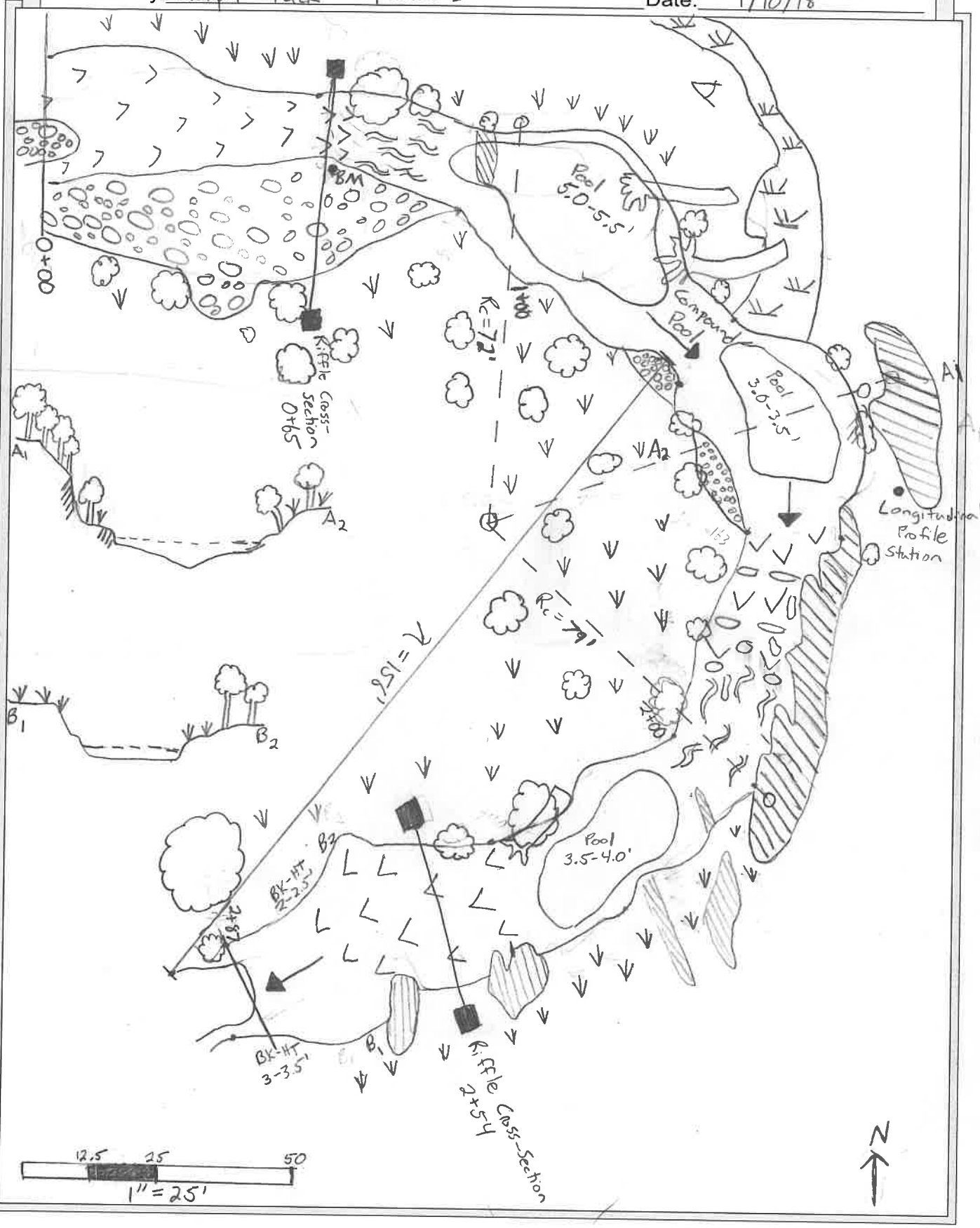
AREA-SITE LOCATION....REACH MAP

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

Drawn By: Ralph Tuck TEAM 2 Date: 4/10/18



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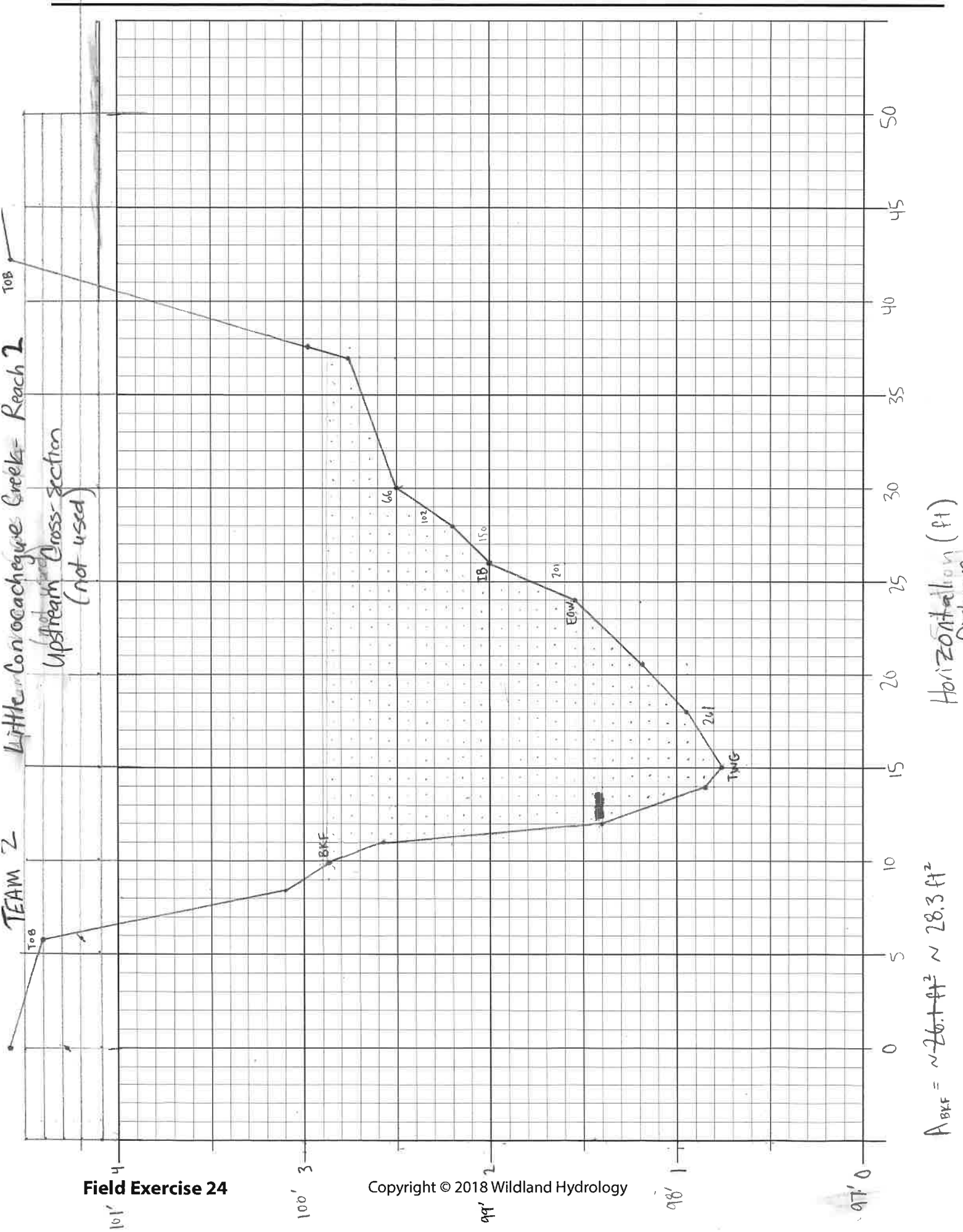

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Team 2 Reach 2
4/10/18

SURVEY DATA ⟹ **CROSS - SECTION 2**

SITE: upstream Cross Sec. 0+65 approx 65' long Date: 4/10/18

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES / COMMENTS / REMARKS
29	BM	100	~~104.73~~	4.73	101.18	
30	0		105.91	4.33	101.58	
31	6			4.51	101.40	Top of bank
32	8.4			5.80	100.11	
33	9.8			6.04	99.87	Bankfull
34	11			6.33	99.58	
35	11.3			7.51	98.40	edge of water
36	14.0			8.06	97.85	
37	15			8.15	97.76	Thalweg
38	18			7.97	97.94	
39	20.6			7.72	98.19	
40	24			7.37	98.54	edge of water
41	25.9			6.88	99.03	inner berm
42	28			6.70	99.21	"
43	30			6.39	99.52	"
44	37			6.15	99.76	Bankfull
45	37.5			5.93	99.98	
46	42			4.37	101.54	Top of Bank
47	46			4.03	101.88	
48						
49						8.15
50						-6.04
51						2.11
52						x 2
53						4.22 max depth
54						
55						8.15
56						-4.22
57						3.93
58						
59	BM_{LP}			5.91		Long Pro BM

110.6' FPW

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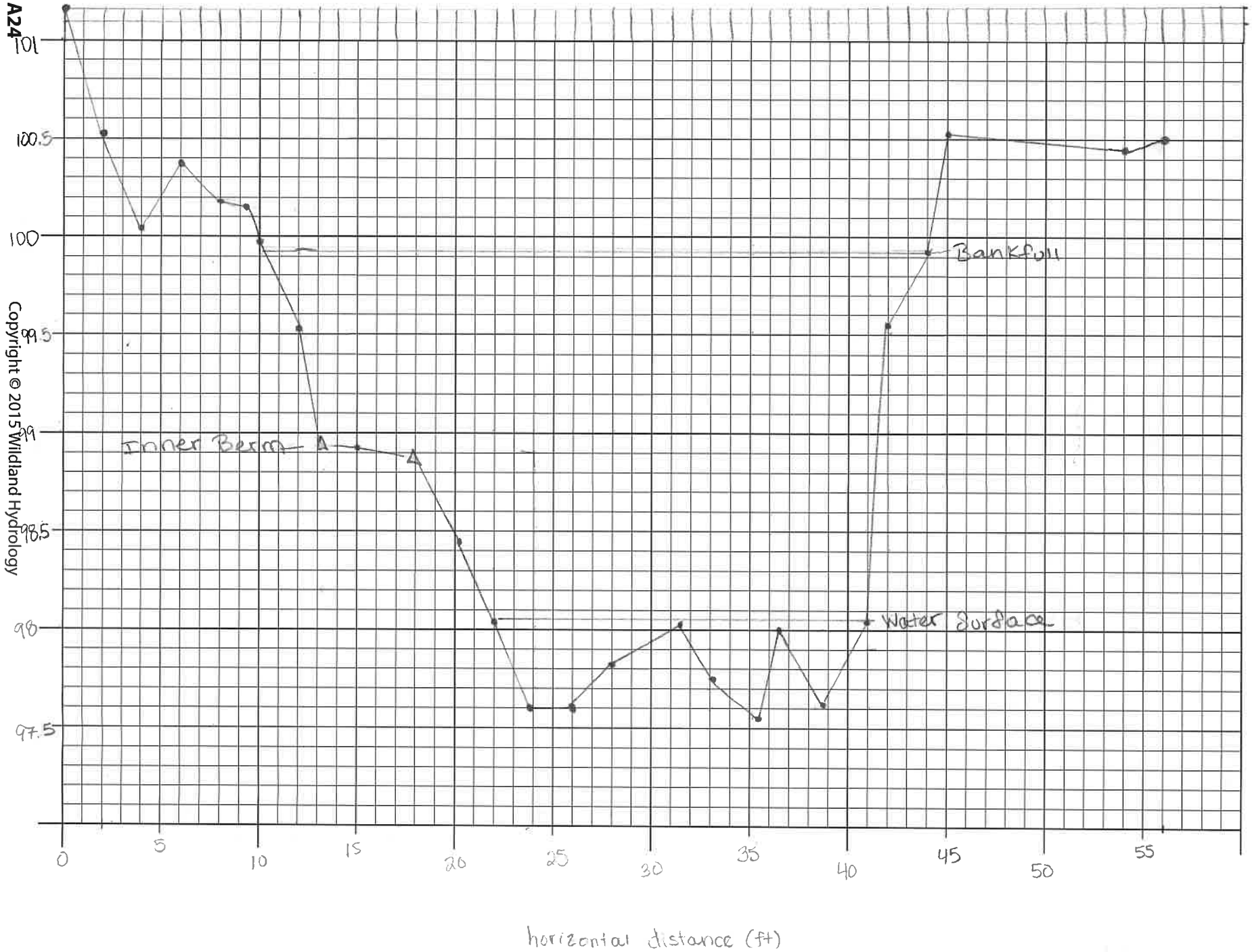
TEAM 2 Little Conocacheague Creek – Reach 2
Channel Cross Section 1

Flood Prone Width 88'



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Team 2 Reach 3

4/10/18

1.18

SURVEY DATA → **CROSS - SECTION** 1

SITE: Team 2 - Reach 2 STA 2+54 Date: 4/10/18

Location: DS Cross Sec. Approx. 254' Long Pro.

Observers: Karly 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	BM	100	~~104.10~~			
2	0		105.34	4.32	~~99.84~~ 101.02	DBL
3	2			4.87	100.52	
4	4			5.30	100.04	
5	6			4.97	100.37	Rock?
6	8			5.15	100.19	Top Bank
7	9.25			5.18	100.16	Bankfull
8	10			5.46	99.88	
9	12			5.80	99.54	
10	13.1			6.42	98.92	inner berm
11	15			6.44	98.90	"
12	18			6.48	98.86	"
13	20.3			6.91	98.43	edge of water
14	22			7.31	98.03	
15	23.9			7.74	97.60	
16	26.1			7.74	97.60	
17	28			7.53	97.81	large cobble
18	31.5			7.32	98.02	center of channel
19	33.7			7.59	97.75	
20	35.4			7.78	97.56	* Thalweg
21	36.6			7.34	98.00	Boulder?
22	38.7			7.73	97.61	
23	41.0			7.29	98.05	edge of water
24	42.3			5.79	99.55	
25	44.0			5.42	99.92	Bankfull * Known flag
26	45			4.83	100.51	Top Bank
27	54			4.90	100.44	
28	56			4.84	100.50	

Flood Prone width 88'

21' water width

7.78
-5.42
2.36
max depth
x 2
4.72

7.78
-4.72
3.06

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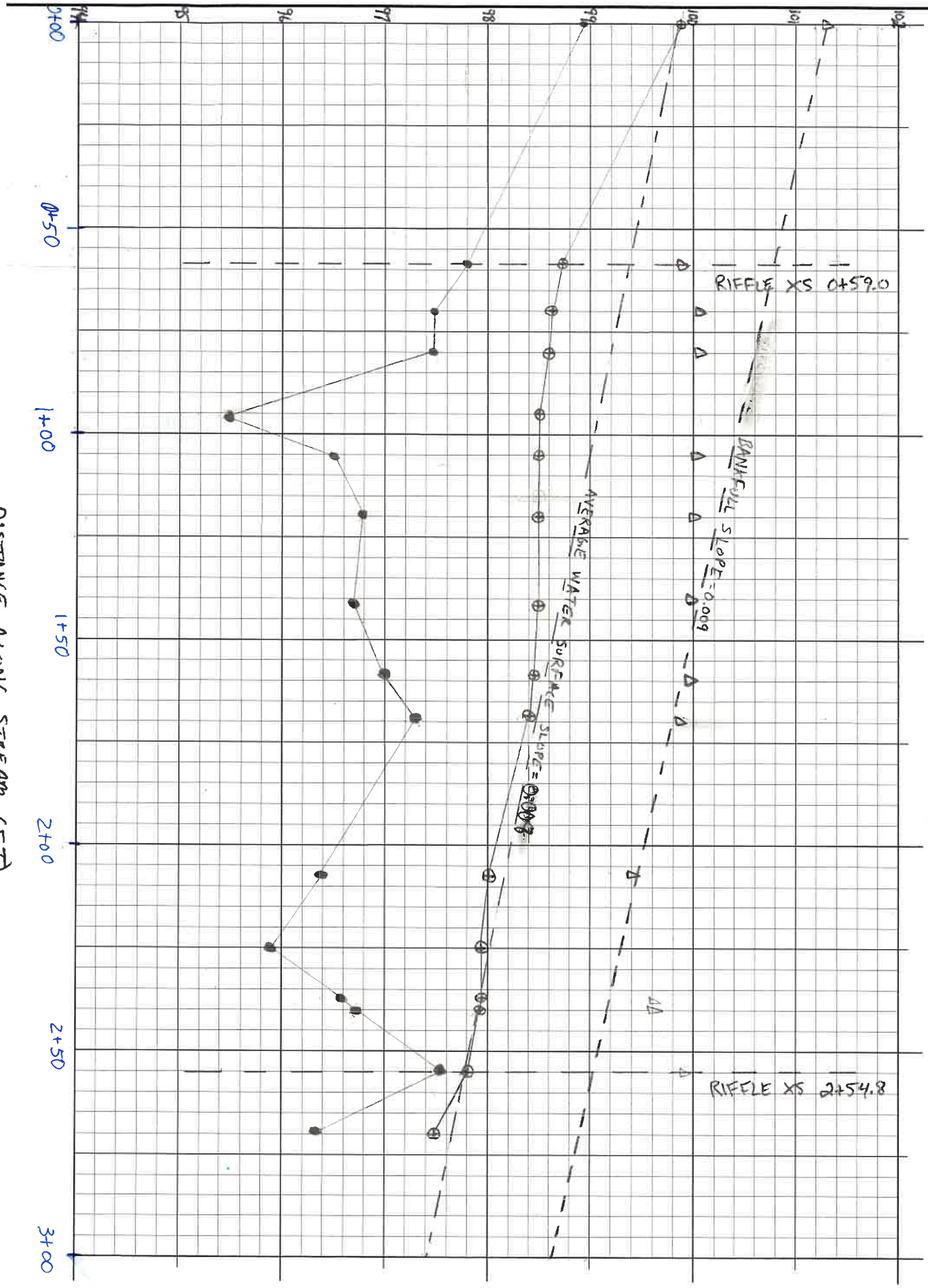
3.42



TEAM 2

LITTLE CONOCACHEGUE CREEK – Reach 2

LONGITUDINAL PROFILE

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SURVEY DATA ⟹ **LONGITUDINAL PROFILE 1**

we can use middle tolerance

SITE: Little Conocachegue Creek Date: 10 April 18

Location: #1 Team 2, Reach 2

Observers: Casey Jensen, Travis Spangler, Trisha Crabill 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	Rock Location (32.0)		107.79		[illegible]	[illegible]						Rock Location (emergency backsight)
2	0			8.83	98.96	7.96	99.83	6.43	101.36	—		Riffle
3	59			9.99	97.8	~~9.30~~ 9.06	98.73	~~7.28~~ cross-section will provide	99.87			mid-riff
4	70.5			10.33	97.42	9.12	98.67	7.71	100.08			Run
5	80.8			10.38	97.49	9.17	98.62	7.71	100.08			mid-Run
6	95.3			12.24	95.55	~~9.30~~ 9.25	98.54	6.76	101.03			pool
7	105.5			11.38	96.49	~~9.30~~ 9.25	98.54	7.23	100.56			Glide
8	121.8			11.00	96.29	~~9.20~~ 9.23	98.56	7.67	100.12		Run ~~Glide~~	~~Riffle~~
9	143.4			11.09	96.70	9.29	98.5	7.79	100.00			Pool
10	159.1			10.79	97.0	9.33	98.46	7.82	99.97			Glide
11	169.0			10.49	97.3	9.36	98.43	7.82	99.97			Riffle
12	207.5			11.41	96.39	9.72	98.07	8.37	99.42			Run
13	225.0			11.91	95.88	9.83	97.96	8.15	99.64			Pool
14	237.0			11.21	96.58	9.83	97.96	8.15	99.64			Glide
15	240.3			11.05	96.74	9.85	97.94	8.15	99.64			Riffle
16	254.8				97.56		98.05	—	99.92			mid-riffle
17	269			11.43	96.36	10.36	97.43					Run
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												

32.0

cross section

top of riffle

top of run max pool depth

top of glide

Scour area around root wad

0.85

10.98

1.24

1.3

Cross-section

97.81

Get from cross-section crew

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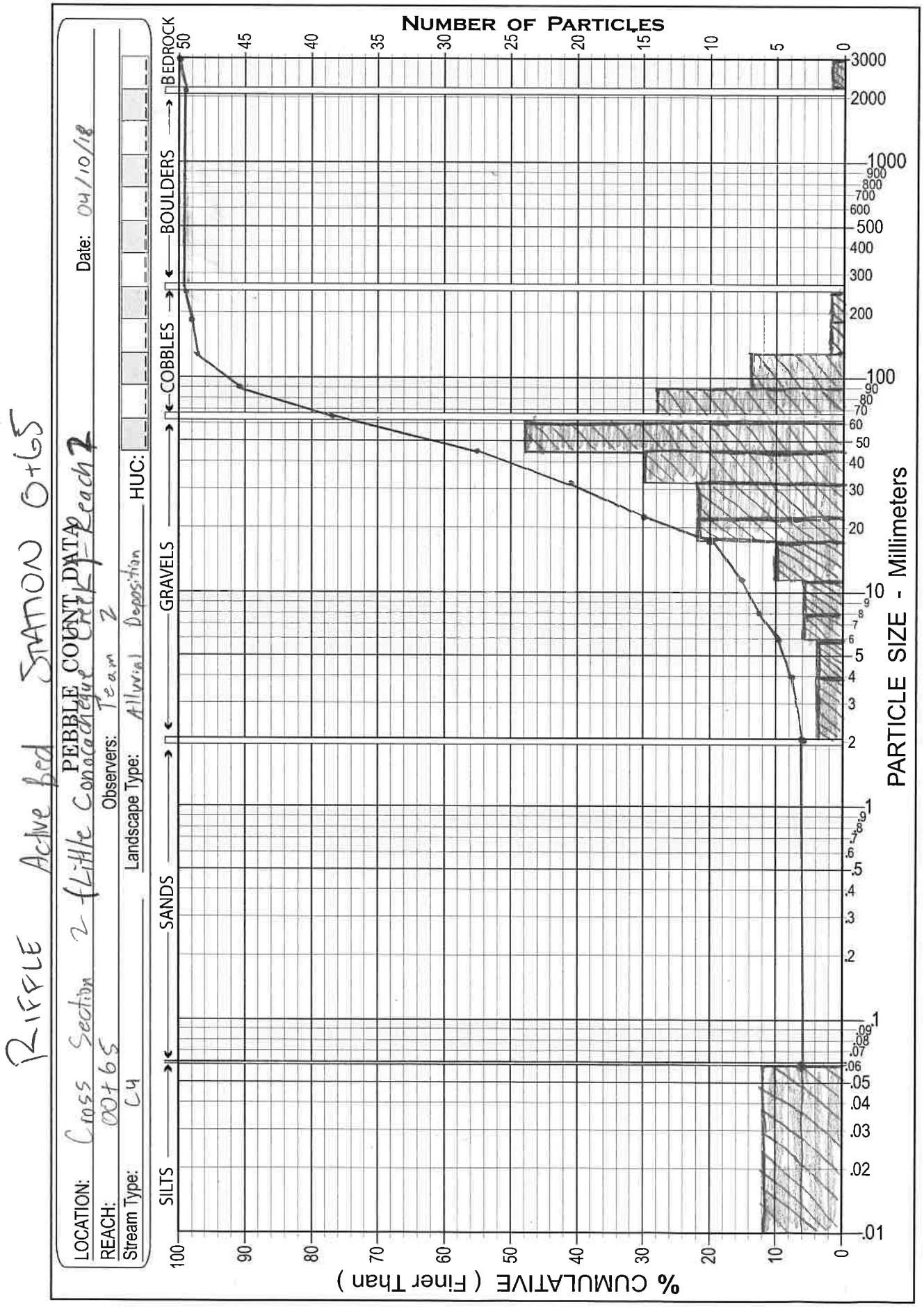
(A) = Bankfull designated by class



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TEAM 2 4/10/18
REPRESENTATIVE

0+30 R
0+60 R
0+90 P
1+25 R

1+60 POOL
1 BANK
1+80 R
2+10 R
2+29 P

50
115
35
165
200
63

2+48 R

111
230
100
440

115
240
85

2+70 R

Team 2
Alluvial Deposition
4/10/18
Reach 2

C4-1

Site: Little Conococheague							RIFFLE (1)			POOL (2)			COMPOSITE (3)		
Location: Reach 2 HUC:							Reach: 2			Reach: 2			Reach: 2		
Observers: CH, CH, CWC				Dot Count for			Date: 04/10/18			Date: 04/10/18			Date: 04/10/18		
Inches	PARTICLE	Millimeters		RIFFLE 1	POOL 2	COMP. 3	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
	Silt / Clay	< .062	S/C				4	5.7	5.7	5	16.7	16.7	9	9	9
	Very Fine	.062 - .125	SAND						5.7	1	3.3	20.0	1	1	10
	Fine	.125 - .25					1	1.4	7.1			20.0	1	1	11
	Medium	.25 - .50							7.1			20.0			11
	Coarse	.50 - 1.0							7.1	1	3.3	23.3	1	1	12
.04 - .08	Very Coarse	1.0 - 2							7.1			23.3			12
.08 - .16	Very Fine	2 - 4	GRAVEL						7.1			23.3			12
.16 - .22	Fine	4 - 5.7					1	1.4	8.5			23.3	1	1	13
.22 - .31	Fine	5.7 - 8							8.5	1	3.3	26.6	1	1	14
.31 - .44	Medium	8 - 11.3							8.5			26.6			14
.44 - .63	Medium	11.3 - 16					2	2.9	11.4			26.6	2	2	16
.63 - .89	Coarse	16 - 22.6					2	2.9	14.3	2	6.7	33.3	4	4	20
.89 - 1.3	Coarse	22.6 - 32					13	18.6	32.9	1	3.3	36.6	14	14	34
1.3 - 1.8	Very Coarse	32 - 45					8	11.4	44.3	3	10.0	46.6	11	11	45
1.8 - 2.5	Very Coarse	45 - 64					12	17.1	61.4	3	10.0	56.6	15	15	60
2.5 - 3.5	Small	64 - 90	COBBLE				11	15.7	77.1	2	6.7	63.3	13	13	73
3.5 - 5.0	Small	90 - 128							77.1	3	10.0	73.3	3	3	76
5.0 - 7.1	Large	128 - 180					3	4.3	81.4	3	10.0	83.3	6	6	82
7.1 - 10.1	Large	180 - 256							81.4			83.3			82
10.1 - 14.3	Small	256 - 362	BOULDER				3	4.3	85.7			83.3	3	3	85
14.3 - 20	Small	362 - 512					1	1.4	87.1			83.3	1	1	86
20 - 40	Medium	512 - 1024							87.1			83.3			86
40 - 80	Large-Vry Large	1024 - 2048							87.1			83.3			86
	Bedrock		BDRK				9	12.9	100	5	16.7	100	14	14	100
Stream Type:			Landscape Type:			TOTAL→	70	100.0		30	100.0		100		

111

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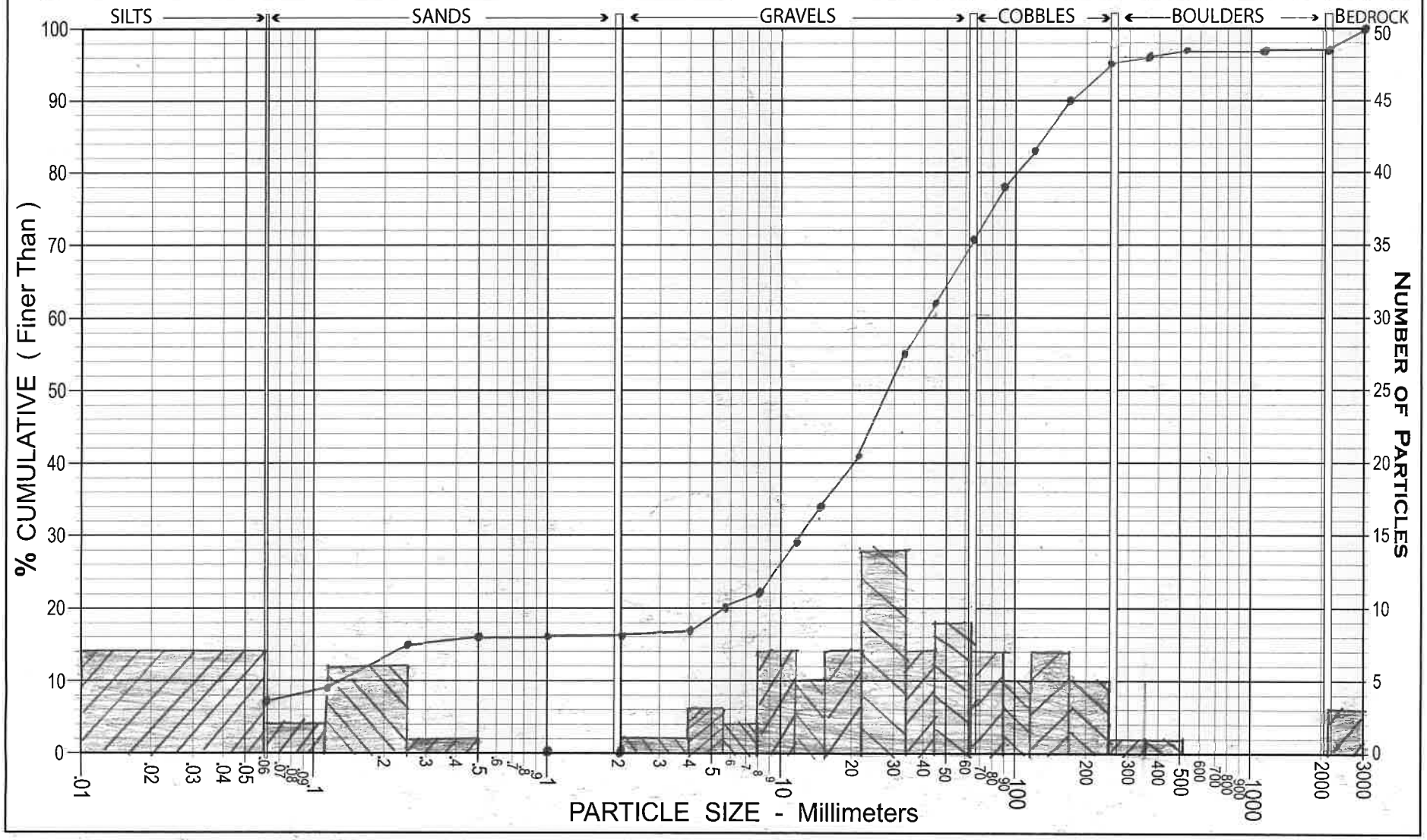
Riffle Active Bed STATION 2+54

PEBBLE COUNT DATA

LOCATION: Cross Section 1 (Little Conococheque Creek) – Reach 2 Date: 04-10-18

REACH: 2 2+54 Observers: Team 2

Stream Type: C4-1 Landscape Type: Alluvial Deposition HUC:



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CS-2 @ 0+65 ft.

Team 2
Alluvial Deposition
4/10/18
UP Reach 2

C4-1

Site: CS-1 & 2
Location: Stn 254.5 HUC:
Observers: TEAM 2

Inches	PARTICLE	Millimeters		Dot Count for ~~RIFFLE~~ CS-1 1	~~POOL~~ CS-2 2	COMP. 3	RIFFLE (1) Down Reach: CS-1 Date: TOT #	ITEM %	% CUM	POOL (2) Reach: CS-2 Date: TOT #	ITEM %	% CUM	COMPOSITE (3) Reach: Date: TOT #	ITEM %	% CUM
	Silt / Clay	< .062	S/C				7	7%	7%	6	5.7	5.7			
	Very Fine	.062 - .125	SAND				2	↓	9%						
	Fine	.125 - .25	SAND				6		15%						
	Medium	.25 - .50	SAND				1		16%						
	Coarse	.50 - 1.0	SAND												
.04 - .08	Very Coarse	1.0 - 2	SAND												
.08 - .16	Very Fine	2 - 4	GRAVEL				1		17%	2	1.9	7.6			
.16 - .22	Fine	4 - 5.7	GRAVEL				3		20%	2	1.9	9.5			
.22 - .31	Fine	5.7 - 8	GRAVEL				2		22%	3	2.8	12.3			
.31 - .44	Medium	8 - 11.3	GRAVEL				7		29	3	2.8	15.1			
.44 - .63	Medium	11.3 - 16	GRAVEL				5		34	5	4.7	19.8			
.63 - .89	Coarse	16 - 22.6	GRAVEL				7		41	11	10.4	30.2			
.89 - 1.3	Coarse	22.6 - 32	GRAVEL				14		55	11	10.4	40.6			
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL				7		62	15	14.2	54.8			
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL				9		71	24	22.6	77.4			
2.5 - 3.5	Small	64 - 90	COBBLE				7		78	14	13.2	90.6			
3.5 - 5.0	Small	90 - 128	COBBLE				5		83	7	6.6	97.2			
5.0 - 7.1	Large	128 - 180	COBBLE				7		90	1	.9	98.1			
7.1 - 10.1	Large	180 - 256	COBBLE				5		95	1	.9	99.0			
10.1 - 14.3	Small	256 - 362	BOULDER				1		96						
14.3 - 20	Small	362 - 512	BOULDER				1		97						
20 - 40	Medium	512 - 1024	BOULDER												
40 - 80	Large-Vry Large	1024 - 2048	BOULDER												
	Bedrock		BDRK				3		100	1	.9	100			
Stream Type:			**Landscape Type:**			TOTAL→	100			106					

116 $\frac{96 \times 60}{106}$

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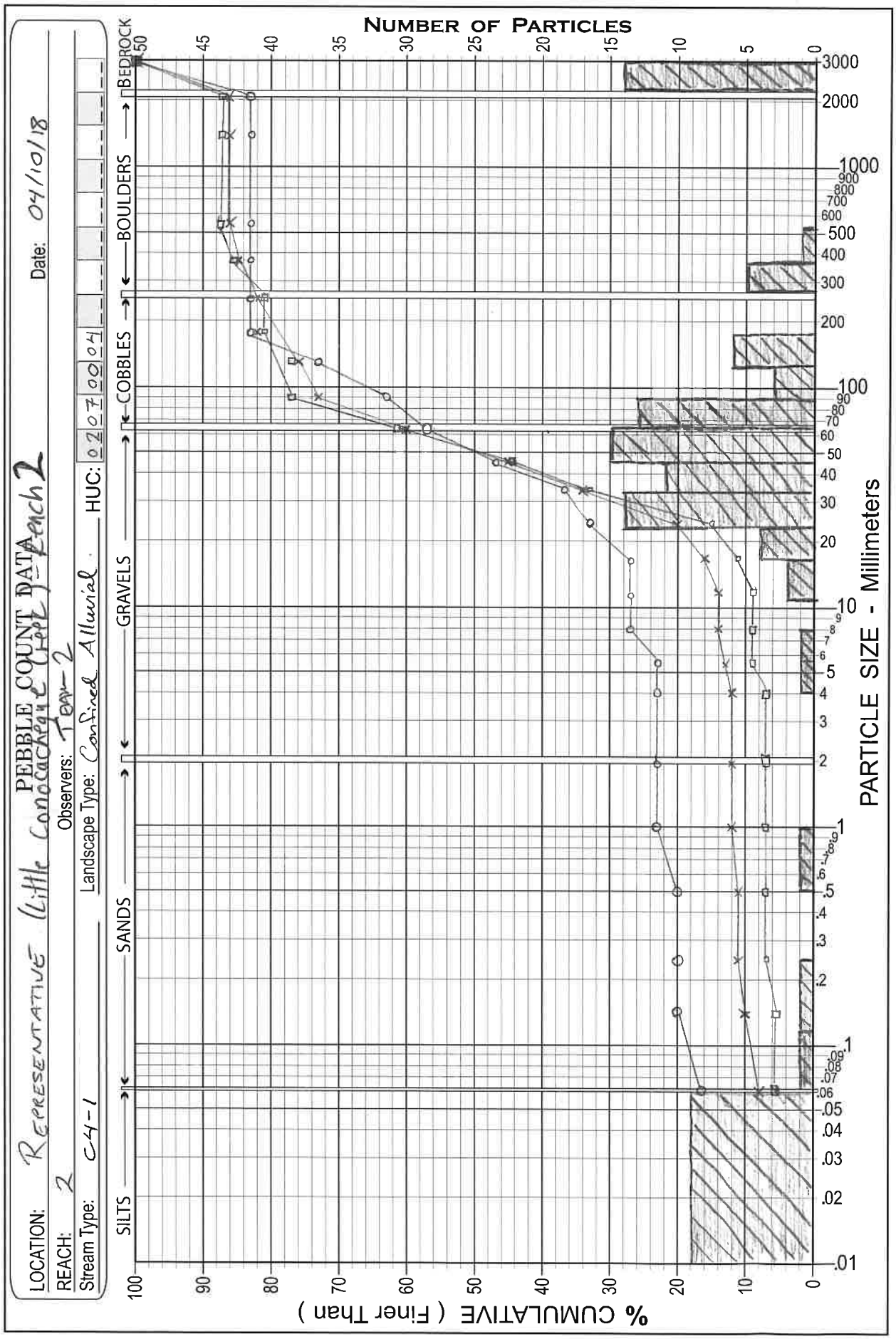

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Worksheet 2. Computations of velocity and discharge using various methods.

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	Little Conococheague	Location:	Reach 3
Date: 4/10/18	Stream Type: C 4/1	Landscape Type:	C-AL-AD
Observers:	Team 2	HUC:	-- -- -- -- -- -- -- -- -- -- --

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional Area	55	A_{bkf} (ft^2)	Bankfull Riffle Mean Depth	1.62	d_{bkf} (ft)
Bankfull Riffle Width	34	W_{bkf} (ft)	Wetted Perimeter $\approx (2 * d_{bkf}) + W_{bkf}$	37.24	W_p (ft)
D_{84} Particle Size at Riffle	150	D_{84} (mm)	D_{84} Particle Size in Feet D_{84} (mm) / 304.8	0.49	D_{84} (ft)
Bankfull Slope	0.0091	S_{bkf} (ft / ft)	Hydraulic Radius A_{bkf} / W_p	1.48	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R (ft) / D_{84} (ft)	3.02	R / D_{84} (ft / ft)
Drainage Area	12	DA (mi^2)	Shear Velocity $u^* = (gRS)^{1/2}$	0.66	u^* (ft / sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $\bar{u} = [2.83 + 5.66 * Log\{R / D_{84}\}] u^*$	3.66	ft / sec	201.3	cfs
2. Roughness Coefficient: a) Manning's *n* from Friction Factor/Relative Roughness (Figures 27–28) $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.04	4.10	ft / sec	225.6	cfs
2. Roughness Coefficient: b) Manning's *n* from Stream Type (Figure 29) $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.04	4.10	ft / sec	225.6	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 $n =$ 0.06	3.08	ft / sec	169.4	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.)	N/A	ft / sec	N/A	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.)	N/A	ft / sec	N/A	cfs
4. Continuity Equations: a) USGS Gage Data $\bar{u} = Q / A$ Return Period for Bankfull Q: Q = ____ year	N/A	ft / sec	N/A	cfs
4. Continuity Equations: b) Regional Curves $\bar{u} = Q / A$	3.89	ft / sec	214.05	cfs

$\bar{u}/u^* = 5.55$

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 **"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 1. Field Form for Level II Stream Classification.

Stream: Little Conocacheague			
Basin: Potomac	Drainage Area:	acres 12	mi^2
Location: Washington County, MD			
Twp.&Rge: Clear Spring, MD	Sec.&Qtr.: Reach 2		
Cross-Section Monuments (Lat./Long.):		Date: 4/10/18	
Observers: Team 2		Landscape Type: C-AL-AD	

Bankfull Width (W_{bkf}) The surface width of the stream at bankfull stage elevation, in a riffle section.	34	ft
Bankfull Mean Depth (d_{bkf}) Mean depth of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A_{bkf} / W_{bkf}$).	1.62	ft
Bankfull Cross-Sectional Area (A_{bkf}) Area of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	55	ft^2
Bankfull Width/Depth Ratio (W_{bkf} / d_{bkf}) *Bankfull Width* divided by *Bankfull Mean Depth*, in a riffle section.	20.99	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.	2.36	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.	88	ft
Entrenchment Ratio (ER) The *Flood-Prone Area Width* divided by *Bankfull Width* (W_{fpa} / W_{bkf}), in a riffle section.	2.59	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.	50	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.	0.008	ft/ft
Channel Sinuosity (k) An index of channel pattern determined from stream length divided by valley length (L_{st} / L_{val}), or from valley slope divided by average water surface slope (S_{val} / S).	1.67	ft/ft

Stream Type C 4/1 **See Classification Key (Figure 2)**

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Worksheet 3. Summary of Morphological Variables.

Stream: Little Conocacheague		**Location:** Washington County, MD	
Team: 2	**Date:** 4/10/18	**Drainage Area:** 12 sq. mi.	

Riffle Channel Dimensions

1. Bankfull Width (W_{bkf}) (ft)	34	2. Bankfull Mean Depth (d_{bkf}) (ft)	1.62
3. Width/Depth Ratio (W_{bkf} / d_{bkf})	20.99	4. Bankfull Cross-Sectional Area (A_{bkf}) (ft^2)	55
5. Bankfull Maximum Depth (d_{max}) (ft)	2.36	6. Width of Flood-Prone Area (W_{fpa}) (ft)	88
7. Entrenchment Ratio (ER) (W_{fpa} / W_{bkf})	2.59		

Channel Pattern / *Pattern Ratios*

8. Belt Width (W_{blt}) (ft)	Mean:	243.3	9. Meander Width Ratio (MWR) (W_{blt} / W_{bkf}) 34	Mean:	7.16
	Min:	120		Min:	3.53
	Max:	440		Max:	12.94
10. Stream Meander Length (L_m) (ft)	Mean:	242.25	11. Meander Length Ratio (MLR) (L_m / W_{bkf}) 34	Mean:	7.13
	Min:	184.5		Min:	5.43
	Max:	300		Max:	8.82
12. Linear Wavelength (λ) (ft)	Mean:	218	13. Linear Wavelength to Bankfull Width (λ / W_{bkf}) 34	Mean:	6.41
	Min:	156		Min:	4.59
	Max:	280		Max:	8.24
14. Radius of Curvature (R_c) (ft)	Mean:	75.5	15. Radius of Curvature to Bankfull Width (R_c / W_{bkf}) 34	Mean:	2.22
	Min:	72		Min:	2.12
	Max:	79		Max:	2.32

Channel Particles

Representative Pebble Count

16. D_{16} (mm)	17.5 mm	17. D_{35} (mm)	35	18. D_{50} (mm)	50
19. D_{84} (mm)	340	20. D_{95} (mm)	2500	21. D_{100} (mm)	3000

Active Bed Riffle Pebble Count

22. D_{16} (mm)	3	23. D_{35} (mm)	17	24. D_{50} (mm)	28
25. D_{84} (mm)	150	26. D_{95} (mm)	250	27. D_{100} (mm)	3000

Classification

28. Sinuosity (k)	1.67	29. Average Water Surface Slope (S)	0.008
30. Stream Type	C4/1	31. Landscape Type	C-AL-AD

Velocity & Discharge

32. Friction Factor ($\bar{u}$ / u^*)	5.55	33. Relative Roughness (R / D_{84})	1.32
34. Manning's 'n' from Friction Factor / Relative Roughness	0.03	35. Manning's 'n' from Stream Type	0.02
36. Estimated Bankfull Mean Velocity ($\bar{u}_{bkf}$) (ft/sec)	3.77	37. Estimated Bankfull Discharge (cfs)	207.35
38. Estimation Method Selected for Velocity & Discharge	Friction Factor / Relative Roughness		

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