Area: 3.6 acres 3.6 mi²
Location: WASHINGTON COUNTY, MD	
Twp.&Rge:	Sec.&Qtr.:
Cross-Section Monuments (Lat./Long.):	Date: 4/16/13
Observers: GROUP 4	Valley Type: VT

Bankfull WIDTH (W_{bkf}) WIDTH of the stream channel at bankfull stage elevation, in a riffle section.	28.9	ft
Bankfull DEPTH (d_{bkf}) Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A_{bkf} / W_{bkf}$).	1.38	ft
Bankfull X-Section AREA (A_{bkf}) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	39.2	ft^2
Width/Depth Ratio (W_{bkf} / d_{bkf}) Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section.	20.65	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.	2.31	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.	87	ft
Entrenchment Ratio (ER) The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH (W_{fpa} / W_{bkf}) (riffle section).	3.05	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.	95	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 (S_{val} / S).	1.01	

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

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

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	SHARMAN'S BRANCH	Location:	STATION 77
Date:	4/16/13	Stream Type:	B3
Valley Type:	VT		
Observers:	GP 4	HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	39.2	A_{bkf} (ft^2)	Bankfull Riffle Mean DEPTH	1.38	d_{bkf} (ft)
Bankfull Riffle WIDTH	28.9	W_{bkf} (ft)	Wetted PERIMETER ~ (2 * d_{bkf}) + W_{bkf}	31.3	W_p (ft)
D_{84} at Riffle protrusion	130	Dia. (mm)	D_{84} (mm) / 304.8	0.427	D_{84} (ft)
Bankfull SLOPE	0.034	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.25	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R(ft) / D_{84} (ft)	2.93	R / D_{84}
Drainage Area	3.6	DA (mi^2)	Shear Velocity $u^* = (gRS)^{1/2}$	1.17	u^* (ft/sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $\bar{u} = [\,2.83 + 5.66 * Log\{R / D_{84}\}\,]\,u^*$	6.40	ft / sec	251	cfs
2. Roughness Coefficient: a) Manning's *n* from Friction Factor / Relative Roughness (Figs. B-34, B-35) $\bar{u} = 1.49 * R^{2/3} * S^{1/2} / n$ $n =$ .067	5.15	ft / sec	202	cfs
2. Roughness Coefficient: b) Manning's *n* from Stream Type (Fig. B-36) $\bar{u} = 1.49 * R^{2/3} * S^{1/2} / n$ $n =$ 0.049	6.51	ft / sec	255	cfs
2. Roughness Coefficient: c) Manning's *n* from Jarrett (USGS): $\bar{u} = 1.49 * R^{2/3} * S^{1/2} / n$ $n = 0.39 * S^{0.38} * R^{-0.16}$ **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 $n =$ 0.104	3.07	ft / sec	120.2	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 $\bar{u} = Q / A$	3.91	ft / sec	113.9	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.

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

Stream: Shannon's Branch Location: Reach 4

Observers: Date: 4/16/13 Valley Type: VI Stream Type: B3/2

River Reach Summary Data.....2

Hydraulics

Streamflow: Estimated Mean Velocity at Bankfull Stage ($\bar{u}_{bkf}$)		ft/sec	Estimation Method	
Streamflow: Estimated Discharge at Bankfull Stage (Q_{bkf})		cfs	Drainage Area	mi^2

Channel Pattern

Geometry	Mean	Min	Max		Dimensionless Geometry Ratios	Mean	Min	Max
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})	53	—	—	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)				ft	Riffle Length to Riffle Width (L_r / W_{bkf})			
Individual Pool Length (L_p)				ft	Individual Pool Length to Riffle Width (L_p / W_{bkf})			
Pool to Pool Spacing (P_s)				ft	Pool to Pool Spacing to Riffle Width (P_s / W_{bkf})			

Channel Profile

Valley Slope (S_{val})	.033	ft/ft	Average Water Surface Slope (S)	0.034	ft/ft	Sinuosity (S_{val} / S)		0.97
Stream Length (SL)	428	ft	Valley Length (VL)	422	ft	Sinuosity (SL / VL)		1.01
Low Bank Height (LBH)	start —	ft	Max Depth (d_{max})	start 1.6	ft	Bank-Height Ratio (BHR) (LBH / d_{max})	start —	
	end —	ft		end 2.0	ft		end —	

Facet Slopes	Mean	Min	Max		Dimensionless Facet Slope Ratios	Mean	Min	Max
Riffle Slope (S_{rif})	.008	.0025	.0125	ft/ft	Riffle Slope to Average Water Surface Slope (S_{rif} / S)	.235	.074	.368
Run Slope (S_{run})	—	—	—	ft/ft	Run Slope to Average Water Surface Slope (S_{run} / S)	—	—	—
Pool Slope (S_p)	.006	0	.019	ft/ft	Pool Slope to Average Water Surface Slope (S_p / S)	.176	0	.559
Glide Slope (S_g)	—	—	—	ft/ft	Glide Slope to Average Water Surface Slope (S_g / S)	—	—	—
Step Slope (S_s)	.076	.03	.16	ft/ft	Step Slope to Average Water Surface Slope (S_s / S)	2.235	.882	4.71

Max Depths[a]	Mean	Min	Max		Dimensionless Depth Ratios	Mean	Min	Max
Max Riffle Depth (d_{maxrif})	2.4	2.1	2.7	ft	Max Riffle Depth to Mean Riffle Depth (d_{maxrif} / d_{bkf})	1.71	1.52	1.96
Max Run Depth (d_{maxrun})	—	—	—	ft	Max Run Depth to Mean Riffle Depth (d_{maxrun} / d_{bkf})	—	—	—
Max Pool Depth (d_{maxp})	3.16	2.2	4.1	ft	Max Pool Depth to Mean Riffle Depth (d_{maxp} / d_{bkf})	2.29	1.59	2.97
Max Glide Depth (d_{maxg})	—	—	—	ft	Max Glide Depth to Mean Riffle Depth (d_{maxg} / d_{bkf})	—	—	—
Max Step Depth (d_{maxs})	2.69	2.0	3.6	ft	Max Step Depth to Mean Riffle Depth (d_{maxs} / d_{bkf})	1.95	1.45	2.61

Channel Materials

	Reach[b]	Riffle[c]	Bar		Reach[b]	Riffle[c]	Bar	Protrusion Height[d]	
% Silt/Clay	0	0		D_{16}	25	62		25	mm
% Sand	4	0		D_{35}	65	115		40	mm
% Gravel	30	29.9		D_{50}	95	225		75	mm
% Cobble	40	23.3		D_{84}	600	1200		130	mm
% Boulder	21	40		D_{95}	1300	2100		200	mm
% Bedrock	5	6.7		D_{100}	3000	3000		300	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.

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

Stream: Shayman's Branch | Location: Reach 4

Observers: | Date: 4/16/13 | Valley Type: V1 | Stream Type: B3/2

River Reach Dimension Summary Data.....1

Riffle Dimensions*, **, *

Riffle Dimensions*,**,***	Mean	Min	Max		Riffle Dimensions & Dimensionless Ratios****	Mean	Min	Max
Riffle Width (W_{bkf})	25.5	22.4	28.5	ft	Riffle Cross-Sectional Area (A_{bkf}) (ft^2)	34.1	29.1	39.2
Riffle Mean Depth (d_{bkf})	1.34	1.30	1.38	ft	Riffle Width/Depth Ratio (W_{bkf} / d_{bkf})	18.9	17.2	20.7
Riffle Maximum Depth (d_{max})	2.3	2.3	2.31	ft	Riffle Max Depth to Riffle Mean Depth (d_{max} / d_{bkf})	1.75	1.7	1.8
Width of Flood-Prone Area (W_{fpa})	64	41	87	ft	Entrenchment Ratio (W_{fpa} / W_{bkf})	2.5	1.8	3.1
Riffle Inner Berm Width (W_{ib})	11	9	13	ft	Riffle Inner Berm Width to Riffle Width (W_{ib} / W_{bkf})	.443	.40	.45
Riffle Inner Berm Depth (d_{ib})	.45	.34	.55	ft	Riffle Inner Berm Depth to Mean Depth (d_{ib} / d_{bkf})	.33	.26	0.39
Riffle Inner Berm Area (A_{ib})	4.7	4.4	5	ft^2	Riffle Inner Berm Area to Riffle Area (A_{ib} / A_{bkf})	.14	.15	.13
Riffle Inner Berm W/D Ratio (W_{ib} / d_{ib})	27	16	38					

Pool Dimensions*, **, *

Pool Dimensions*,**,***	Mean	Min	Max		Pool Dimensions & Dimensionless Ratios****	Mean	Min	Max
Pool Width (W_{bkfp})	25.5	25	26	ft	Pool Width to Riffle Width (W_{bkfp} / W_{bkf})	1.02	.91	1.12
Pool Mean Depth (d_{bkfp})	3.87	3.4	4.34	ft	Pool Mean Depth to Riffle Mean Depth (d_{bkfp} / d_{bkf})	2.88	2.61	3.14
Pool Cross-Sectional Area (A_{bkfp})	99	85	113	ft	Pool Area to Riffle Area (A_{bkfp} / A_{bkf})	2.9	2.88	2.92
Pool Maximum Depth (d_{maxp})	3.85	2.44	5.27	ft	Pool Max Depth to Riffle Mean Depth (d_{maxp} / d_{bkf})	2.85	1.87	3.82
Pool Inner Berm Width (W_{ibp})	12.5	9	16	ft	Pool Inner Berm Width to Pool Width (W_{ibp} / W_{bkfp})	.49	.36	.62
Pool Inner Berm Depth (d_{ibp})	1.5	1.1	1.9	ft	Pool Inner Berm Depth to Pool Depth (d_{ibp} / d_{bkfp})	.38	.32	.44
Pool Inner Berm Area (A_{ibp})	63	25	76	ft^2	Pool Inner Berm Area to Pool Area (A_{ibp} / A_{bkfp})	.48	.29	.67
Point Bar Slope (S_{pb})	N/A	N/A	N/A	ft/ft	Pool Inner Berm Width/Depth Ratio (W_{ibp} / d_{ibp})	8.29	8.18	8.4

Run Dimensions*

Run Dimensions*	Mean	Min	Max		Run Dimensionless Ratios****	Mean	Min	Max
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 Dimensions*	Mean	Min	Max		Glide Dimensions & Dimensionless Ratios****	Mean	Min	Max
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**	Mean	Min	Max		Step Dimensionless Ratios****	Mean	Min	Max
Step Width (W_{bkfs})				ft	Step Width to Riffle Width (W_{bkfs} / W_{bkf})			
Step Mean Depth (d_{bkfs})				ft	Step Mean Depth to Riffle Mean Depth (d_{bkfs} / d_{bkf})			
Step Cross-Sectional Area (A_{bkfs})				ft	Step Area to Riffle Area (A_{bkfs} / A_{bkf})			
Step Maximum Depth (d_{maxs})				ft	Step Max Depth to Riffle Mean Depth (d_{maxs} / d_{bkf})			
Step Width/Depth Ratio (W_{bkfs} / d_{bkfs})								

*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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Extension

Site: Swamp Branch
Location: 1+90 / 0+72
Party: Team 4
Date: 4/10/13
HUC:

Dot Count for

	RIFFLE 1	POOL 2	COMP. 3
TOTAL →	10		

Inches	PARTICLE	Millimeters		S/C
	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	
3.5 - 5.0	Small	90 - 128		
5.0 - 7.1	Large	128 - 180		
7.1 - 10.1	Large	180 - 256	BOULDER	
10.1 - 14.3	Small	256 - 362		
14.3 - 20	Small	362 - 512		
20 - 40	Medium	512 - 1024		
40 - 80	Large-Vry Large	1024 - 2048		
	Bedrock		BDRK	

Stream Type: *Valley Type:*

RIFFLE (1)			POOL (2)			COMPOSITE (3)		
Reach:			Reach:			Reach:		
Date:			Date:			Date:		
TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
3 /								
4 /								
4 /								
5 /	1							
2 /	4							
4 /	8							
11 /	17							
13 /	17							
18 /	19							
13 /	14							
9 /	8							
8 /	9							
6 /	3							

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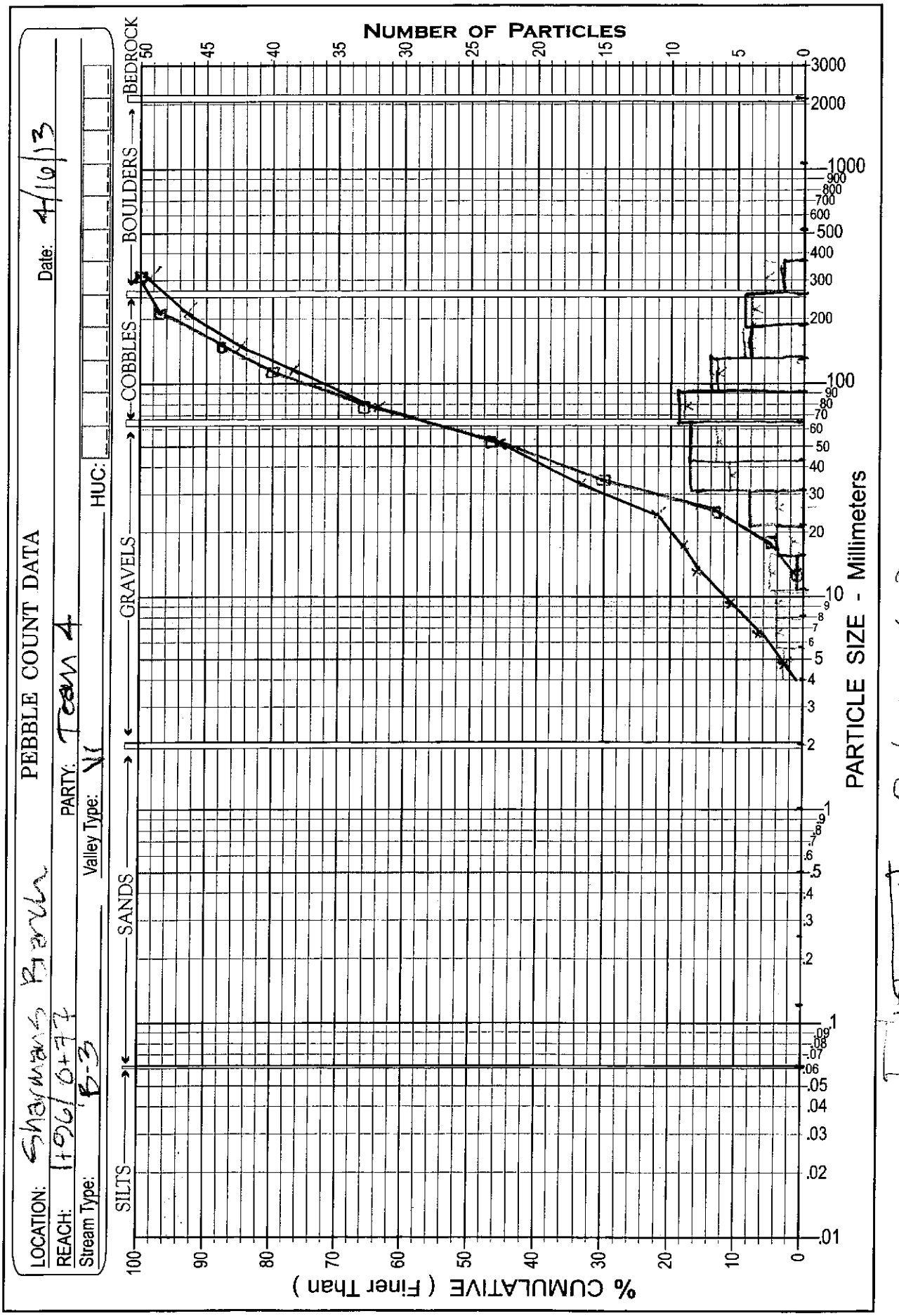

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SURVEY DATA ⟹ CROSS-SECTION 1/3

SITE: Sharmans Branch - Reach 4 **Date:** 4/16/2013

Location: Section 3 (Riffle) Station 1+96

Party / Notes: Erik N. / Mike S. **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	4.27	104.27		100	Benchmark
2	0			2.64	101.63	Left pin
3	2.0			3.89	100.38	Slope break
4	3.0			4.57	99.7	" " Left Bankfull
5	6.0			5.39	98.88	Slope break w/ deposition
6	9.0			5.92	98.35	Left edge of water
7	12.0			6.35	97.92	
8	14.0			6.43	97.84	
9	16.0			6.64	97.63	Thalweg
10	18.0			5.97	98.3	
11	20.0			5.75	98.52	
* 12	14.0			5.50	98.77	Boulder
* 13	17.0			5.81	98.46	Boulder
14	22.3			5.86	98.41	Right edge of water
15	24.5			4.53	99.74	Bankfull
16	28.0			3.73	100.54	Slope break
17	32.0			3.00	101.27	
18	36.0			2.55	101.72	
19	45.0			0.75	103.52	
20						
21						
22						
23						
24						
25						
26						
27						
28						

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SURVEY DATA ⟹ **CROSS-SECTION** #4

SITE: Sharmans Branch - Reach 4 Date: 4/16/2013

Location: Section 4 (Riffle) Station 0+77

Party / Notes: Erik N / Mike S 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	4.50	104.5		100	Benchmark
2	0			4.86	99.64	Left pin
3	2.0			6.18	98.32	Slope break
4	3.0			6.50	98.00	L Bkf
5	6.0			7.30	97.20	
6	7.3			7.84	96.66	L Edge of water
7	9.0			8.05	96.45	
8	11.0			7.83	96.67	Boulder
9	13.0			8.10	96.40	
10	15.0			8.05	96.45	Boulder
11	17.0			8.59	95.91	
12	18.2			8.81	95.69	Thalweg
13	R.0			8.54	95.96	
14	21.0			8.32	96.18	
15	23.2			8.10	96.40	R edge of water
16	25.0			7.71	96.79	deposition
17	27.0			7.88	96.62	deposition
18	29.0			7.68	96.82	
19	31.0			7.01	97.49	Slope Break
20	32.0			6.05	98.45	
21	35.0			5.03	99.47	Right Pin
22						
23	A_{bkf}	39.19				$W/d = 28.5/1.38 = 20.65$
24	W_{BKF}	28.5				
25	d_{BKF}	39.19/28.5 = 1.38				$W_{fpa} = 87.0$
26						$ER = 87/28.5 = 3.05$
27	d_{max} =	2.31				
28						

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SURVEY DATA ⟹ CROSS-SECTION 1

SITE: SHARMAN CREEK - REACH 4 **Date:** 4/16/13

Location: SECTION 4 (POOL #1) STA 3+57

Party / Notes: ERIK N. / MIKE H **HUC:**

STATION 0+57 SECOND TAPE

WBKF=25

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	4.43	104.43		100	BENCH MARK
2	0			4.80	99.63	LPIN
3	4.0			5.14	99.29	
4	7.0			5.43	99.0	
5	10.0			6.78	97.65	
6	12.0			7.89	96.54	
7	13.6			8.59	95.84	LEW
8	16.0			9.20	95.23	
9	17.5			9.59	94.84	
10	19.0			9.70	94.73	THW
11	20.0			9.65	94.78	
12	21.0			8.91	95.52	
13	22.4			9.20	95.23	
14	24.0			7.15	97.28	BOULDER
15	25.0			6.99	97.44	BOULDER
16	26.0			8.2	96.23	BOULDER
17	27.2			8.26	96.17	BOULDER
18	28.5			8.50	95.93	BOULDER
19	29.0			7.58	96.85	BOULDER
20	30.5			8.50	95.93	LEW - SIDE CHANNEL
21	31.0			9.05	95.38	BOULDER
22	31.4			8.64	95.79	REW - SIDE CHANNEL
23	33.0			7.85	96.46	BOULDER
24	35.6			7.97	97.28	REW
25	36.5			7.15	97.28	BOULDER
26	39.0			6.91	97.52	SLOPE BREAK
27	41.0			5.60	98.83	BOULDER
28	42.2			5.40	99.03	RPIN

22.0 REW MAIN STEM

A_{bkf} 113.7

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SURVEY DATA → CROSS-SECTION #2

SITE: BHARMANS BRANCH - REACH 4 Date: 4/16/13

Location: SECTION 20 (POOL #2) 2+52'

Party / Notes: MIKE S / ERIK N 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	4.5	104.55		100	BENCHMARK
2	0			4.0	100.5	LPIN
3	3			4.28	100.22	SLOPE BREAK
4	4.4			5.95	98.55	" "
5	6.5			5.53	98.97	" "
6	8.0			6.85	97.65	" "
7	9.6			6.40	98.1	UNDERCUT
8	10.0			7.12	97.38	LEW
9	11.1			8.01	96.49	
10	12.0			8.2	96.3	
11	13.5			8.01	96.49	
12	15.4			8.21	96.29	
13	16.7			8.75	95.75	
14	19.0			8.94	95.56	
15	20.0			9.01	95.49	THL
16	21.2			8.85	95.65	
17	22.3			8.22	96.28	
18	23.0			7.54	96.96	
19	23.8			7.65	96.85	
20	24.7			7.44	97.06	
21	25.2			7.73	96.77	
22	26.0			7.09	97.41	
23	26.9			7.23	97.27	
24	27.7			7.34	97.16	
25	28.1			7.07	97.43	REW
26	29.0			6.75	97.75	
27	30.0			6.75	97.75	
28	31.0			6.37	98.13	

LONGPRO STA 252 FT

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SURVEY DATA ⟹ **CROSS - SECTION 2**

SITE: SHARMAN'S BRANCH Date: 4/16/13

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29	33.1			5.81	98.69	RBF
30	36.0			5.61	98.89	SLOPE BREAK
31	37.0			5.15	99.35	
32	41.0			4.61	99.89	RPIN
33						
34						
35						
36						
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SURVEY DATA → LONGITUDINAL PROFILE 1

SITE: Sharman's Branch Date:

Location: Reach 4

Party / Notes: Sheet 1 of 3 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			100.00									
2	0+00			1.60	98.40	1.06	98.84					top of step
3	0+08			2.40	97.60	1.88	98.12					0.100 S_s
4	0+10			3.14	96.86	2.14	97.86					top pool
5	0+11			3.32	96.68	2.14	97.86					max pool
6	0+16			2.80	97.20	2.14	97.86					0.000 S_p top chute
7	0+17			3.38	96.62	2.36	97.64					bottom of chute 0.130 S_s
8	0+18			3.90	96.10	2.40	97.60					tg/max pool
9	0+23			3.43	96.57	2.40	97.60	0.96	99.04			0.001 S_p mid pool 1.44' bankfull
10	0+29			2.98	97.02	2.41	97.59					top of chute
11	0+32			3.26	96.74	2.56	97.44					max pool
12	0+34			2.99	97.91	2.69	97.31					step
13	0+37			3.62	96.38	2.76	97.24					max pool 0.044 S_s
14	0+42			3.18	96.82	2.91	97.09					riffle
15	0+50			3.22	96.78	2.96	97.04					top of chute
16	0+55			4.61	95.39	3.67	96.33					bottom of chute
17	0+59			4.83	95.17	3.76	96.24					max pool
18	0+65			4.24	95.76	3.77	96.23					0.0017 S_p step
19	0+70			4.66	95.34	3.95	96.05					0.036 S_s max pool
20	0+77			4.69	95.31	4.06	95.94	2.55	97.45			0.015 S_p top of step 1.51' bankfull
21	0+84			5.69	94.31	4.84	95.16					riffle 0.0595 S_p
22	0+96			6.28	93.72	5.18	94.82					pool
23	1+02			5.60	94.40	5.22	94.78					0.0067 S_p top of step
24	1+11			7.34	92.66	5.99	94.01					bottom of chute 0.086 S_s
25	1+13			7.79	92.21	6.00	94.00	4.46	95.54			max pool 1.54' bankfull
26	1+22			6.69	93.21	5.00	94.00					top of riffle
27	1+35			7.14	92.86	6.27	93.73	4.72	95.28			max pool 1.55' 0.011 S_p

step XSec

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1

SURVEY DATA → LONGITUDINAL PROFILE 4

SITE: Sharman's Branch Date:

Location: Reach 4

Party / Notes: Sheet 2 of 3 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	
+ 82	1+44			7.08	92.92	6.33	93.67					top of step
+ 83	1+53			7.69	92.31	7.00	93.00					pool
+ 84	1+60			7.71	92.29	7.12	92.88					riffle/chute top
+ 85	1+80			9.04	90.96	8.25	91.75					bottom chute
+ 86	1+89			9.37	90.63	8.27	91.73					max pool
- 87	1+96			9.24	90.76	8.56	91.44	6.94	93.06			step 1.52'
- 88	2+04			9.61	90.39	8.58	91.42					max pool
- 89	2+13			9.20	90.80	8.58	91.42					top of step
- 90	2+22			9.92	90.08	9.20	90.80					bottom step
- 91	2+26			10.26	89.74	9.20	90.80	7.70	92.30			pool 1.50'
- 92	2+32			9.88	90.12	9.22	90.78					top of step
93	2+50	5.56	98.21	7.35								
94	2+45			8.96	89.29	7.82	90.39					bottom of step
- 95	2+50			10.28	87.93	7.85	90.36	6.65	91.52			max pool 1.2
96	2+58			8.65	89.56	7.91	90.30					top of pool - chute top of
97	2+78			9.97	88.24	8.83	89.38					bottom of chute/cascade
98	2+79			10.43	87.78	8.83	89.38					max pool
99	2+94			9.39	88.82	8.86	89.35	7.58	90.63			top of step 1.20
100	3+07			11.24	86.97	10.08	88.13					pool
101	3+11			11.00	87.21	10.46	87.75					top of step
102	3+17			11.67	86.54	10.89	87.32					bottom of step
103	3+27			11.55	86.66	10.94	87.27					top of step
104	3+31			12.53	85.68	11.58	86.63					bottom of step
105	3+35			12.22	85.99	11.68	86.53					
106	3+41			12.36	8585	11.68	86.53	10.18	88.03			pool 1.5'
107	3+44			12.90	85.31	11.68	86.53					top of step
108	3+53			13.37	84.84	12.55	85.66					bottom of step

step xsec

2+52 pool xsec

3+57 pool xsec

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(2)

SURVEY DATA → LONGITUDINAL PROFILE 2

SITE: Sharman's Branch Date:

Location: Reach 4

Party / Notes: Sheet 3 of 3 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	3+59			13.96	84.25	12.55	85.66					max pool
29	3+63			12.97	85.24	12.59	85.62					top chute
30	3+76			14.31	83.90	13.67	84.54					bottom chute
31	3+84			14.82	83.39	13.74	84.47					pool / riffle
32	3+87			14.20	84.01	13.74	84.47					pool
33	3+97			15.33	82.88	13.78	84.43					max pool
34	4+13			14.27	83.94	13.78	84.43					tip of riffle
35	4+19			14.73	83.48	13.88	84.33					max pool
36	4+28			14.25	83.96	13.91	84.30	12.30	85.91			tip of riffle
37												
38												
39												
40												
41												
42												
43												
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49												
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53												
54												

S_f 0.004
S_s 0.083
S_p 0.003
S_R 0.0125
1.61' 0.003 S_p

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(3)

REPRESENTATIVE PEBBLE COUNT

Site: SHARMAN'S BRANCH Date: 4/16/13
Location: WA Co., MD HUC:
Party: GROUP 4

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) Reach: 4 Date: TOT #	ITEM %	% CUM	POOL (2) Reach: 4 Date: TOT #	ITEM %	% CUM	COMPOSITE (3) Reach: 4 Date: TOT #	ITEM %	% CUM
	Silt / Clay	<.062	S/C				0								
	Very Fine	.062 - .125	SAND				0								
	Fine	.125 - .25	SAND				0	3		3	9.3	4.3	3	3	3
	Medium	.25 - .50	SAND				0					4.3			
	Coarse	.50 - 1.0	SAND				0					4.3			
.04 - .08	Very Coarse	1.0 - 2	SAND				0			1	1.4	5.7	1	1	4
.08 - .16	Very Fine	2 - 4	GRAVEL				0			1	1.4	7.1	1	1	5
.16 - .22	Fine	4 - 5.7	GRAVEL				0								
.22 - .31	Fine	5.7 - 8	GRAVEL				0			1	1.4	8.5	1	1	6
.31 - .44	Medium	8 - 11.3	GRAVEL				0			3	4.3	12.8	3	3	9
.44 - .63	Medium	11.3 - 16	GRAVEL				1	3.3	3.3				1	1	10
.63 - .89	Coarse	16 - 22.6	GRAVEL				0		3.3	1	1.4	14.2	1	1	11
.89 - 1.3	Coarse	22.6 - 32	GRAVEL				1	3.3	6.6	7	10	24.2	8	8	19
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL				3	10	16.6	5	7.1	31.3	8	8	27
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL				4	13.3	29.9	3	4.3	35.6	7	7	34
2.5 - 3.5	Small	64 - 90	COBBLE				2	6.7	36.6	12	17.1	52.7	14	14	48
3.5 - 5.0	Small	90 - 128	COBBLE				1	3.3	39.9	10	14.3	67	11	11	59
5.0 - 7.1	Large	128 - 180	COBBLE				1	3.3	43.2	4	5.7	72.7	5	5	64
7.1 - 10.1	Large	180 - 256	COBBLE				3	10	53.2	7	10	82.7	10	10	74
10.1 - 14.3	Small	256 - 362	BOULDER				3	10	63.2	1	1.4	84.1	4	4	78
14.3 - 20	Small	362 - 512	BOULDER				2	6.7	69.9	3	4.3	88.4	5	5	83
20 - 40	Medium	512 - 1024	BOULDER				4	13.3	83.2	2	2.9	91.3	6	6	89
40 - 80	Large-Vry Large	1024 - 2048	BOULDER				3	10	93.2	3	4.3	95.6	6	6	95
	Bedrock		BDRK				2	6.7	99.9	3	4.3	99.9	5	5	5
Stream Type:				**Valley Type:**		TOTAL→	30			70			100	100	100

7 Pool stations: 12, 63, 202, 228, x, 281, (62+?)=362, (96+?)=396
3 Riffle stations: 81, 258, (72+?)=372

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PEBBLE COUNT AT XS-77

Site:					Date:		RIFFLE (1)			POOL (2)			COMPOSITE (3)		
Location:			HUC:				Reach:			Reach:			Reach:		
Party:				Dot Count for			Date:			Date:			Date:		
Inches	PARTICLE	Millimeters		RIFFLE 1	~~POOL~~ 2	COMP. 3	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% 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			3	~~2.5~~ 2									
.44 - .63	Medium	11.3 - 16			3	~~2.5~~ 2									
.63 - .89	Coarse	16 - 22.6			1	1									
.89 - 1.3	Coarse	22.6 - 32			6	5									
1.3 - 1.8	Very Coarse	32 - 45			6	5									
1.8 - 2.5	Very Coarse	45 - 64		1	12	10									
2.5 - 3.5	Small	64 - 90	COBBLE		16	13									
3.5 - 5.0	Small	90 - 128			11	9									
5.0 - 7.1	Large	128 - 180			14	~~11.5~~ 11									
7.1 - 10.1	Large	180 - 256			6	5									
10.1 - 14.3	Small	256 - 362	BOULDER		5	4									
14.3 - 20	Small	362 - 512			5	4									
20 - 40	Medium	512 - 1024			13	11									
40 - 80	Large-Vry Large	1024 - 2048			22	18									
	Bedrock		BDRK												
Stream Type:			**Valley Type:**			TOTAL→	100								

44 ~~45~~ ~~46~~

121

121

132
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17
77

44

22
121

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RIFFLE D84 at XS 196'

Site: Shermans Branch Date: 4/16/13

Location: HUC:

Party: GP 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		1			1	-	-						
.22 - .31	Fine	5.7 - 8													
.31 - .44	Medium	8 - 11.3		1			1	-	-						
.44 - .63	Medium	11.3 - 16		2			2	-	-						
.63 - .89	Coarse	16 - 22.6		4			4	-	-						
.89 - 1.3	Coarse	22.6 - 32		1			1	-	-						
1.3 - 1.8	Very Coarse	32 - 45		6			6	-	-						
1.8 - 2.5	Very Coarse	45 - 64		6			6	-	-						
2.5 - 3.5	Small	64 - 90	COBBLE	14			14	-	-						
3.5 - 5.0	Small	90 - 128		7			7	-	-						
5.0 - 7.1	Large	128 - 180		8			8	-	-						
7.1 - 10.1	Large	180 - 256		10			10	-	-						
10.1 - 14.3	Small	256 - 362	BOULDER	4			4	-	-						
14.3 - 20	Small	362 - 512		5			5	-	-						
20 - 40	Medium	512 - 1024		1			11	-	-						
40 - 80	Large-Vry Large	1024 - 2048		13			13	-	-						
	Bedrock		BDRK	7			7	-	-						
Stream Type:			**Valley Type:**			TOTAL→	100								

22 2500
7

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PROTRUSION AT XS-77 '

XS-77'

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Site: Date:

Location: HUC:

Party: GP 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	30, 25, 65, 35, 85, 45, 20, 20, 35, 15, 55						11					
	Fine	.125 - .25	SAND	45, 50, 25, 35, 30, 40, 185, 165, 80, 40						10					
	Medium	.25 - .50	SAND	35, 40, 50, 75, 80, 120, 80, 105, 100						9					
	Coarse	.50 - 1.0	SAND	115, 210, 55, 55, 90, 65, 130, 125, 35, 55						10					
.04 - .08	Very Coarse	1.0 - 2	SAND	100, 75, 55, 45, 50, 160, 115, 135, 145, 90						10					
.08 - .16	Very Fine	2 - 4	GRAVEL	75, 70, 95, 135, 165, 95, 215, 95, 75, 185						10					
.16 - .22	Fine	4 - 5.7	GRAVEL	80, 100, 70, 40, 50, 55, 65, 45, 50, 200						10					
.22 - .31	Fine	5.7 - 8	GRAVEL	100, 35, 30, 20, 30, 25, 330, 55, 50, 220						10					
.31 - .44	Medium	8 - 11.3	GRAVEL	55, 130, 320, 70, 20, 60, 40, 30, 70, 55						10					
.44 - .63	Medium	11.3 - 16	GRAVEL	95, 200, 215, 260, 190, 40, 85, 70, 45, 35						10					
.63 - .89	Coarse	16 - 22.6	GRAVEL												
.89 - 1.3	Coarse	22.6 - 32	GRAVEL												
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL												
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL												
2.5 - 3.5	Small	64 - 90	COBBLE												
3.5 - 5.0	Small	90 - 128	COBBLE												
5.0 - 7.1	Large	128 - 180	COBBLE												
7.1 - 10.1	Large	180 - 256	COBBLE												
10.1 - 14.3	Small	256 - 362	BOULDER												
14.3 - 20	Small	362 - 512	BOULDER												
20 - 40	Medium	512 - 1024	BOULDER												
40 - 80	Large-Vry Large	1024 - 2048	BOULDER												
	Bedrock		BDRK												
Stream Type:				***Valley Type:***		TOTAL→									

PROTRUSION AT XS 196

Site: Date:

Location: HUC:

Party:

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) Reach: Date: TOT #	ITEM %	% CUM	POOL (2) Reach: Date: TOT #	ITEM %	% CUM	COMPOSITE (3) Reach: Date: TOT #	ITEM %	% CUM
	Silt / Clay	< .062	S/C												
	Very Fine	.062 - .125	SAND	35,45,90,	105,60,45,	40,70,50	100			10					
	Fine	.125 - .25	SAND	280,350,	330,340,	350,270,180,90,130,50				0					
	Medium	.25 - .50	SAND	40,250,220,50,	50,	65,90,56,50,100,115				0					
	Coarse	.50 - 1.0	SAND	130,75,35,180,120,	135,95,120,65,25,					0					
.04 - .08	Very Coarse	1.0 - 2	SAND	150,160,185,200,60,75,	80,45,60,40					0					
.08 - .16	Very Fine	2 - 4	GRAVEL	35,15,15,15,25,65,50,	60,150,115					0					
.16 - .22	Fine	4 - 5.7	GRAVEL	35,45,80,	75,20,15,25,75,50,205										
.22 - .31	Fine	5.7 - 8	GRAVEL	10,10,8,7,7	10,15,6,5,8										
.31 - .44	Medium	8 - 11.3	GRAVEL	7,5,5,65,	75,130,45,65,50,70					0					
.44 - .63	Medium	11.3 - 16	GRAVEL	125,175,	240,50,85,130,30,75,95,115										
.63 - .89	Coarse	16 - 22.6	GRAVEL												
.89 - 1.3	Coarse	22.6 - 32	GRAVEL												
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL												
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL												
2.5 - 3.5	Small	64 - 90	COBBLE												
3.5 - 5.0	Small	90 - 128	COBBLE												
5.0 - 7.1	Large	128 - 180	COBBLE												
7.1 - 10.1	Large	180 - 256	COBBLE												
10.1 - 14.3	Small	256 - 362	BOULDER												
14.3 - 20	Small	362 - 512	BOULDER												
20 - 40	Medium	512 - 1024	BOULDER												
40 - 80	Large-Vry Large	1024 - 2048	BOULDER												
	Bedrock		BDRK												
Stream Type:				***Valley Type:***		TOTAL→									

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