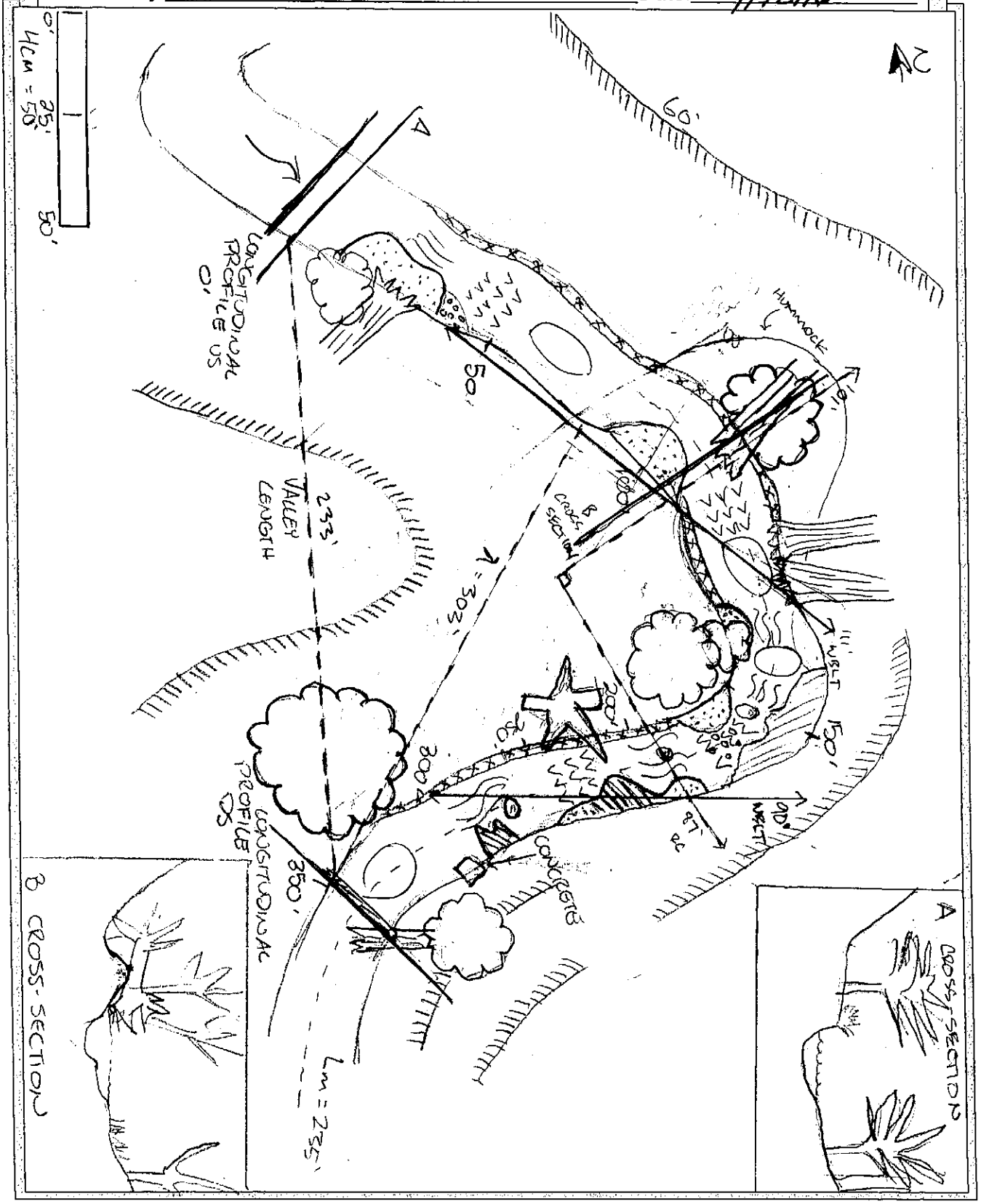
AREA-SITE LOCATION....REACH MAP

Stream/Drainage: Little Conococheague Creek Site/Reach: 2

Drawn By: Date: 4/12/16



LITTLE CONOCACHEAGUE CREEK - REACH 2

DRAWN BY: MRH / WEB DATE: 4/12/16

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SURVEY DATA → CROSS - SECTION 1

SITE: Little Conocacheague Creek Date: 4/12/16

Location: (LONG PRO 1+22)

Party / Notes: GROUP 2 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	6.42	106.42		100	
2	1.5			0.75	105.67	
3	7.2			3.55	102.87	
4	11.7			4.75	101.67	
5	18.2			7.07	99.35	
6	26.5			7.08	99.34	
7	36.0			7.09	99.33	
8	40.6			7.08	99.34	
9	42.4			5.47	100.95	
10	44.6			5.08	101.34	TOP BANK_L
11	49.4			5.58	100.84	
12	50.8			5.92	100.50	
13	51.9			6.14	100.28	BKFL_L
14	54.3			6.85	99.57	
15	56.3			7.92	98.50	WS_L
16	56.7			8.64	97.78	
17	58.5			8.96	97.46	
18	59.9			9.02	97.40	TW
19	61.3			8.86	97.46	
20	62.4			8.55	97.87	
21	63.6			8.52	97.90	
22	65.1			8.36	98.06	
23	66.6			8.15	98.27	
24	67.7			7.98	98.44	WS_R
25	70.50			7.66	98.76	
26	74.2			7.50	98.92	Inner berm
27	77.00			7.51	98.91	
28	78.6			7.06	99.36	

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SURVEY DATA → CROSS - SECTION 2

SITE: Little Conococheague Creek GROUP 2 (LONG PRO 1+22) Date: 4/12/16

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
29	80.1			6.21	100.21	
30	81.5			5.99	100.43	BKFL R (NOT USED IN CALC)
31	84.4			5.66	100.76	
32	88.5			5.32	101.10	
33	92.6			4.85	101.57	TOP BANK R
34	97.00			4.89	101.58	
35	105.8			5.15	101.27	
36	110.6			6.01	100.41	
37	114.9			6.15	100.27	
38	118.26			5.59	100.83	
39	130.5			5.28	101.14	
40	140.00			5.26	101.16	
41	150.10			4.95	101.47	
42	160.00			4.42	102.00	
43	170.00			3.94	102.48	
44	180.0			3.42	103.00	
45	190.0			2.86	103.56	
46						
47						
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59						

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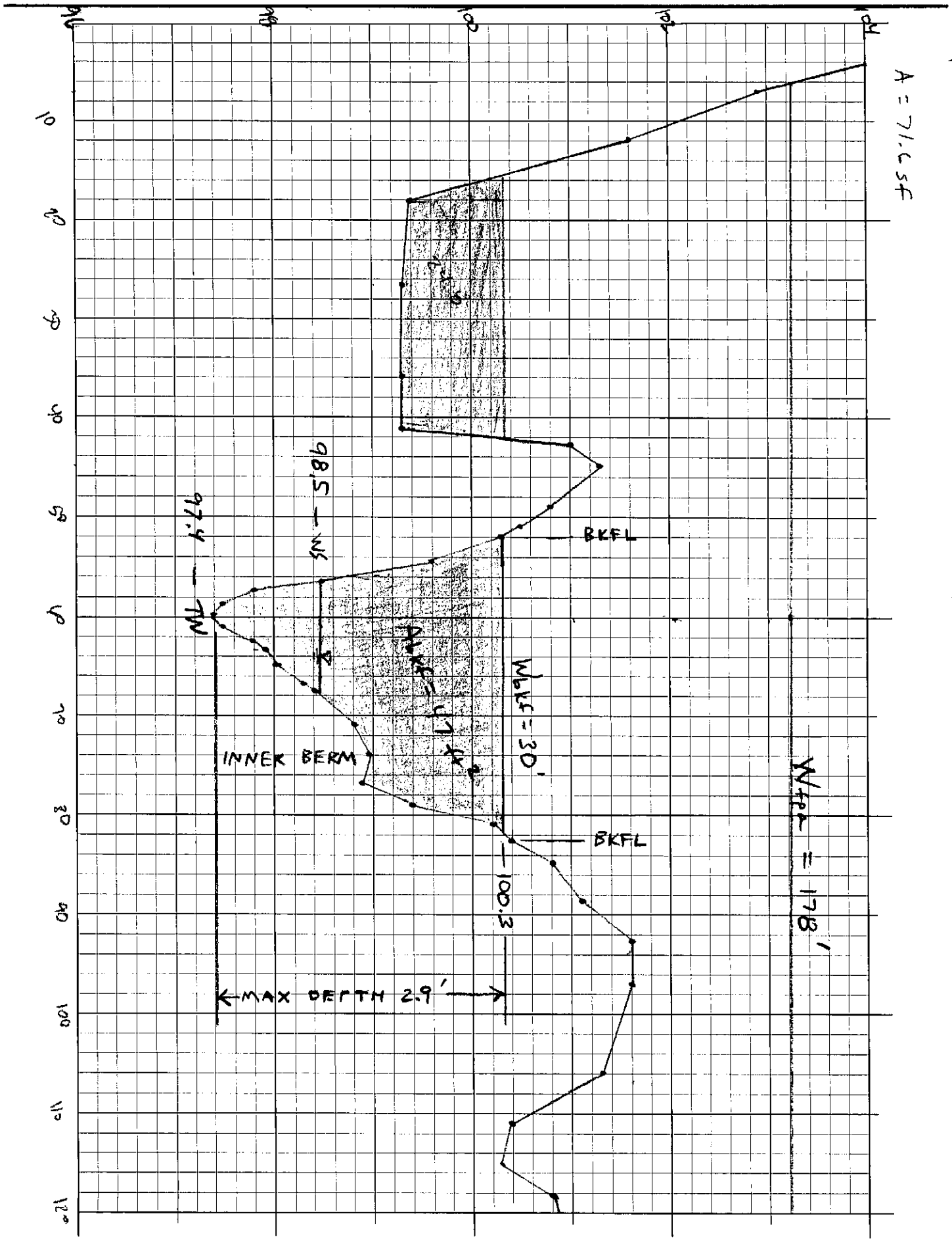

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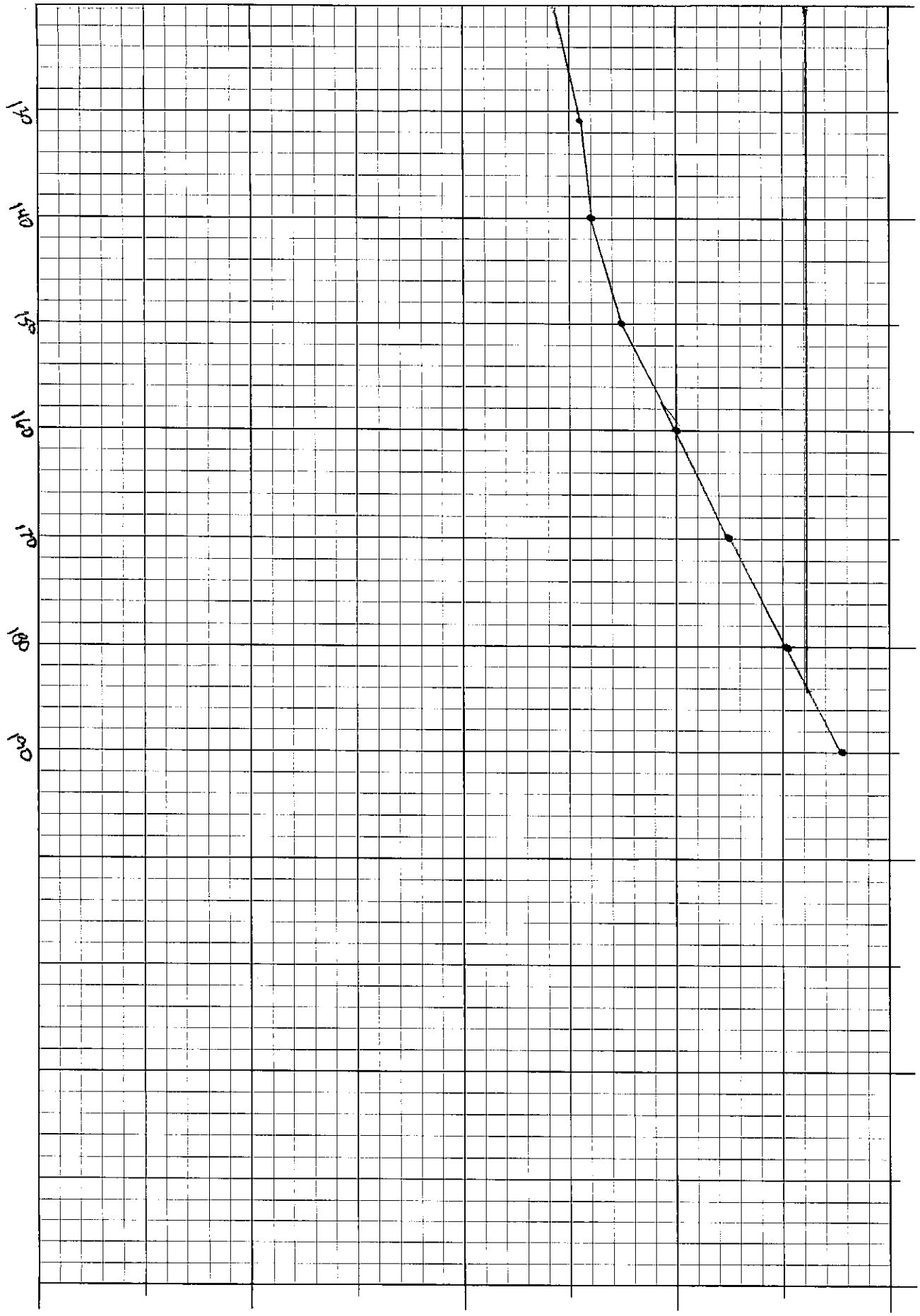

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SURVEY DATA ⟶ **LONGITUDINAL PROFILE 1**

SITE: Little Conococheague Creek **Date:** 4/12/2016

Location: Team 2

Party / Notes: DAWN, ERIC, MIKE (GRP 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		5.94	105.81									
2	0			7.85	97.96	7.30	98.51			L 5.11	100.70	WS-REW T-RIFF
3	16			8.11	97.7	7.60	98.21			L 5.10	100.71	WS-LEW MID-RIFF
4	32			8.30	97.51	7.71	98.10			L 5.14	100.67	WS-REW ANOTHER PART OF RIFF
5	47			9.09	96.72	8.36	97.45			R 4.93	100.88	WS-LEW
6	69			9.36	96.45	8.42	97.39			R 5.26	100.55	WS-REW T POOL — COMPOUND POOL
7	77			9.46	96.35	8.44	97.37			R 5.35	100.46	POOL
8	80			11.28	94.53	8.45	97.36			R 5.38	100.43	WS-REW B POOL
9	89			11.17	94.64	8.44	97.37			R 5.53	100.28	WS-REW POOL
10	96			10.49	95.32	8.43	97.38			R 5.89	99.92	WS-REW POOL
11	108			8.77	97.04	8.40	97.41			R 5.79	100.02	WS-REW TRANSVERSE BAR 8.77
12	122			9.49	96.32	8.49	97.32	6.46	99.35	R 5.81	100.00	
13	134			10.22	95.59	8.46	97.35			R 5.89	99.92	WS-LEW
14	146			9.84	95.97	8.49	97.32	6.66	99.15	R 5.88	99.93	WS-REW
15	155			9.59	96.22	8.72	97.09			R 5.72	100.09	~~WS-REW~~ TOP-RIF
16	161			9.90	95.91	8.74	97.07			R 5.76	100.05	WS-LEW BOT-RIFF THAL.
17	167			9.78	96.03	8.88	96.93			R 5.78	100.03	END-RIFF
18	198			10.35	95.46	8.94	96.87	7.03	98.78	R 6.40	99.41	WS-LEW T-POOL
19	215			11.12	94.69	8.98	96.83			R 6.31	99.50	WS-LEW MIX DEPTH POOL
20	220			10.37	95.44	9.00	96.81			R 6.10	99.71	WS-LEW T-GLIDE
21	228			9.88	95.93	9.01	96.80	7.01	98.8	R 5.83	99.98	WS-LEW T-RIFF
22	~~TP~~	~~3.34~~	~~103.34~~	~~5.81~~	~~100.00~~							
23	~~243~~			~~7.66~~	~~95.68~~	~~6.65~~	~~96.69~~	~~5.05~~		~~R 4.93~~		~~WS-LEW~~
24	~~261~~			~~8.15~~	~~95.19~~	~~7.39~~	~~95.95~~			~~R 4.21~~		~~WS-LEW BOT RIFF~~
25	~~280~~			~~8.53~~	~~94.81~~	~~7.43~~	~~95.91~~			~~R 4.91~~		~~WS-LEW~~
26	~~297~~			~~9.18~~	~~94.16~~	~~7.49~~	~~95.89~~			~~R 4.12~~		~~WS-LEW~~
27	~~305~~			~~8.82~~	~~94.52~~	~~7.46~~	~~95.88~~			~~R 4.41~~		~~BOT POOL~~

122

121 0.9%

BM A9 TP. see page 2

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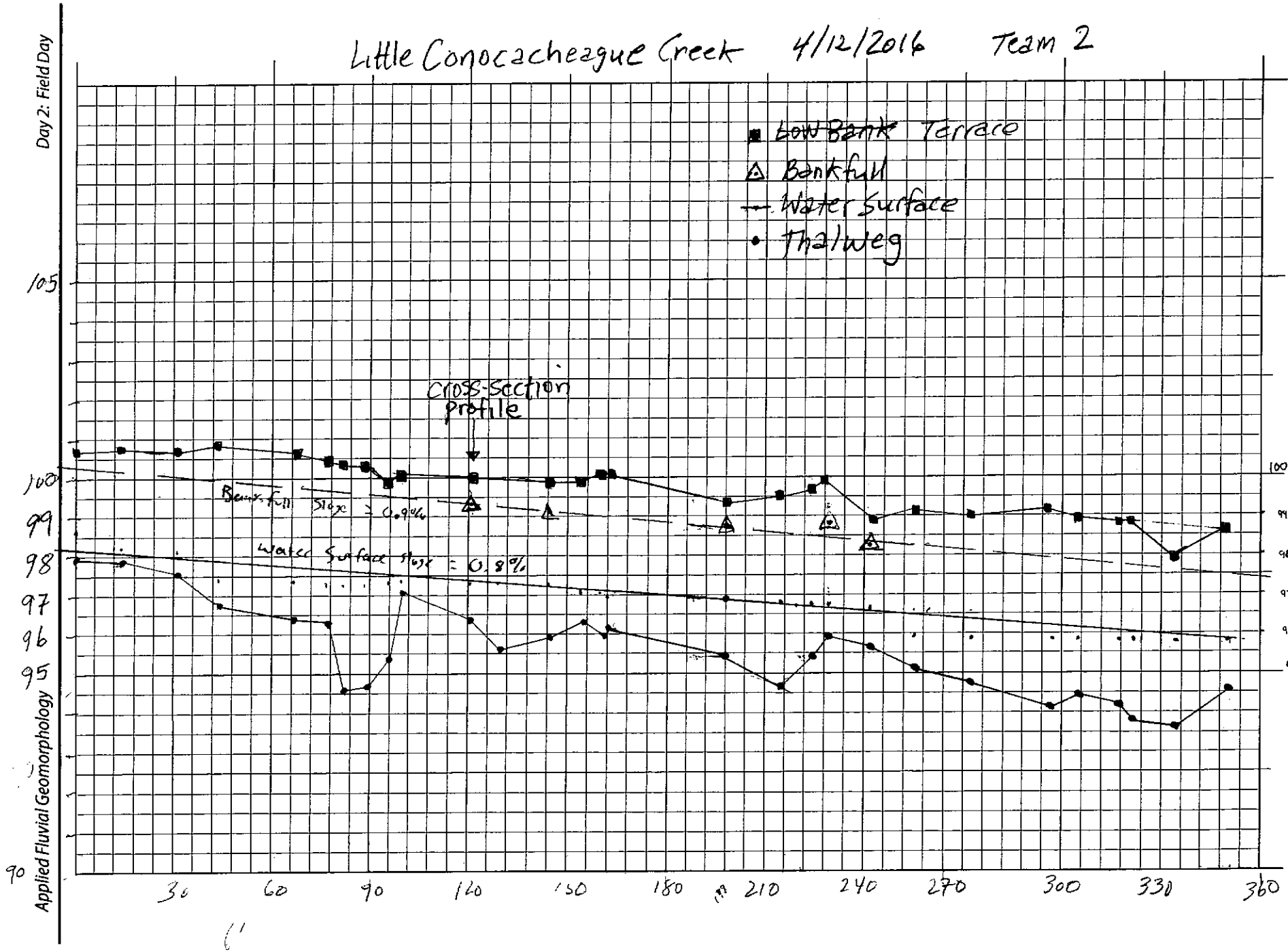

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SURVEY DATA → LONGITUDINAL PROFILE 1

SITE: Little Conococheague Creek **Date:** 4/12/16

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	
1	TP	3.311	103.31	5.81								
2	243			7.66	95.65	6.65	96.66	5.05	98.26	R 4.73	[illegible]	WS-LEW
3	261			8.15	95.16	7.39	95.92			R 4.21	97.10	WS-LEW BOT-RIF
4	280			8.53	94.78	7.43	95.88			R 4.21	97.00	WS-LEW
5	297			9.18	94.13	7.45	95.86			R 4.12	97.19	WS-LEW
6	305			8.82	94.49	7.46	95.95			R 4.41	98.90	WS-LEW BOT-POOL
7	318			8.99	94.32	7.46	95.85			R 4.38	98.92	WS-LEW T-POOL
8	322			9.57	93.74	7.46	95.85			R 4.41	98.90	WS-LEW POOL
9	334			9.71	93.60	7.47	95.84			R 3.90	97.81	WS-LEW
10	350			8.72	94.59	7.48	95.83			R 4.68	98.63	WS-LEW END-
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												

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Site: Reach 2 Date: 4/12/16

Location: HUC:

Party: SW, AH, JK

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) TOT #	ITEM %	% CUM	POOL (2) TOT #	ITEM %	% CUM	COMPOSITE (3) TOT #	ITEM %	% CUM
							Reach:			Reach:			Reach:		
							Date:			Date:			Date:		
	Silt / Clay	< .062	S/C				1	3.3	3.3	3	4.5	4.5	4	4.2	4.2
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25								1	1.5	6.0	1	1.1	5.3
	Medium	.25 - .50								1	1.5	7.5	1	1.1	6.4
	Coarse	.50 - 1.0													
.04 - .08	Very Coarse	1.0 - 2													
.08 - .16	Very Fine	2 - 4	GRAVEL							1	1.5	9.0	1	1.1	7.5
.16 - .22	Fine	4 - 5.7								1	1.5	10.5	1	1.1	8.6
.22 - .31	Fine	5.7 - 8					1	3.3	6.6	2	3.0	13.5	3	3.2	11.8
.31 - .44	Medium	8 - 11.3													
.44 - .63	Medium	11.3 - 16					3	10.7	17.3	4	6.0	19.5	7	7.4	19.2
.63 - .89	Coarse	16 - 22.6					4	14.3	31.6	10	14.9	34.4	14	14.7	33.9
.89 - 1.3	Coarse	22.6 - 32					3	10.7	42.3	11	16.4	50.8	14	14.7	48.6
1.3 - 1.8	Very Coarse	32 - 45					2	7.1	49.4	12	18.0	68.8	14	14.7	63.3
1.8 - 2.5	Very Coarse	45 - 64					6	21.4	70.8	2	3.0	71.8	8	8.4	71.7
2.5 - 3.5	Small	64 - 90	COBBLE				3	10.7	81.5	2	3.0	74.8	5	5.3	77.0
3.5 - 5.0	Small	90 - 128					3	10.7	92.2	1	1.5	76.8	4	4.2	81.2
5.0 - 7.1	Large	128 - 180													
7.1 - 10.1	Large	180 - 256													
10.1 - 14.3	Small	256 - 362	BOULDER												
14.3 - 20	Small	362 - 512													
20 - 40	Medium	512 - 1024													
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		BDRK				2	7.1	99.3	16	24.0	100.3	18	18.9	100.1
Stream Type:			Valley Type:			TOTAL→	28			67			95		

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Riffle Cross-section

Site: Reach 2 Date: 4/12/16

Location: HUC:

Party: SW, AH, JK

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) TOT #	ITEM %	% CUM	POOL (2) TOT #	ITEM %	% CUM	COMPOSITE (3) TOT #	ITEM %	% CUM
	Silt / Clay	< .062	S/C												
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25		'			1	0.9	0.9						
	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		''			2	1.8	2.7						
.63 - .89	Coarse	16 - 22.6		⊠⊡			17	15.3	18						
.89 - 1.3	Coarse	22.6 - 32		⊠⊡⊡			28	25.2	43.2						
1.3 - 1.8	Very Coarse	32 - 45		⊠⊠⊡			28	25.2	68.4						
1.8 - 2.5	Very Coarse	45 - 64		⊠⊠			22	19.8	88.2						
2.5 - 3.5	Small	64 - 90	COBBLE	⊡			7	6.3	94.5						
3.5 - 5.0	Small	90 - 128		''			4	3.6	98.1						
5.0 - 7.1	Large	128 - 180		'			1	0.9	99						
7.1 - 10.1	Large	180 - 256													
10.1 - 14.3	Small	256 - 362	BOULDER												
14.3 - 20	Small	362 - 512													
20 - 40	Medium	512 - 1024													
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		BDRK	'			1	0.9	99.9						
Stream Type: C4			**Valley Type:**			TOTAL→	111		100						

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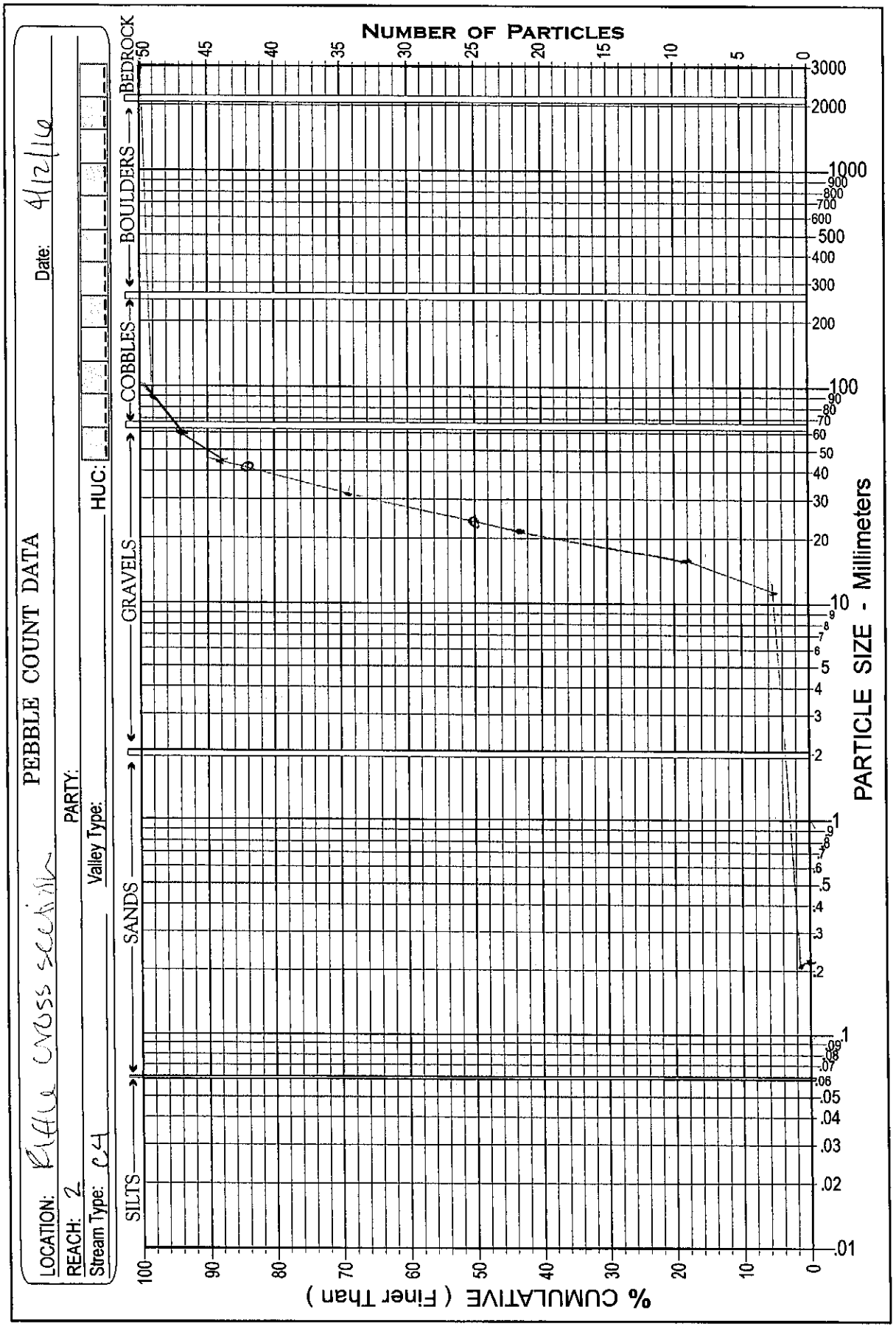

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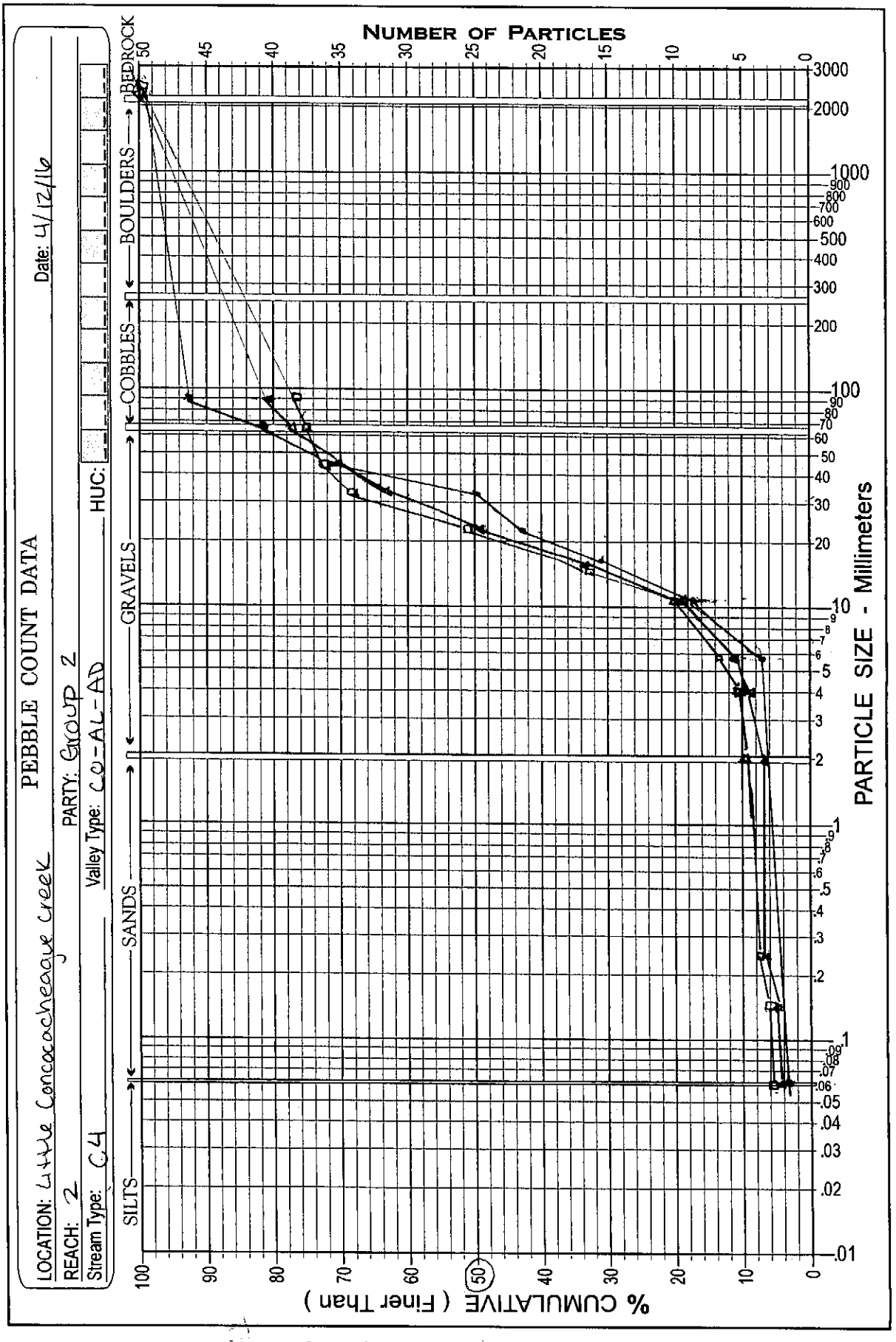
42



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

Stream: Little Conocacheague Creek			
Basin:	Drainage Area:	acres	.12 mi^2
Location: Washington Co, MD			
Twp.&Rge: Charlton	Sec.&Qtr.:		
Cross-Section Monuments (Lat./Long.):		Date: 4/12/16	
Observers: Group 2		Landscape Type:	

Bankfull Width (W_{bkf}) The surface width of the stream at bankfull stage elevation, in a riffle section.	30	ft
Bankfull Mean Depth (d_{bkf}) Mean depth of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A_{bkf} / W_{bkf}$).	1.6	ft
Bankfull Cross-Sectional Area (A_{bkf}) Area of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	47	ft^2
Width/Depth Ratio (W_{bkf} / d_{bkf}) *Bankfull Width* divided by *Bankfull Mean Depth*, in a riffle section.	18.8	ft/ft
Bankfull 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.	2.9	ft
Flood-Prone Area Width (W_{fpa}) Width of the channel at an elevation that is twice the *Bankfull Maximum Depth*, measured perpendicular to the fall line of the valley in a riffle section.	178	ft
Entrenchment Ratio (ER) The *Flood-Prone Area Width* divided by *Bankfull Width* (W_{fpa} / W_{bkf}), in a riffle section.	5.9	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.	25	mm
Average Water Surface Slope (S) The elevation difference of water surface measurements over the stream length between two similar bed features (e.g., start of riffle to start of last riffle) for several riffle-pool or step-pool sequences, representing channel gradient.	.0077	ft/ft
Channel Sinuosity (k) An index of channel pattern determined from stream length divided by valley length (SL / VL), or from valley slope divided by average water surface slope (S_{val} / S).	1.5	ft/ft

Stream Type C4/1 **See Classification Key (Figure A-2)**

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

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	Little Conococheague Creek	Location:	Washington Co, MD
Date:	4/12/16	Stream Type:	C-1
Landscape Type:			
Observers:	Group 2	HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional Area	47	A_{bkf} (ft^2)	Bankfull Riffle Mean Depth	1.6	d_{bkf} (ft)
Bankfull Riffle Width	30	W_{bkf} (ft)	Wetted Perimeter $\approx (2 * d_{bkf}) + W_{bkf}$	33.2	W_p (ft)
D_{84} Particle Size at Riffle	42	D_{84} (mm)	D_{84} Particle Size in Feet D_{84} (mm) / 304.8	0.14	D_{84} (ft)
Bankfull Slope	0.0077	S_{bkf} (ft / ft)	Hydraulic Radius A_{bkf} / W_p	1.42	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R (ft) / D_{84} (ft)	10.1	R / D_{84} (ft / ft)
Drainage Area	12	DA (mi^2)	Shear Velocity $u^* = (gRS)^{1/2}$	0.59	u^* (ft / sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $\bar{u} = [\,2.83 + 5.66 * Log\{R / D_{84}\}\,]\,u^*$	5.03	ft / sec	236	cfs
2. Roughness Coefficient: a) Manning's n from Friction Factor/Relative Roughness (Figs. A-28, A-29) $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.035	3.17	ft / sec	148.9	cfs
2. Roughness Coefficient: b) Manning's n from Stream Type (Fig. A-30) $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.031	5.32	ft / sec	250.4	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 $n =$ 0.006	27.53	ft / sec	1293.91	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 Q Q = ____ year		ft / sec		cfs
4. Continuity Equations: b) Regional Curves $\bar{u} = Q / A$	4.25	ft / sec	200	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 A-3. Summary of Morphological Variables.

Stream: Little Concocacheague Creek		**Location:** Washington Co, MD	
Team: Group 2	**Date:** 4/12/16	**Drainage Area:** 12 sq/mi	

Riffle Channel Dimensions

1. Bankfull Width (W_{bkf}) (ft)	30	2. Bankfull Mean Depth (d_{bkf}) (ft)	1.6
3. Width/Depth Ratio (W_{bkf} / d_{bkf})	18.75	4. Bankfull Cross-Sectional Area (A_{bkf}) (ft^2)	47
5. Bankfull Maximum Depth (d_{max}) (ft)	2.9	6. Width of Flood-Prone Area (W_{fpa}) (ft)	178
7. Entrenchment Ratio (ER) (W_{fpa} / W_{bkf})	5.9		

Channel Pattern / *Dimensionless Ratios*

8. Belt Width (W_{blt}) (ft)	Mean	100.5	9. Meander Width Ratio (MWR) (W_{blt} / W_{bkf})	Mean	3.350
	Min	90		Min	3
	Max	111		Max	3.7
10. Stream Meander Length (L_m) (ft)	Mean	235	11. Meander Length Ratio (MLR) (L_m / W_{bkf})	Mean	7.8
	Min	235		Min	7.8
	Max	235		Max	7.8
12. Linear Wavelength (λ) (ft)	Mean	303	13. Linear Wavelength to Bankfull Width (λ / W_{bkf})	Mean	10.1
	Min	303		Min	10.1
	Max	303		Max	10.1
14. Radius of Curvature (R_c) (ft)	Mean	94	15. Radius of Curvature to Bankfull Width (R_c / W_{bkf})	Mean	3.13
	Min	87		Min	2.9
	Max	101		Max	3.36

Channel Particles

Representative Pebble Count

16. D_{16} (mm)	9	17. D_{35} (mm)	17	18. D_{50} (mm)	22
19. D_{84} (mm)	150	20. D_{95} (mm)	900	21. D_{100} (mm)	2000

Active Bed Riffle Pebble Count

22. D_{16} (mm)	15	23. D_{35} (mm)	18	24. D_{50} (mm)	25
25. D_{84} (mm)	42	26. D_{95} (mm)	65	27. D_{100} (mm)	100

Classification

28. Sinuosity (k)	1.5	29. Average Water Surface Slope (S)	.0077
30. Stream Type	C	31. Landscape Type CONFINED	CO-AL-AD

Velocity & Discharge

32. Friction Factor ($\bar{u}$ / u*)	8.1	33. Relative Roughness (R / D_{84})	10.1
34. Manning's 'n' from Friction Factor / Relative Roughness	.035	35. Manning's 'n' from Stream Type	.031
36. Estimated Bankfull Mean Velocity ($\bar{u}_{bkf}$) (ft/sec)	5.03	37. Estimated Bankfull Discharge (cfs)	236
38. Estimation Method Selected for Velocity & Discharge	#1 Friction Factor / Relative Roughness		

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