TEAM 3

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)

Geometry & Sketch Map

Geometry Overview **A53**
Geometry Instructions **A55**
Sketch Map **A56**

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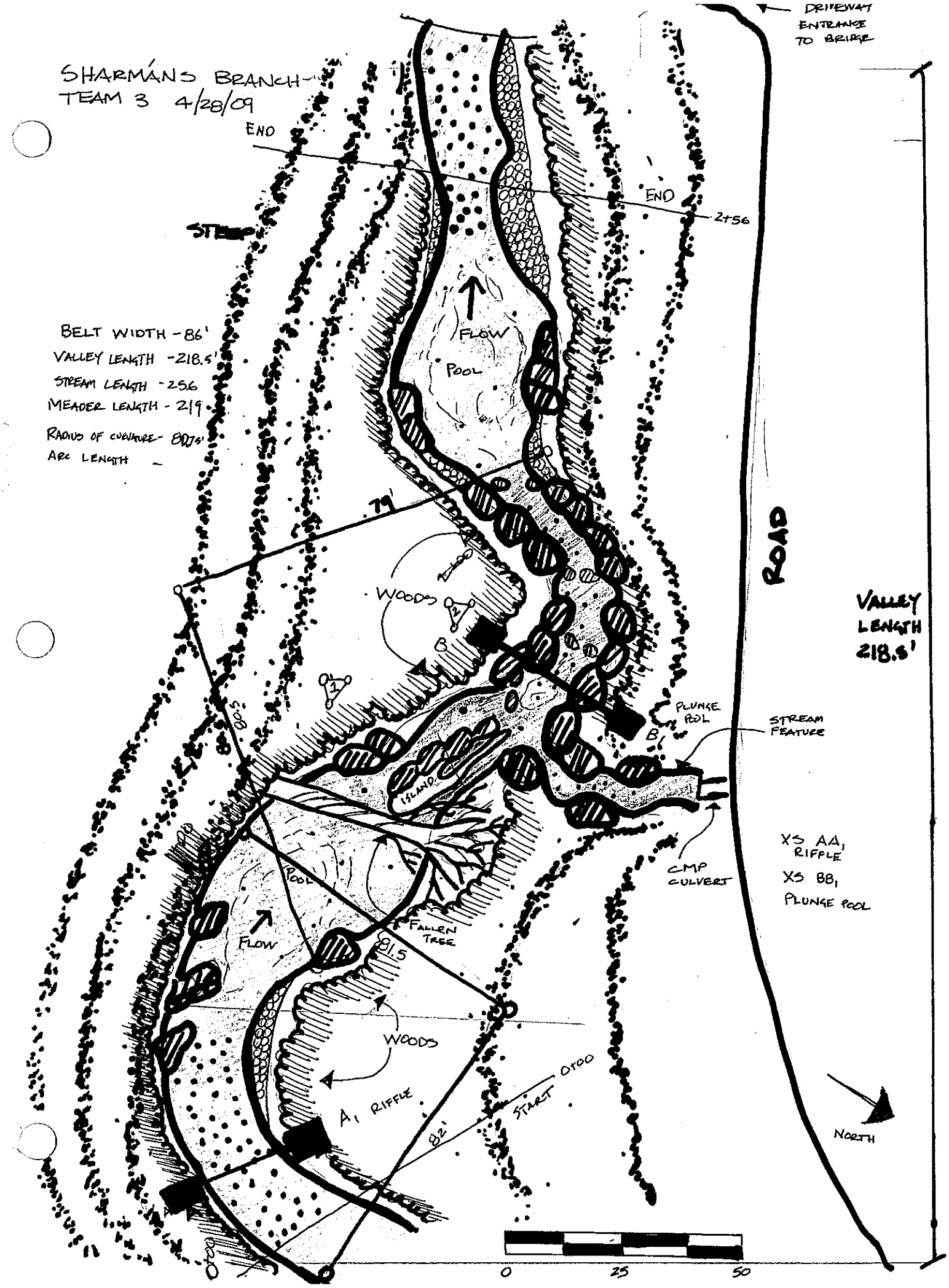
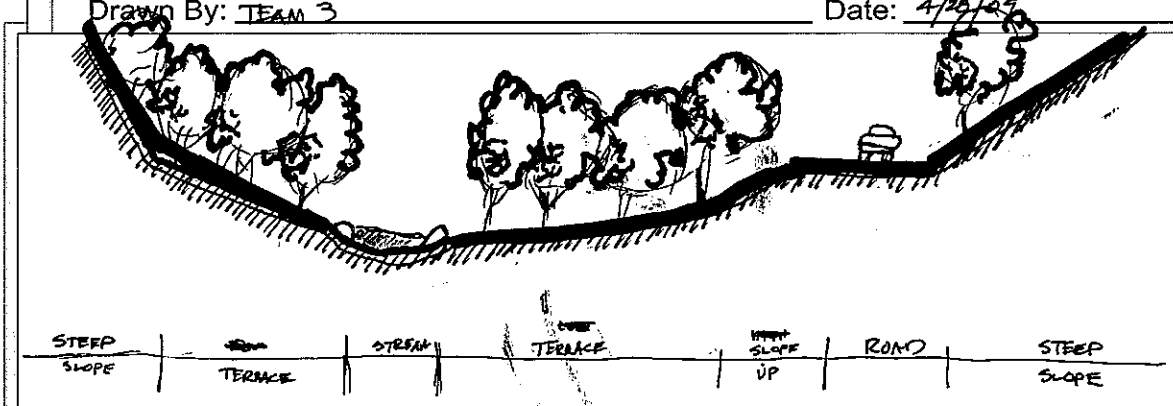

SHARMÁNS BRANCH
TEAM 3 4/28/09
DRIVEWAY ENTRANCE TO BRIDGE
END
END
2+56
STEEP
BELT WIDTH - 86'
VALLEY LENGTH - 218.5'
STREAM LENGTH - 256
MEADER LENGTH - 219
RADIUS OF CURVATURE - 80.75'
ARC LENGTH -
FLOW
POOL
79'
WOODS
B
B1
PLUNGE POOL
STREAM FEATURE
ROAD
VALLEY LENGTH 218.5'
ISLAND
XS AA1 RIFFLE
XS BB1 PLUNGE POOL
CMP CULVERT
POOL
FLOW
FALLEN TREE
81.5
WOODS
A1 RIFFLE
START
82'
NORTH
0
25
50

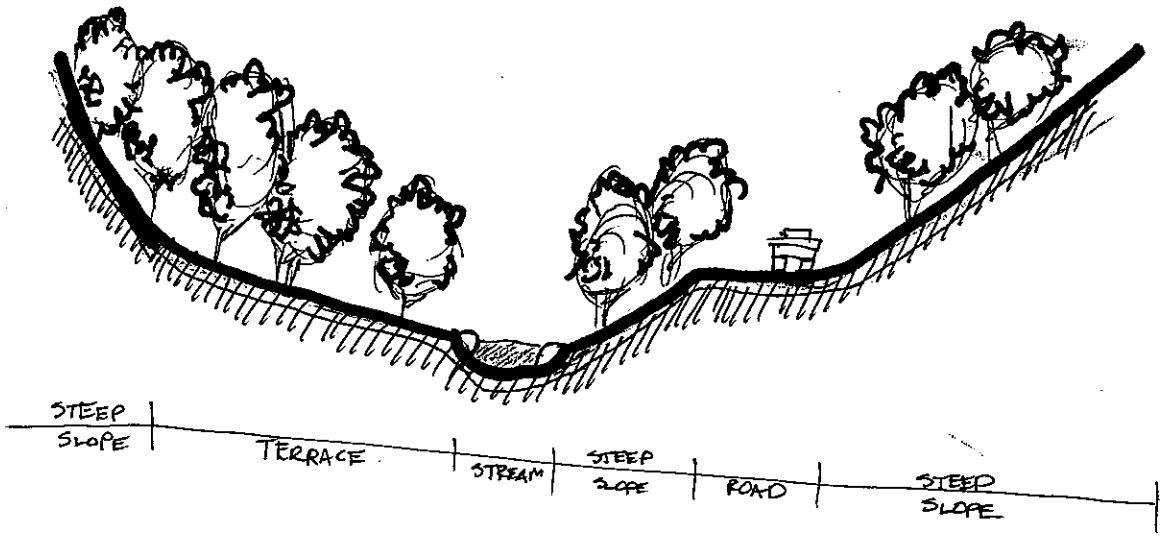
AREA-SITE LOCATION....REACH MAP

Stream: SHARMANS BRANCH Reach: 3

Drawn By: TEAM 3 Date: 4/20/09



VALLEY CROSS SECTION AT A-A,



NOT TO SCALE

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

Stream: Sharmans Branch	
Basin:	Drainage Area: 3.6 acres 3.. mi^2
Location: Wash. Co, MD	
Twp. & Rge:	Sec. & Qtr.:
Cross-Section Monuments (Lat./Long.):	Date: 04/29/09
Observers: TEAM 3	Valley Type: II

Bankfull WIDTH (W_{bkf}) WIDTH of the stream channel at bankfull stage elevation, in a riffle section.	33.4	ft
Bankfull DEPTH (d_{bkf}) Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A / W_{bkf}$).	1.50	ft
Bankfull X-Section AREA (A_{bkf}) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	50.1	ft^2
Width/Depth Ratio (W_{bkf} / d_{bkf}) Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section.	21.8	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.	2.40	ft
WIDTH of Flood-Prone Area (W_{fpa}) Twice maximum DEPTH, or ($2 \times d_{max}$) = the stage/elevation at which flood-prone area WIDTH is determined in a riffle section.	66	ft
Entrenchment Ratio (ER) The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH (W_{fpa} / W_{bkf})(riffle section).	2.0	ft/ft
Channel Materials (Particle Size Index) D_{50} The D_{50} particle size index represents the mean diameter of channel materials, as sampled from the channel surface, between the bankfull stage and Thalweg elevations.	135	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.	0.028	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).	1.17	

Stream Type B3/1 *B2/1* **See Classification Key**

42% Boulder in Reach

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

Stream: Sharmans Branch | Location: Wash. Co., MD

Observers: group 3 | Date: 4/29/09 | Valley Type: 2 | Stream Type: B3

River Reach Summary Data

Channel Dimension

Mean Riffle Depth (d_{bkf})	1.50	ft	Riffle Width (W_{bkf})	33.4	ft	Riffle Area (A_{bkf})	50.1	ft^2
Mean Pool Depth (d_{bkfp})	1.1	ft	Pool Width (W_{bkfp})	26.1	ft	Pool Area (A_{bkfp})	28.71	ft^2
Mean Pool Depth/Mean Riffle Depth	0.73	d_{bkfp}/d_{bkf}	Pool Width/Riffle Width	0.78	W_{bkfp}/W_{bkf}	Pool Area/Riffle Area	0.57	A_{bkfp}/A_{bkf}
Max Riffle Depth (d_{maxrif})	2.4	ft	Max Pool Depth (d_{maxp})	5.5	ft	Max Riffle Depth/Mean Riffle Depth	1.6	
Max Pool Depth/Mean Riffle Depth	3.67		Point Bar Slope	—	ft/ft	Inner Berm Width (W_{ib})	24.5	ft
Inner Berm Depth (d_{ib})	0.9	ft	Inner Berm Width/Depth Ratio	30.6	W_{ib}/d_{ib}	Inner Berm Area (A_{ib})	19.6	ft^2
Streamflow: Estimated Mean Velocity at Bankfull Stage (u_{bkf})			4.11	ft/s	Estimation Method	manning n-step		
Streamflow: Estimated Discharge at Bankfull Stage (Q_{bkf})			206	cfs	Drainage Area	3.6	mi^2	

Channel Pattern

Geometry	Mean	Min	Max		Dimensionless Geometry Ratios	Mean	Min	Max
Meander Wavelength (L_m)	219	—	—	ft	Meander Length Ratio (L_m/W_{bkf})	6.6	—	—
Radius of Curvature (R_c)	80.8	79.8	81.8	ft	Radius of Curvature/Riffle Width (R_c/W_{bkf})	2.4	2.39	2.45
Belt Width (W_{blt})	86	—	—	ft	Meander Width Ratio (W_{blt}/W_{bkf})	2.6	—	—
Individual Pool Length	17.1	5	35.5	ft	Pool Length/Riffle Width	0.51	0.15	1.06
Pool to Pool Spacing	40.5	18.7	79.0	ft	Pool to Pool Spacing/Riffle Width	1.21	0.56	2.37
Riffle Length	26.8	4	64	ft	Riffle Length/Riffle Width	0.80	0.12	1.92

Channel Profile

Valley Slope (VS)	0.030	ft/ft	Average Water Surface Slope (S)	0.028	ft/ft	Sinuosity (VS/S)	1.07	
Stream Length (SL)	256	ft	Valley Length (VL)	218.5	ft	Sinuosity (SL/VL)	1.17	
Low Bank Height (LBH) start	—	ft	Max Riffle Depth start		ft	Bank-Height Ratio (BHR) (LBH/Max Riffle Depth) start		
Low Bank Height (LBH) end	—	ft	Max Riffle Depth end		ft	Bank-Height Ratio (BHR) (LBH/Max Riffle Depth) end		

Facet Slopes	Mean	Min	Max		Dimensionless Slope Ratios	Mean	Min	Max
Riffle Slope (S_{rif})	0.019	0.018	0.020	ft/ft	Riffle Slope/Average Water Surface Slope (S_{rif}/S)	0.68	0.64	0.71
~~Run~~ Step Slope (S_{run})	0.28	0.13	0.52	ft/ft	~~Run~~ Step Slope/Average Water Surface Slope (S_{run}/S)	10	4.6	18.6
Pool Slope (S_p)	0.002	0.001	0.004	ft/ft	Pool Slope/Average Water Surface Slope (S_p/S)	0.09	0.04	0.14
Glide Slope (S_g)	0.0037	0.0013	.006	ft/ft	Glide Slope/Average Water Surface Slope (S_g/S)	0.13	0.05	0.21

Feature Midpoint[a]	Mean	Min	Max		Dimensionless Depth Ratios	Mean	Min	Max
Max Riffle Depth (d_{maxrif})	2.45	2.4	2.5	ft	Max Riffle Depth/Mean Riffle Depth (d_{maxrif}/d_{bkf})	1.62	1.6	1.66
Max ~~Run~~ Step Depth (d_{maxrun})				ft	Max ~~Run~~ Step Depth/Mean Riffle Depth (d_{maxrun}/d_{bkf})			
Max Pool Depth (d_{maxp})	3.5	1.9	5.5	ft	Max Pool Depth/Mean Riffle Depth (d_{maxp}/d_{bkf})	2.30	1.30	3.67
Max Glide Depth (d_{maxg})	1.7	1.5	1.9	ft	Max Glide Depth/Mean Riffle Depth (d_{maxg}/d_{bkf})	1.13	1.0	1.27

Step
min - 0.13
max - 0.19
mean - 0.16

Dimensionless
min - 4.64
max - 6.79
mean - 5.41

Riffle slopes were low due to most gradient in step reg

→ max pool depth co with step slope ind step morph

Channel Materials

	Reach[b]	Riffle[c]	Bar		Reach[b]	Riffle[c]	Bar	Protrusion Height[d]	
% Silt/Clay	0	0.9	—	D_{16}	30	0	—	28	mm
% Sand	7	11.0	—	D_{35}	85	85	—	55	mm
% Gravel	23	51.3	—	D_{50}	130	17	—	70	mm
% Cobble	33	23.5	—	D_{84}	600	140	—	180	mm
% Boulder	42	13.5	—	D_{95}	1000	150	—	275	mm
% Bedrock	2	0	—	D_{100}	2000	1250	—	375	mm

0-0.3

[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** #2

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

Location: Riffle cross section

Party / Notes: T3:11 / R0 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		6.39	106.39			
2	1.4			5.39	101	
3	2.0			5.55	100.84	
4	4.0			5.75	100.64	
5	6.0			5.85	100.54	
6	7.0			5.89	100.5	
7	8.0			5.85	100.54	
8	8.5			5.90	100.49	
9	9.0			5.98	100.41	bankfull
10	9.3			6.08	100.31	
11	9.8			6.38	100.01	
12	10.5			6.24	100.15	
13	10.6			7.0	99.39	
14	11.0			7.24	99.15	
15	11.1			7.34	99.05	
16	11.2			7.6	98.79	left bank water
17	11.3			7.85	98.54	
18	11.7			7.96	98.43	
19	12.0			8.04	98.35	
20	13.0			7.82	98.57	
21	13.5			8.02	98.37	
22	14.0			8.09	98.3	
23	14.5			7.9	98.49	
24	15.0			7.6	98.79	
25	15.4			8.05	98.34	
26	16.0			8.14	98.25	
27	16.5			8.14	98.25	
28	17.3			8.15	98.24	

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(2)

SURVEY DATA ⟹ CROSS - SECTION 2

SITE: Riffle Cross Section Date:

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES / COMMENTS / REMARKS
29	17.6			7.67	98.72	
30	18.3			7.9	98.49	
31	18.7			8.06	98.33	
32	19.1			8.06	98.33	
33	19.3			7.84	98.55	
34	19.6			7.97	98.42	
35	20.2			8.05	98.34	
36	20.3			7.68	98.71	
37	21.3			7.69	98.7	
38	21.7			8.2	98.19	
39	22.5			7.63	98.76	
40	22.8			8.13	98.26	
41	24.0			7.94	98.42	
42	25.0			7.74	98.65	
43	25.6			7.53	98.86	
44	26.0			7.9	98.49	
45	27.0			7.95	98.44	
46	27.5			7.84	98.55	
47	28.0			7.9	98.49	
48	28.5			7.83	98.56	
49	29.0			7.78	98.61	
50	29.5			7.89	98.5	
51	30.0			7.78	98.61	
52	30.5			7.85	98.54	
53	31.			7.75	98.64	
54	31.6			7.58	98.81	Rt bank water
55	32.			7.36	99.03	
56	33.0			7.25	99.14	
57	34.0			7.2	99.19	
58	35.			7.11	99.25	
59	36.			6.79	99.6	

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(3)

SURVEY DATA ⟹ CROSS - SECTION 2

SITE: Riffle Cross Section. Date:

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES / COMMENTS / REMARKS
29	36.8			6.65	95.74	
30	42.4			4.88	101.51	
31	44.0			4.78	101.61	
32	46.0			4.6	101.79	
33	48.0			4.42	101.97	
34	50.			4.41	101.98	
35	52.0			4.41	101.88	
36	54.			4.54	101.85	
37	56			4.64	101.75	
38	58			4.6	101.79	
39	60			4.5	101.89	
40	62			4.24	102.15	
41	69.8			2.2.	104.19	
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						

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SURVEY DATA ⟶ CROSS - SECTION 1

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

Location: Pool cross section

Party / Notes: B.H/Bo 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	0	10.72	102.03	3.82	98.21	
2	3.0			3.89	98,14	
3	6.0			4.20	97.83	
4	9.0			4.41	97.62	
5	12.0			4.59	97.44	
6	14.0			4.79	97.24	
7	16.0			5.0	97.03	
8	17.0			5.0	97,03	
9	18.0			5.98	96.05	
10	20.0			6.5	95.53	
11	22.0			7.15	94.88	
12	24.0			7.48	94.55	
13	25.0			7.77	94.26	Left Bankfull
14	26.0			8.04	93.99	179.3 long pro
15	27.0			8.33	93.7	
16	27.8			8.72	93.31	lt bank water
17	28.9			9.04	92.99	
18	29.6			9.27	92.76	
19	31.0			9.49	92.54	
20	32.8			9.33	92.6	
21	34.1			9.52	92.57	
22	35.7			9.54	92.49	
23	37.5			9.55	92.48	
24	38.3			9.4	92.63	
25	38.5			9.05	92.98	
26	39.2			9.28	92.75	
27	39.5			8.98	93,05	
28	39.9			9.24	92.79	

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SURVEY DATA ⟹ **CROSS - SECTION 1**

SITE: Sherman's Creek Date: 4/28/09

Location: Pool Cross Section

Party / Notes: Bill/Bo 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	40.6	10.72	102.03	9.22	92.81	
2	41.5			9.37	92.66	
3	42.1			9.26	92.77	
4	43.0			9.14	92.89	
5	43.6			8.83	93.2	Rt. bank water
6	44.8			8.4	93.63	
7	46.0			7.9	94.13	
8	46.9			7.77	94.26	Rt. Bankfull
9	48.			7.84	94.19	Rt bankfull ?
10	50			7.82	94.21	
11	51.6			7.75	94.28	
12	53.6			6.35	95.69	boulder
13	60.			2.8	99.23	boulder
14						
15						
16						
17						
18						
19						
20						
21						
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23						
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25						
26						
27						
28						

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SURVEY DATA → LONGITUDINAL PROFILE 1

SITE: SHARMANS CREEK Date: 4/28/09

Location: MARYLAND

Party / Notes: GROUP 3/SUNNY/90° 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		6.39	106.39		100							
2	0+00			8.25	98.14							START
3	0+02			8.00	98.0	7.34	99.05	5.70	100.69			Head Riffle
4	0+21.3					7.6	98.79	5.85	100.54			X/S 1
5	0+59.3			9.20	97.19	8.56	97.83	weak indicators				Mid-Riffle
6	0+66			9.32	97.07	8.61	97.78	6.81	99.58			Head Run
7	0+75.5			10.06	96.33	8.85	97.54	7.07	99.32			Head Pool
8	0+81			Dmax 10.11	96.28	8.85	97.54	7.12	99.27			mid-Pool
9	1+11			9.75	96.64	8.89	97.5	weak indicators				End Pool/ u/send log
10	1+12			7.87	98.52							Top log
11	1+16			10.52	95.87	9.23	97.16					DS log-Pool
12	1+22			10.07	96.32	9.30	97.09					start shute
13	1+28.5			12.17	94.22	10.83	95.56					scour hole @ DSL
14	1+32			11.10	95.29	10.93	95.46					start run
15	1+54.5			12.34	94.05	10.94	95.45					Beg Pool/ END RUN
16	1+59			Dmax 12.56	93.83	10.95	95.44					Pool max
17	1+64			11.72	94.67	11.10	95.29					Top Rif
18	1+68			11.76	94.63	11.51	94.88					step
19	1+69			12.67	93.72	12.03	94.36					plunge pool
20	1+70		102.03	8.03	94.00	7.77	94.26					step
21	1+78.3			9.65	92.38	8.64	93.19					top pool
22	1+79.3			9.60	92.43							X sec (Pool) Tw
23	1+85			9.78	92.25	8.83	93.2					step
24	1+91			11.86	90.17	9.99	92.04					Top chute
25	1+93			10.96	91.07							mid chute
26	1+97			11.46	90.57	9.92	92.11					end chute Top pool
27	1+99			11.73	90.30							max pool

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7.15 / 254 = 0.028

7.92 / 268.5 = 0.029

SURVEY DATA → LONGITUDINAL PROFILE 2

SITE: SHAMAN BRANCH Date: 4/28/09

Location: WASH. CO., MD

Party / Notes: TEAM 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	2+02			10.99	91.04							Top Glide
29	2+03.5			10.95	91.08	9.95	92.08	8.37	93.66			Top Rif
30	2+16			11.58	90.45	10.07	91.96					End Rif/ Top Pool
31	2+22.5			may duplic 11.56	90.47							Pool
32	2+45			10.68	91.35	10.18	91.85					Beg Glide
33	2+56			10.76	91.40	10.13	91.90					Top Rif
34	2+70.5			11.12	90.91	10.60	91.43	9.26	92.77			mid Rif
35												
36												
37												
38												
39												
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50												
51												
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53												
54												

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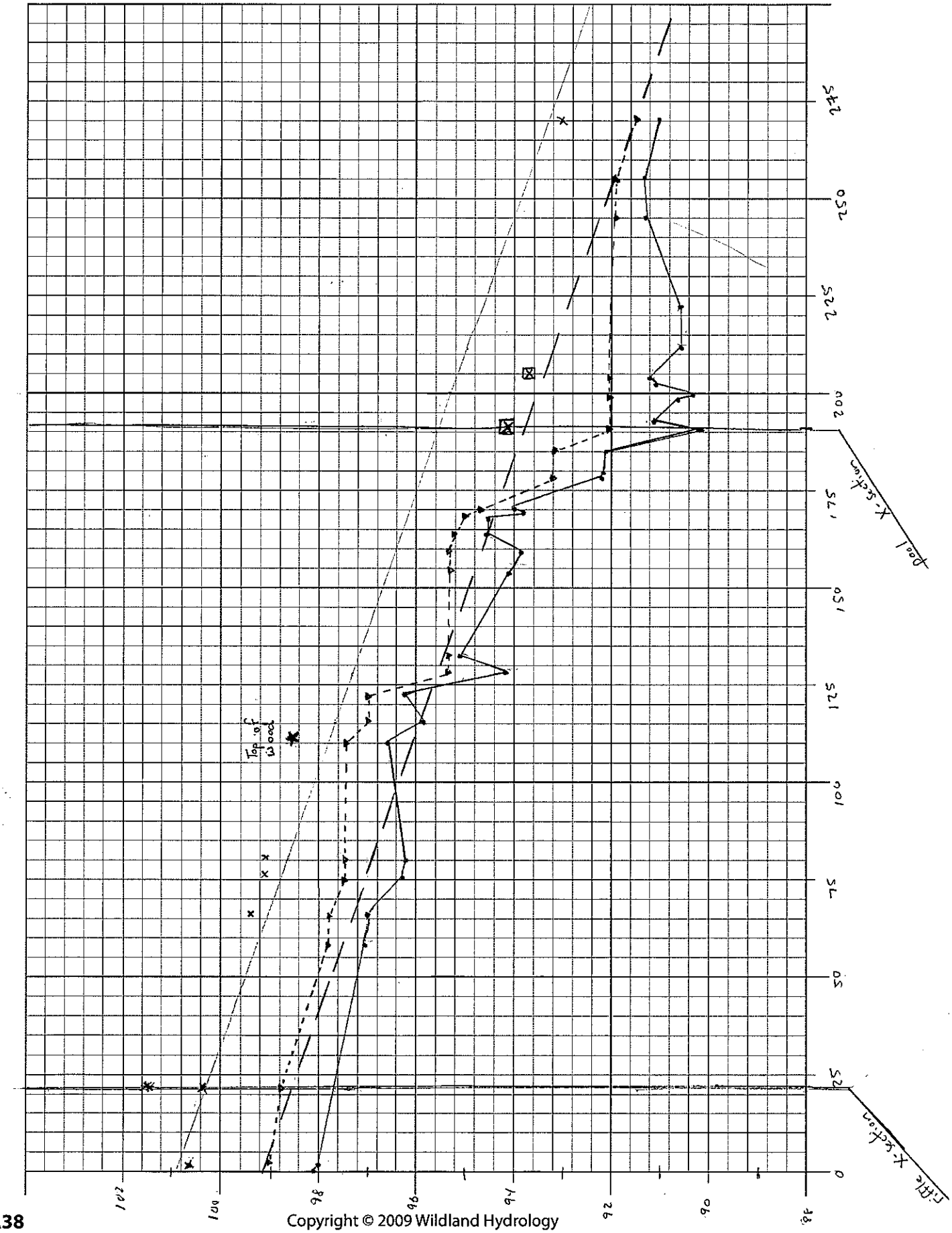
SHAMANS BRANCH
PROFILE
4/28/09
GROUP 3



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

Bankfull VELOCITY / DISCHARGE Estimates

Site:	SHARMANS BRANCH	Location:	Wash. Co., MD
Date:	4/28	Stream Type:	B3/1
Valley Type:	II		
Observers:	TEAM 3	HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Cross-sectional AREA	50.1	A_{bkf} (ft^2)	Bankfull Mean DEPTH	1.5	d_{bkf} (ft)
Bankfull WIDTH	1.5	W_{bkf} (ft)	Wetted PERIMETER ~ $2 * d_{bkf} + W_{bkf}$	36.4	W_p (ft)
D_{84} @ Riffle	120	Dia. (mm)	D_{84} mm / 304.8 =	0.3937	D_{84} (ft)
Bankfull SLOPE	2.8	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.38	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R (ft) / D_{84} (ft)	3.5*	0
Drainage AREA	3.6	DA (mi^2)	Shear Velocity $u^* = \sqrt{gRS}$	1.12	u^* (ft / sec)

*See attach

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE		
1. Friction Factor / Relative Roughness $u = [2.83 + 5.66 \text{ Log}\{R/D_{84}\}]u^*$ D84 RIFFLE	6.28	ft / sec	314.6	cfs	
2. Roughness Coefficient: a) Manning's 'n' from friction factor / relative roughness $u = 1.4865 * R^{2/3} * S^{1/2} / n$ n = .045	5.24	ft / sec	262	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 = 0.095 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.	3.25	ft / sec	162.8	cfs	
2. Roughness Coefficient: $u = 1.4865 * R^{2/3} * S^{1/2} / n$ c) Manning's 'n' from Stream Type n = 0.075	4.11	ft / sec	206	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	3.59	ft / sec	180	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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* Attachment to Worksheet A-2
Relative Roughness & Velocity Calcs.

d84 protrus

(2) relative roughness (D_{84} reach)

d84 reach = 600 converted to feet = 1.968

relative roughness = $R_{ft} / D_{84\,ft}$ = 1.38 / 1.968 = (0.070)

friction factor / rel. roughness =

$v = [2.83 + 5.66 \text{ Log } \{1.38/1.968\}] \times 1.12 =$ 1.85 ft/sec

~ 92.7 cfs × 50.1

(3) relative roughness (D_{50} reach)

d50 reach = 135 converted to feet = 0.4429

relative roughness = $R_{ft} / D_{50\,ft}$ = 1.38 / 0.4429 = (3.12)

friction factor / rel. roughness =

$v = [2.83 + 5.66 \text{ Log } \{1.38/0.4429\}] \times 1.12 =$ 5.96 ft/sec

~ 298.6 cfs × 50.1

(4) relative roughness (D_{50} riffle)

d50 riffle = 120 converted to feet = 0.3937

relative roughness = $R_{ft} / D_{84\,ft}$ = 1.38 / 0.3937 = (3.51)

friction factor / rel. roughness =

$v = [2.83 + 5.66 \text{ Log } \{1.38/0.3937\}] \times 1.12 =$ 6.28 ft/sec

~ 314.6 cfs × 50.1

(5) relative roughness (D_{84} protrusion)

d84 protrus = 175 converted to feet = 0.5741

relative roughness = $R_{ft} / D_{84\,prot}$ = 1.38 / 0.5741 = (2.401)

friction factor / rel. roughness =

$v = [2.83 + 5.66 \text{ Log } \{1.38/0.5741\}] \times 1.12 =$ 5.24 ft/sec

~ 262.5 cfs × 50.1

(6) relative roughness (D_{50} protrusion)

d50 protrus = 70 converted to feet = 0.2297

rel. roughness = $R_{ft} / D_{84\,prot}$ = 1.38 / 0.2297 = (6.0)

friction factor / rel. roughness

$v = [2.83 + 5.66 \text{ Log } \{1.38/0.2297\}] \times 1.12 =$ 7.77 ft/sec

~ 389.3 cfs × 50.1

Site: Reach - Sharman Cr Date: 4/28/09

Location: HUC:

Party: Tracy + Pavel

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	SAND												
	Medium	.25 - .50	SAND												
	Coarse	.50 - 1.0	SAND												
.04 - .08	Very Coarse	1.0 - 2	SAND												
.08 - .16	Very Fine	2 - 4	GRAVEL				1	1.4	1.4	2	6.7	6.7	3	3	3
.16 - .22	Fine	4 - 5.7	GRAVEL				1	1.4	2.8				1	1	4
.22 - .31	Fine	5.7 - 8	GRAVEL	//						1	3.3	10	1	1	5
.31 - .44	Medium	8 - 11.3	GRAVEL							1	3.3	13.3	1	1	6
.44 - .63	Medium	11.3 - 16	GRAVEL				1	1.4	4.2	1	3.3	16.6	2	2	8
.63 - .89	Coarse	16 - 22.6	GRAVEL				2	2.8	7				2	2	10
.89 - 1.3	Coarse	22.6 - 32	GRAVEL				4	5.7	12.7				4	4	14
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL				6	8.6	21.3	1	3.3	19.9	7	7	21
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL			2+1	2	2.8	24.1				2	2	23
2.5 - 3.5	Small	64 - 90	COBBLE				5	7.1	31.2				5	5	28
3.5 - 5.0	Small	90 - 128	COBBLE		1		10	14.3	45.5	2	6.7	26.6	12	12	40
5.0 - 7.1	Large	128 - 180	COBBLE				3	4.3	49.8	5	16.7	43.3	8	8	48
7.1 - 10.1	Large	180 - 256	COBBLE			1	7	10	59.8	1	3.3	46.6	8	8	56
10.1 - 14.3	Small	256 - 362	BOULDER				8	11.4	71.2	1	3.3	49.9	9	9	65
14.3 - 20	Small	362 - 512	BOULDER				1	1.4	72.6				1	1	66
20 - 40	Medium	512 - 1024	BOULDER				9	12.9	85.5	7	23.3	73.2	16	16	82
40 - 80	Large-Vry Large	1024 - 2048	BOULDER				10	14.3	99.8	6	20.0	93.2	16	16	98
	Bedrock		BDRK							2	6.7	99.9	2	2	100
Stream Type:				**Valley Type:**		TOTAL→	70			30			100		

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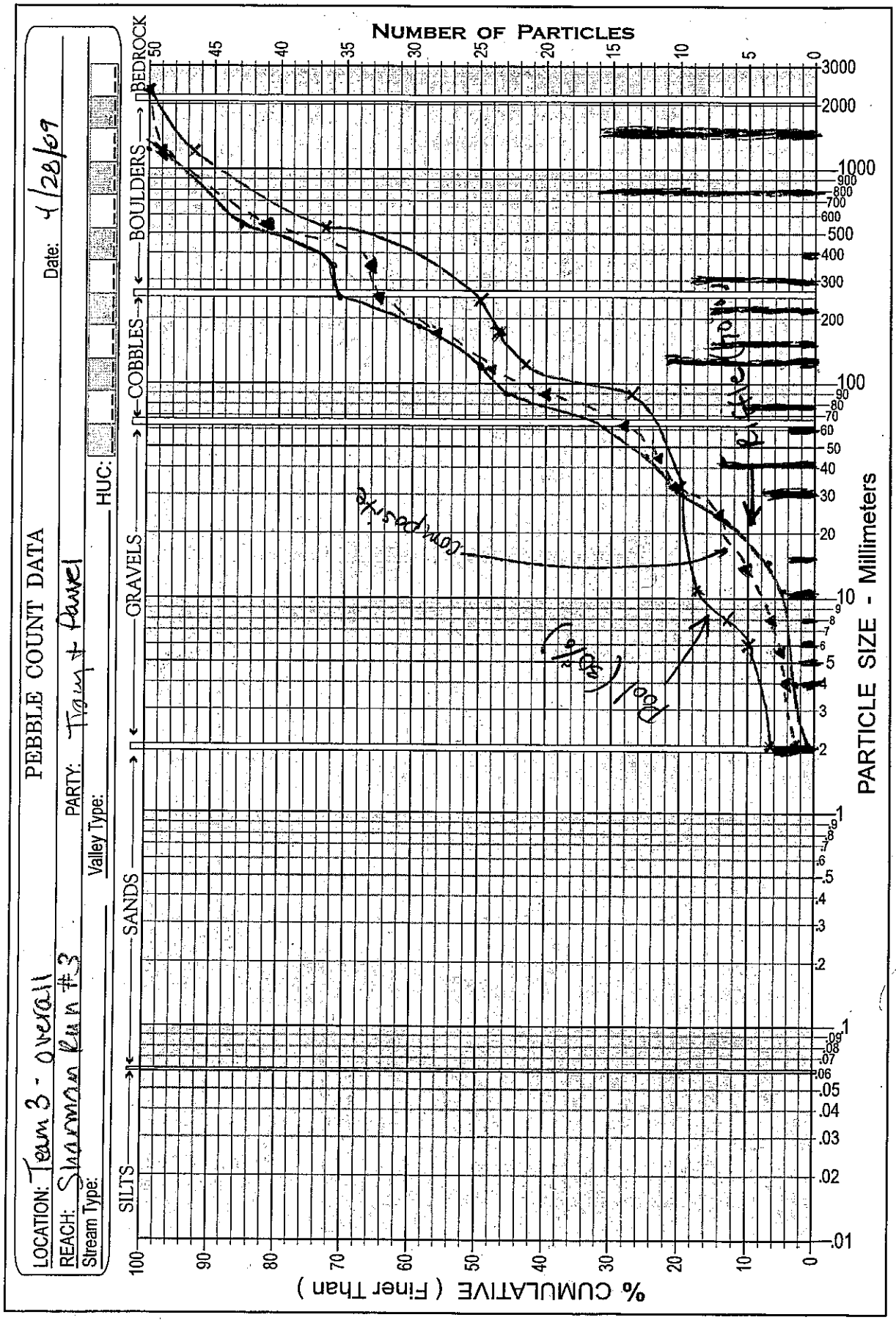

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XSECTION | PROTRUSION

Site: SHARMAN RUN Date: 4/28/09

Location: TEAM 3 HUC: _____

Party: TRACY, PAWEL

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) TOT #	RIFFLE (1) ITEM %	RIFFLE (1) % CUM	~~POOL~~ (2) TOT #	~~POOL~~ (2) ITEM %	~~POOL~~ (2) % CUM	COMPOSITE (3) TOT #	COMPOSITE (3) ITEM %	COMPOSITE (3) % CUM
							Reach:			Reach:			Reach:		
							Date:			Date:			Date:		
	Silt / Clay	< .062	S/C				4	2.9	2.9						
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25													
	Medium	.25 - .50					5	3.6	6.5						
	Coarse	.50 - 1.0					1	0.7	7.2						
.04 - .08	Very Coarse	1.0 - 2				11.5	6	4.3	11.5						
.08 - .16	Very Fine	2 - 4	GRAVEL				9	6.4	17.9						
.16 - .22	Fine	4 - 5.7					10	7.1	25						
.22 - .31	Fine	5.7 - 8					9	6.4	31.4						
.31 - .44	Medium	8 - 11.3					3	2.1	33.5						
.44 - .63	Medium	11.3 - 16					10	7.1	40.6						
.63 - .89	Coarse	16 - 22.6					11	7.9	48.5	2	1.8	1.8			
.89 - 1.3	Coarse	22.6 - 32					8	5.7	54.2						
1.3 - 1.8	Very Coarse	32 - 45					7	5.0	59.2	9	8.0	9.8			
1.8 - 2.5	Very Coarse	45 - 64				51.3	5	3.6	62.8	22	19.5	29.3			
2.5 - 3.5	Small	64 - 90	COBBLE				10	7.1	69.9	21	18.6	47.9			
3.5 - 5.0	Small	90 - 128					8	5.7	75.6	22	19.5	67.4			
5.0 - 7.1	Large	128 - 180					10	7.1	82.7	10	8.8	76.1			
7.1 - 10.1	Large	180 - 256					5	3.6	86.3	8	7.1	83.3			
10.1 - 14.3	Small	256 - 362	BOULDER				3	2.1	88.4	16	14.2	97.4			
14.3 - 20	Small	362 - 512					3	2.1	90.5	3	2.7	100			
20 - 40	Medium	512 - 1024					4	2.9	93.4						
40 - 80	Large-Vry Large	1024 - 2048					9	6.4	99.8						
	Bedrock		BDRK												
Stream Type:			***Valley Type:***			TOTAL→	140		100	113		100			

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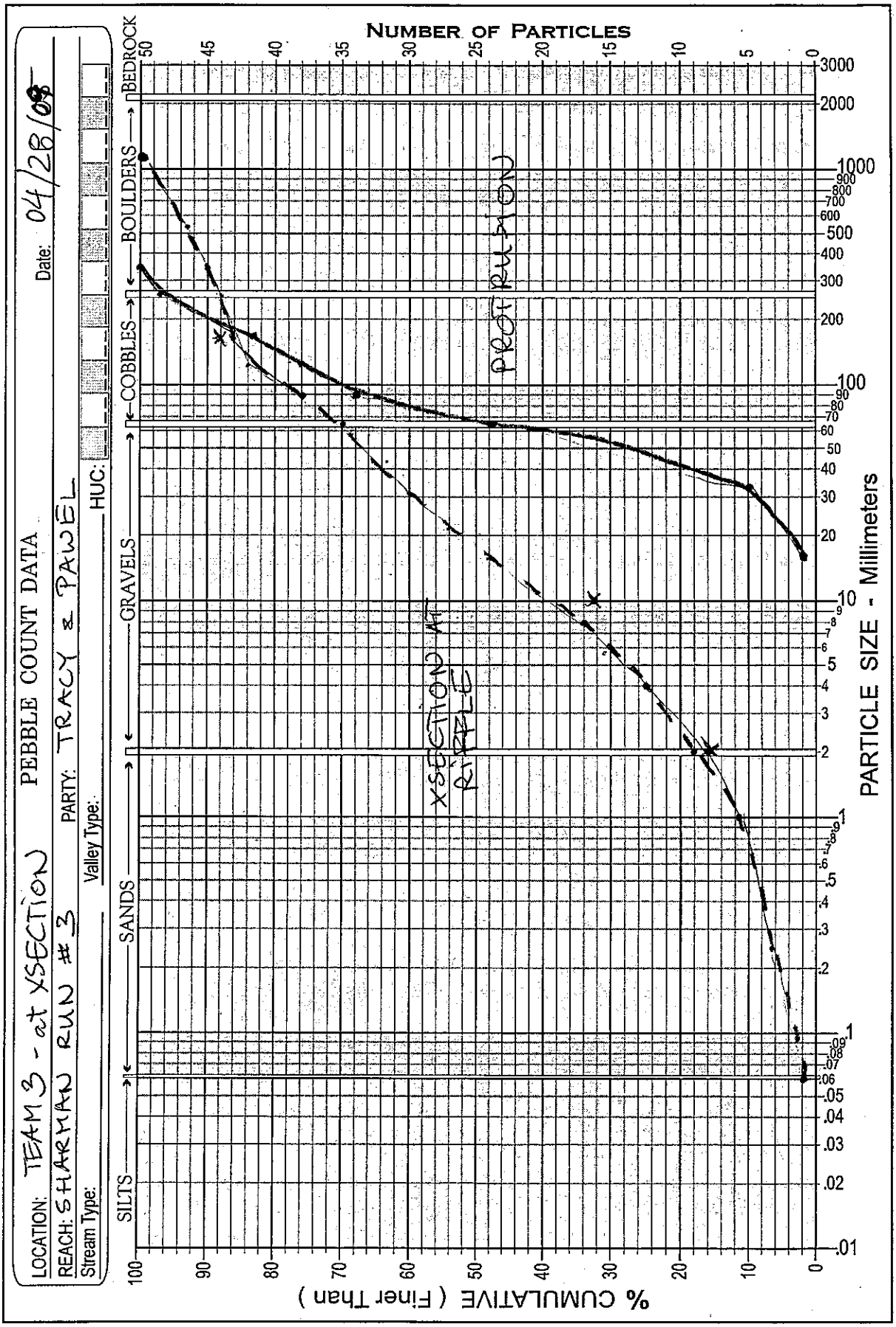

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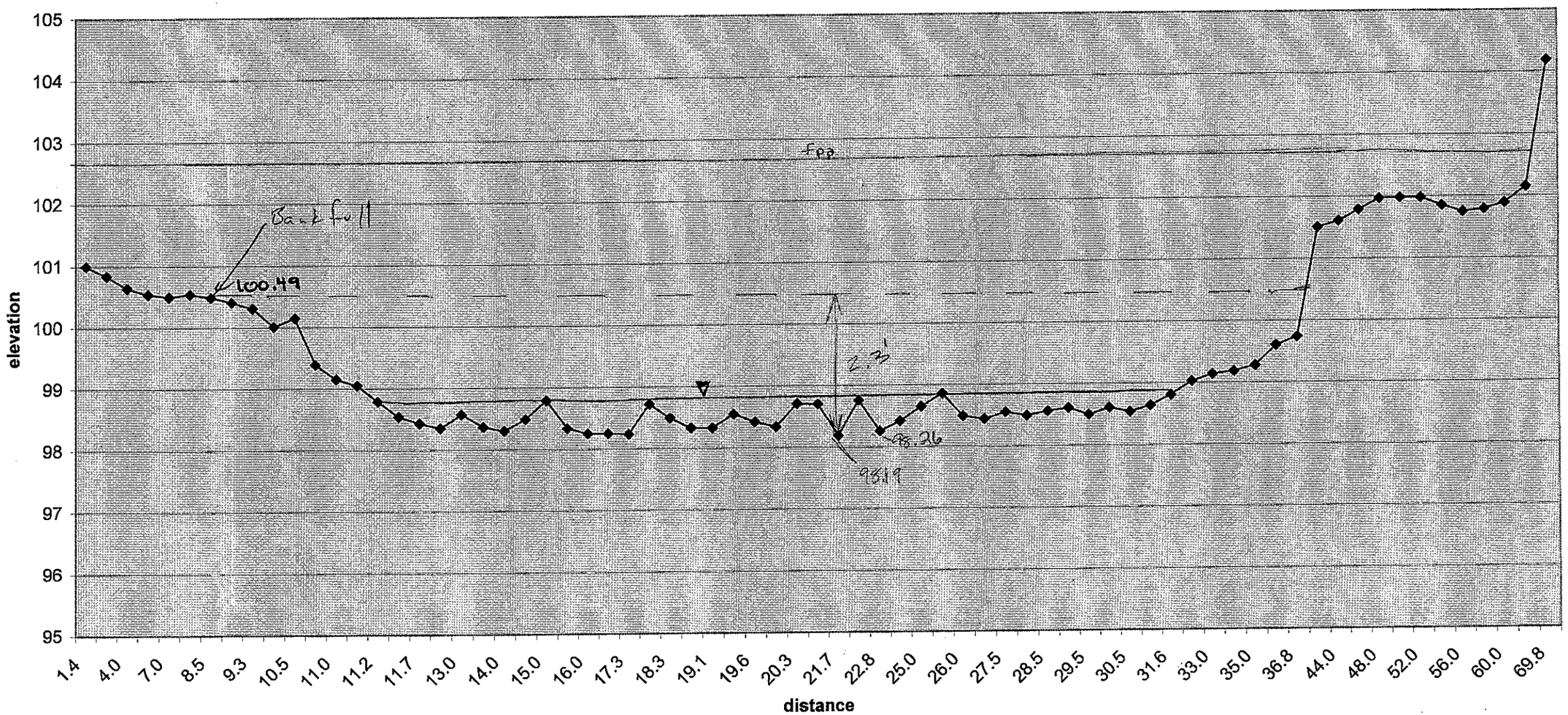
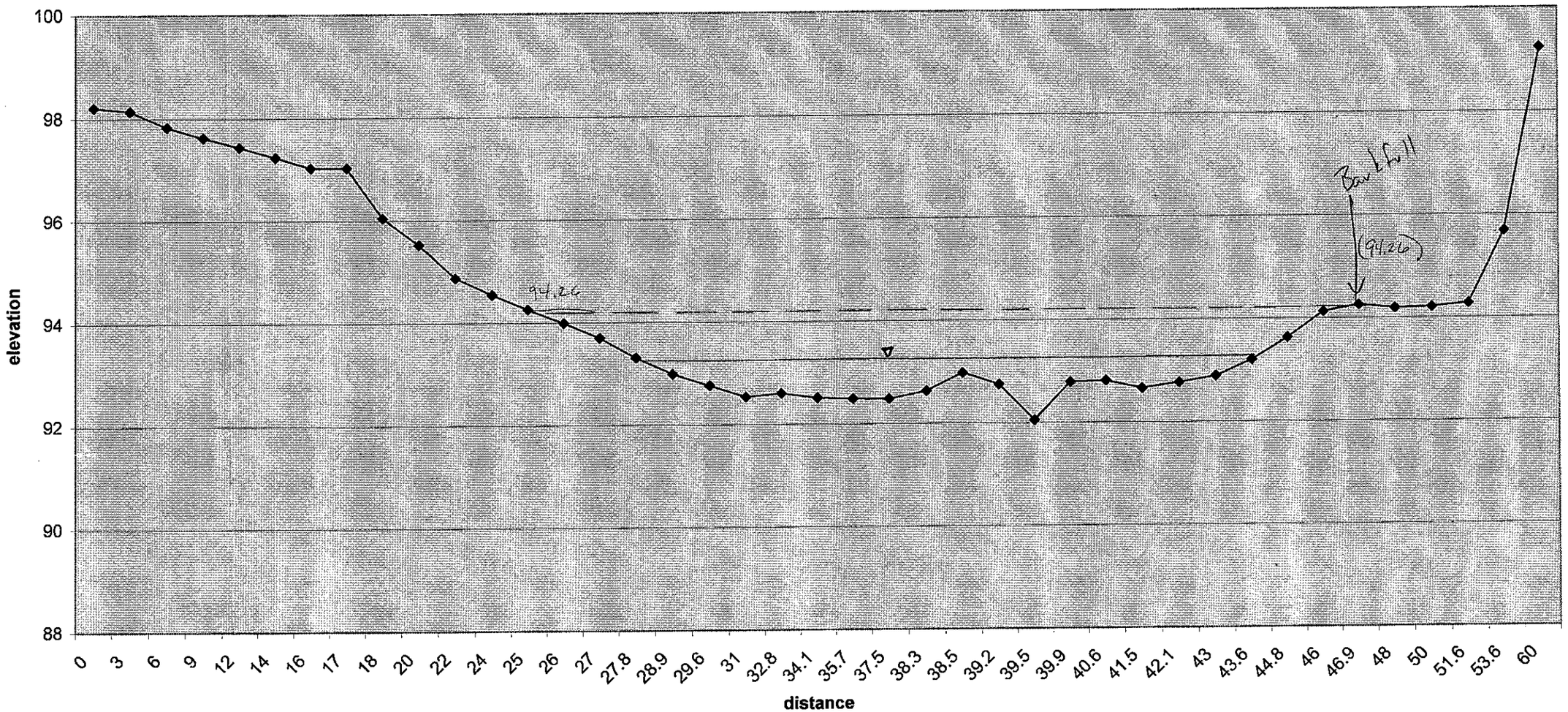
Riffle Cross Section



ht_{iberm} = 99.2 − 98.4 = .8
99.2 − 98.2 = 1
99.2 − 98.6 = .6
ave .8 ft

w_{iberm} = 11 − 35.5 = 24.5 ft

$area_{iberm}$ = .8 × 24.5 = 19.6 ft^2

Pool Cross Section