XSEC

0+04 Riffle (1)

0+69 Pool (3)

0+36 Glide (2)

0+91 Glide (4)

1+08 Riffle (5)

1+54 Run (6)

1+71 Run (7)

1+87 Pool (8)

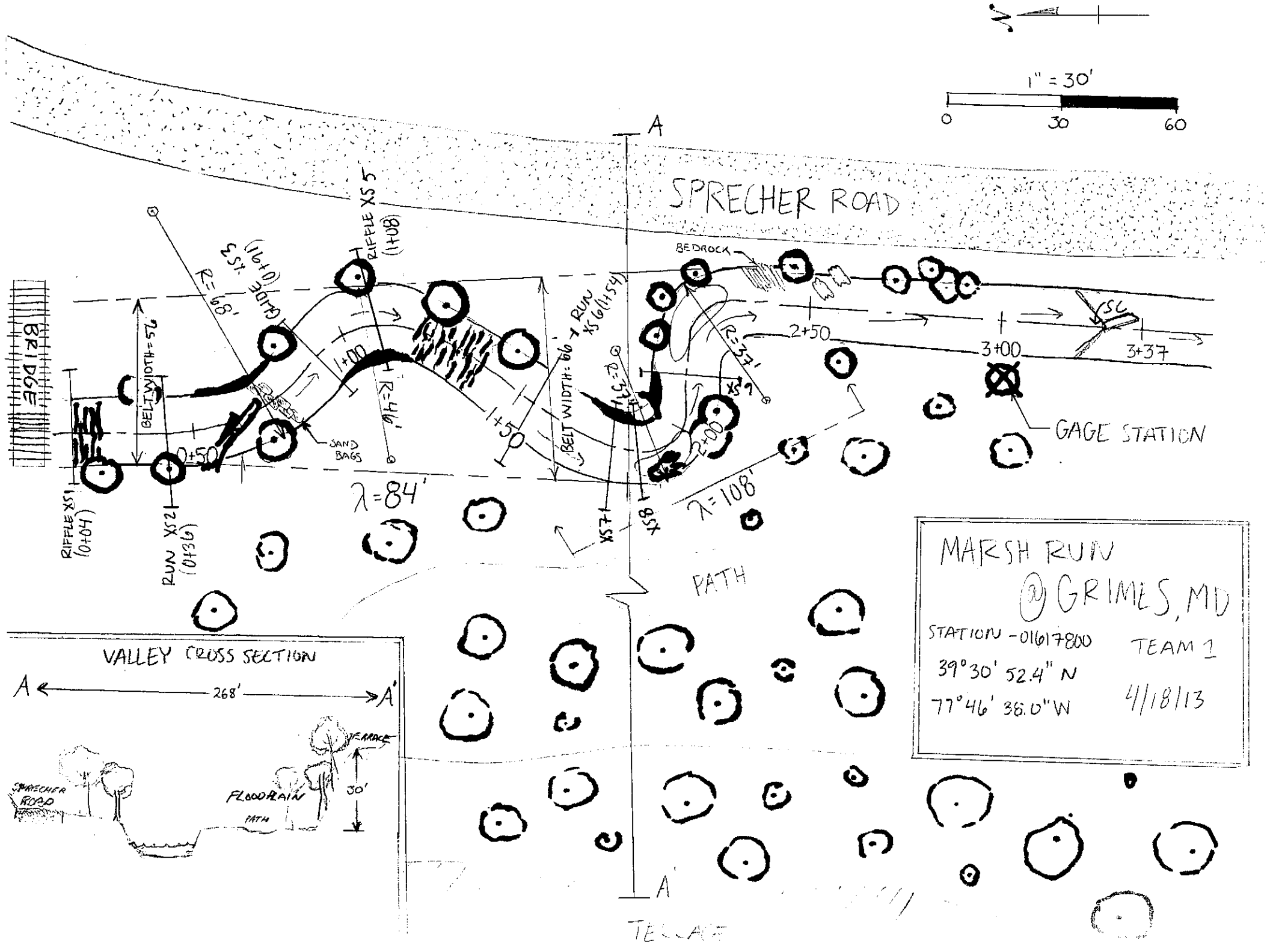
2+14 Glide (9)

VL = 285'

SL = 337'

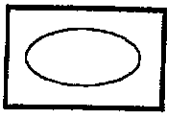
K = 1.18

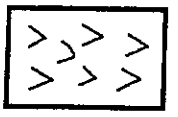
Super critical flow



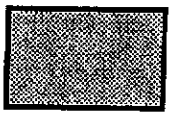
1" = 30'
0
30
60
A
SPRECHER ROAD
BEDROCK
RIFFLE XS 5 (1+08)
GLIDE XS 3 (0+91)
R=68'
BELT WIDTH=56'
BRIDGE
1+00
R=46'
1+50
BELT WIDTH: 66' RUN XS 6 (1+54)
R=37'
R=37'
XS 9
2+50
3+00
3+37
SC
GAGE STATION
0+50
SAND BAGS
λ=84'
λ=108'
RIFFLE XS 1 (0+04)
RUN XS 2 (0+36)
XS 7
XS 8
PATH
MARSH RUN
@ GRIMES, MD
STATION - 01617800
TEAM 1
39°30' 52.4" N
77°46' 38.0" W
4/18/13
VALLEY CROSS SECTION
A
268'
A'
TERRACE
SPRECHER ROAD
FLOODPLAIN
PATH
30'
A'
TERRACE

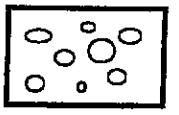
Geomorphic Map Symbols Key


Pool


Riffle

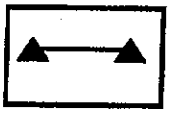
Run

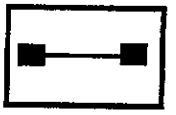

Sand


Gravel

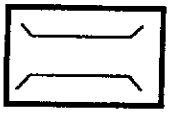
Boulder

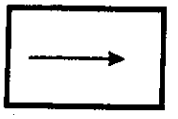
Bedrock


Baltimore City Cross Section


U.S. Fish and Wildlife Service Cross Section

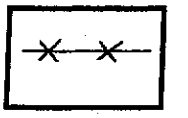
Building

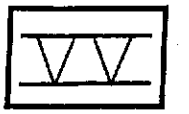

Bridge Crossing

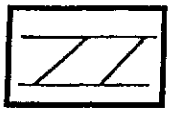

Flow Direction

Fallen Tree

Utility Crossing


Fence


Raw Steep Bank


Stable Sloped Bank
(angle of line represents angle of bank)

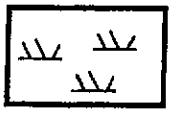
Camera Shot

Outfall

Individual Tree

Group of Trees

Herbaceous


Wetland

Project Reach Limits

Worksheet 5-4. Morphological relations, including dimensionless ratios of river reach sites (Rosgen and Silvey, 2007; Rosgen, 2008).

Stream: **MarshRun**		Location: **Reach 1**	
Observers: **Team 1**	Date: **04/18/13**	Valley Type: **VIII c**	Stream Type: **F 1**

River Reach Summary Data.....2

Hydraulics

Streamflow: Estimated Mean Velocity at Bankfull Stage (u_{bkf})	3.592	ft/sec	Estimation Method	Mannings
Streamflow: Estimated Discharge at Bankfull Stage (Q_{bkf})	104.815	cfs	Drainage Area	18.9 mi^2

Channel Pattern

Geometry	Mean	Min	Max		Dimensionless Geometry Ratios	Mean	Min	Max
Linear Wavelength (λ)	96	84	108	ft	Linear Wavelength to Riffle Width (λ / W_{bkf})	4.025	3.522	4.528
Stream Meander Length (L_m)	117	109	124	ft	Stream Meander Length Ratio (L_m / W_{bkf})	4.906	4.570	5.199
Radius of Curvature (R_c)	38	37	68	ft	Radius of Curvature to Riffle Width (R_c / W_{bkf})	1.593	1.551	2.851
Belt Width (W_{blt})	62	56	66	ft	Meander Width Ratio (W_{blt} / W_{bkf})	2.600	2.348	2.767
Arc Length (L_a)	51	42	64	ft	Arc Length to Riffle Width (L_a / W_{bkf})	2.138	1.761	2.683
Riffle Length (L_r)	32.8	27.7	37.9	ft	Riffle Length to Riffle Width (L_r / W_{bkf})	1.375	1.159	1.590
Individual Pool Length (L_p)	55.8	25	88.7	ft	Individual Pool Length to Riffle Width (L_p / W_{bkf})	2.340	1.049	3.720
Pool to Pool Spacing (P_s)	121	121	121	ft	Pool to Pool Spacing to Riffle Width (P_s / W_{bkf})	5.078	5.078	5.078

Channel Profile

Valley Slope (S_{val})	0.0055	ft/ft	Average Water Surface Slope (S)	0.00467	ft/ft	Sinuosity (S_{val} / S) 1.18
Stream Length (SL)	337	ft	Valley Length (VL)	285	ft	Sinuosity (SL / VL) 1.1825

Low Bank Height (LBH)	start	3.34	ft	Max Depth (d_{max})	start	0.76	ft	Bank-Height Ratio (BHR) (LBH / d_{max}) start 4.3947
	end	2.14	ft		end	0.35	ft	end 6.1143

Facet Slopes	Mean	Min	Max		Dimensionless Facet Slope Ratios	Mean	Min	Max
Riffle Slope (S_{rif})	0.034	0.005	0.077	ft/ft	Riffle Slope to Average Water Surface Slope (S_{rif} / S)	7.310	1.081	16.544
Run Slope (S_{run})	0.002	0.001	0.002	ft/ft	Run Slope to Average Water Surface Slope (S_{run} / S)	0.323	0.266	0.373
Pool Slope (S_p)	0.001	0.000	0.002	ft/ft	Pool Slope to Average Water Surface Slope (S_p / S)	0.126	0.021	0.332
Glide Slope (S_g)	0.004	0.003	0.006	ft/ft	Glide Slope to Average Water Surface Slope (S_g / S)	0.953	0.555	1.373
Step Slope (S_s)	0.000	0.000	0.000	ft/ft	Step Slope to Average Water Surface Slope (S_s / S)	0.000	0.000	0.000

Max Depths[a]	Mean	Min	Max		Dimensionless Depth Ratios	Mean	Min	Max
Max Riffle Depth (d_{maxrif})	1.82	1.73	1.9	ft	Max Riffle Depth to Mean Riffle Depth (d_{maxrif} / d_{bkf})	1.24	1.177	1.2925
Max Run Depth (d_{maxrun})	1.94	1.83	2.04	ft	Max Run Depth to Mean Riffle Depth (d_{maxrun} / d_{bkf})	1.32	1.245	1.3878
Max Pool Depth (d_{maxp})	3.47	2.62	4.47	ft	Max Pool Depth to Mean Riffle Depth (d_{maxp} / d_{bkf})	2.36	1.782	3.0408
Max Glide Depth (d_{maxg})	1.51	1.4	1.69	ft	Max Glide Depth to Mean Riffle Depth (d_{maxg} / d_{bkf})	1.03	0.952	1.1497
Max Step Depth (d_{maxs})	0	0	0	ft	Max Step Depth to Mean Riffle Depth (d_{maxs} / d_{bkf})	0	0	0

Channel Materials

	Reach[b]	Riffle[c]	Bar		Reach[b]	Riffle[c]	Bar	Protrusion Height[d]
% Silt/Clay	9			D_{16}	0.58			26.52 mm
% Sand	13			D_{35}	326.67			46.23 mm
% Gravel	5			D_{50}	Bedrock			55.42 mm
% Cobble	6			D_{84}	Bedrock			90 mm
% Boulder	4			D_{95}	Bedrock			162.67 mm
% Bedrock	63			D_{100}	Bedrock			256 mm

[a] Min, max & mean depths are measured from Thalweg to bankfull at mid-point of feature for riffles and runs, 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 5-4. Morphological relations, including dimensionless ratios of river reach sites (Rosgen and Silvey, 2007; Rosgen, 2008).

Stream: **MarshRun** Location: **Reach 1**

Observers: **Team 1** Date: **04/18/13** Valley Type: **VIII c** Stream Type: **F 1**

River Reach Dimension Summary Data.....1

Riffle Dimensions*, **, *

Riffle Dimensions*, **, ***	Mean	Min	Max		Riffle Dimensions & Dimensionless Ratios****	Mean	Min	Max
Riffle Width (W_{bkf})	23.9	21.3	26.4	ft	Riffle Cross-Sectional Area (A_{bkf}) (ft^2)	35.15	29.18	41.11
Mean Riffle Depth (d_{bkf})	1.47	1.37	1.56	ft	Riffle Width/Depth Ratio (W_{bkf} / d_{bkf})	16.23	15.57	16.90
Maximum Riffle Depth (d_{max})	1.88	1.74	2.01	ft	Max Riffle Depth to Mean Riffle Depth (d_{max} / d_{bkf})	1.279	1.270	1.288
Width of Flood-Prone Area (W_{fpa})	28.9	28.4	29.2	ft	Entrenchment Ratio (W_{fpa} / W_{bkf})	1.221	1.108	1.333
Riffle Inner Berm Width (W_{ib})	21	18.4	23.6	ft	Riffle Inner Berm Width to Riffle Width (W_{ib} / W_{bkf})	0.880	0.865	0.894
Riffle Inner Berm Depth (d_{ib})	0.62	0.46	0.77	ft	Riffle Inner Berm Depth to Mean Depth (d_{ib} / d_{bkf})	0.415	0.336	0.493
Riffle Inner Berm Area (A_{ib})	13.3	8.5	18.1	ft^2	Riffle Inner Berm Area to Riffle Area (A_{ib} / A_{bkf})	0.366	0.291	0.441
Riffle Inner Berm W/D Ratio (W_{ib} / d_{ib})	35.3	30.6	40					

Pool Dimensions*, **, *

Pool Dimensions*, **, ***	Mean	Min	Max		Pool Dimensions & Dimensionless Ratios****	Mean	Min	Max
Pool Width (W_{bkfp})	27.5	27.2	27.8	ft	Pool Width to Riffle Width (W_{bkfp} / W_{bkf})	1.153	1.140	1.167
Mean Pool Depth (d_{bkfp})	2.18	1.88	2.47	ft	Mean Pool Depth to Mean Riffle Depth (d_{bkfp} / d_{bkf})	1.483	1.279	1.680
Pool Cross-Sectional Area (A_{bkfp})	60	51.1	68.9	ft	Pool Area to Riffle Area (A_{bkfp} / A_{bkf})	1.706	1.453	1.959
Maximum Pool Depth (d_{maxp})	3.86	3.3	4.41	ft	Max Pool Depth to Mean Riffle Depth (d_{maxp} / d_{bkf})	2.626	2.245	3.000
Pool Inner Berm Width (W_{ibp})	11.7	0	23.4	ft	Pool Inner Berm Width to Pool Width (W_{ibp} / W_{bkfp})	0.421	0.000	0.842
Pool Inner Berm Depth (d_{ibp})	1.05	0	2.1	ft	Pool Inner Berm Depth to Pool Depth (d_{ibp} / d_{bkfp})	0.426	0.000	0.852
Pool Inner Berm Area (A_{ibp})	24.7	0	49.3	ft^2	Pool Inner Berm Area to Pool Area (A_{ibp} / A_{bkfp})	0.358	0.000	0.716
Point Bar Slope (S_{pb})	0.277	0.204	0.350	ft/ft	Pool Inner Berm Width/Depth Ratio (W_{ibp} / d_{ibp})	5.570	0.000	11.140

Run Dimensions*

Run Dimensions*	Mean	Min	Max		Run Dimensionless Ratios****	Mean	Min	Max
Run Width (W_{bkfr})	23.7	19	28.4	ft	Run Width to Riffle Width (W_{bkfr} / W_{bkf})	0.994	0.796	1.191
Mean Run Depth (d_{bkfr})	1.99	1.92	2.06	ft	Mean Run Depth to Mean Riffle Depth (d_{bkfr} / d_{bkf})	1.354	1.306	1.401
Run Cross-Sectional Area (A_{bkfr})	47.4	36.4	58.4	ft	Run Area to Riffle Area (A_{bkfr} / A_{bkf})	1.349	1.036	1.661
Maximum Run Depth (d_{maxr})	2.73	2.66	2.8	ft	Max Run Depth to Mean Riffle Depth (d_{maxr} / d_{bkf})	1.857	1.810	1.905
Run Width/Depth Ratio (W_{bkfr} / d_{bkfr})	11.8	9.89	13.8	ft				

Glide Dimensions*

Glide Dimensions*	Mean	Min	Max		Glide Dimensions & Dimensionless Ratios****	Mean	Min	Max
Glide Width (W_{bkfg})	23.1	20	26.2	ft	Glide Width to Riffle Width (W_{bkfg} / W_{bkf})	0.967	0.837	1.097
Mean Glide Depth (d_{bkfg})	1.62	1.55	1.69	ft	Mean Glide Depth to Mean Riffle Depth (d_{bkfg} / d_{bkf})	1.102	1.054	1.150
Glide Cross-Sectional Area (A_{bkfg})	37.2	33.7	40.7	ft	Glide Area to Riffle Area (A_{bkfg} / A_{bkf})	1.058	0.959	1.157
Maximum Glide Depth (d_{maxg})	2.13	1.82	2.44	ft	Max Glide Depth to Mean Riffle Depth (d_{maxg} / d_{bkf})	1.449	1.238	1.660
Glide Width/Depth Ratio (W_{bkfg} / d_{bkfg})	14.3	11.8	16.9	ft/ft	Glide Inner Berm Width/Depth Ratio (W_{ibg} / d_{ibg})	0.000	0.000	0.000
Glide Inner Berm Width (W_{ibg})	0	0	0	ft	Glide Inner Berm Width to Glide Width (W_{ibg}/W_{bkfg})	0.000	0.000	0.000
Glide Inner Berm Depth (d_{ibg})	0	0	0	ft	Glide Inner Berm Depth to Glide Depth (d_{ibg} / d_{bkfg})	0.000	0.000	0.000
Glide Inner Berm Area (A_{ibg})	0	0	0	ft^2	Glide Inner Berm Area to Glide Area (A_{ibg} / A_{bkfg})	0.000	0.000	0.000

Step**

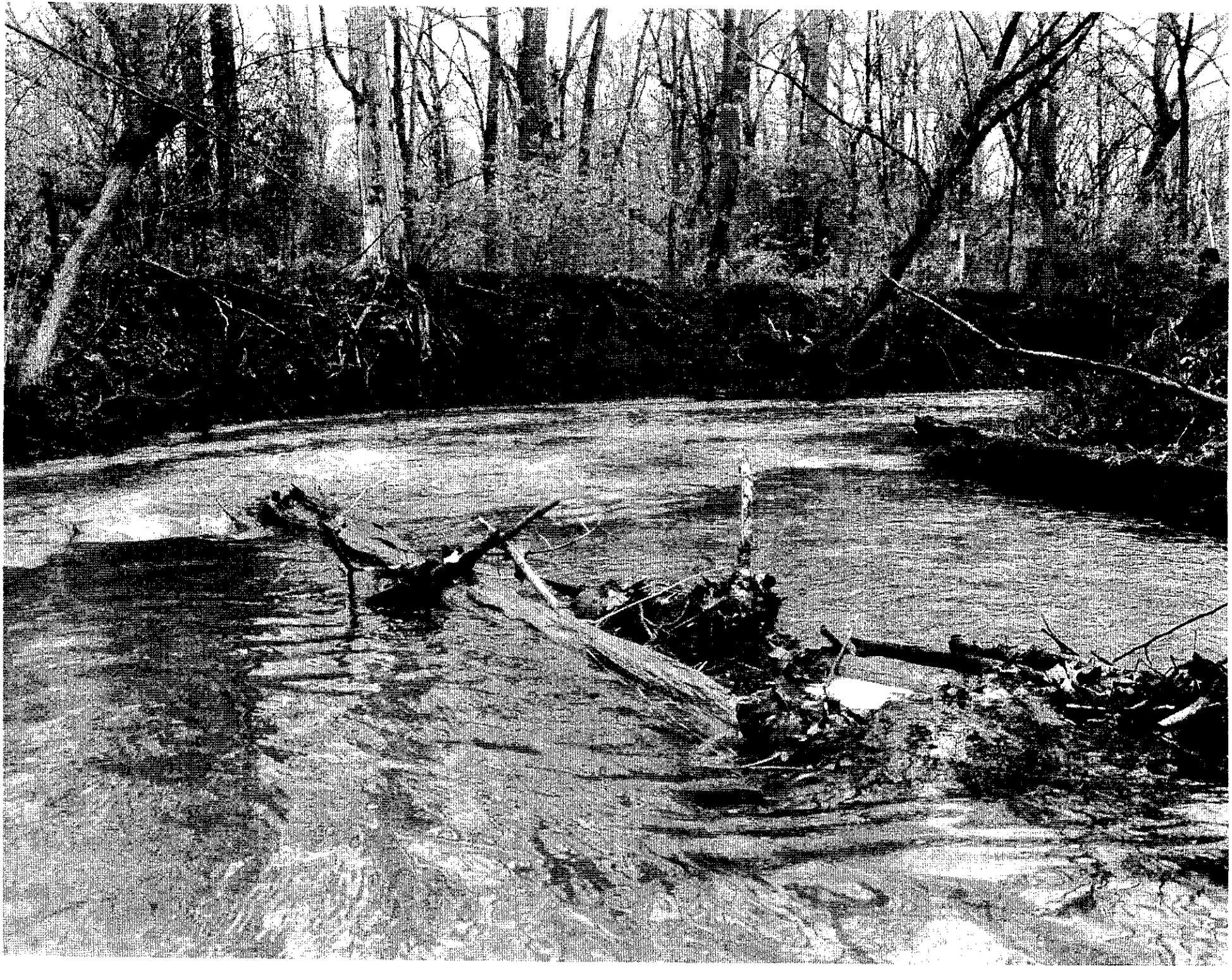
Step**	Mean	Min	Max		Step Dimensionless Ratios****	Mean	Min	Max
Step Width (W_{bkfs})	0	0	0	ft	Step Width to Riffle Width (W_{bkfs} / W_{bkf})	0.000	0.000	0.000
Mean Step Depth (d_{bkfs})	0	0	0	ft	Mean Step Depth to Riffle Depth (d_{bkfs} / d_{bkf})	0.000	0.000	0.000
Step Cross-Sectional Area (A_{bkfs})	0	0	0	ft	Step Area to Riffle Area (A_{bkfs} / A_{bkf})	0.000	0.000	0.000
Maximum Step Depth (d_{maxs})	0	0	0	ft	Max Step Depth to Mean Riffle Depth (d_{maxs} / d_{bkf})	0.000	0.000	0.000
Step Width/Depth Ratio (W_{bkfs} / d_{bkfs})	0	0	0					

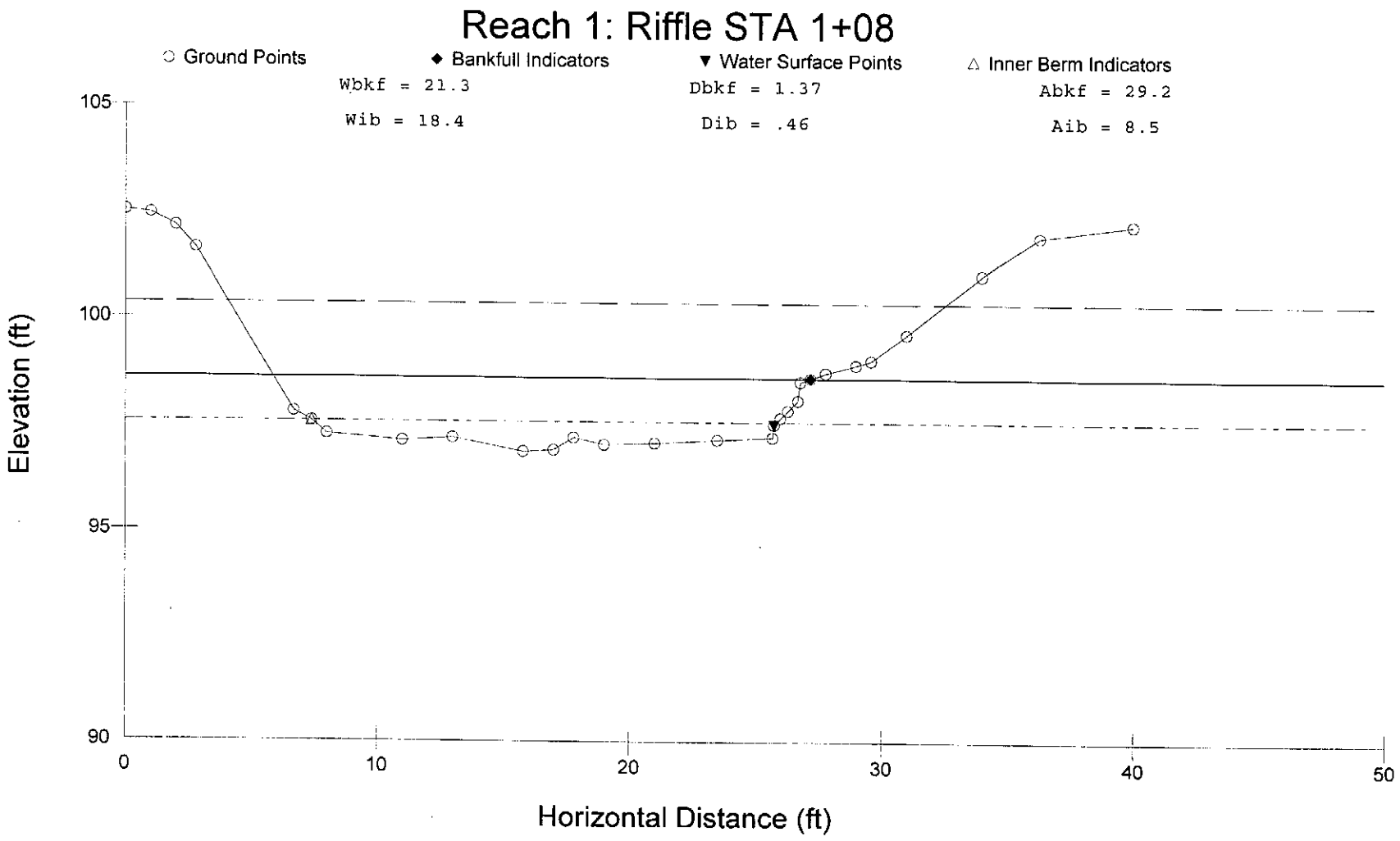
*Riffle–Pool system (i.e., C, E, F stream types) bed features include riffles, runs, pools and glides.

**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.

****Mean values are used as the normalization parameter for all dimensionless ratios; e.g., minimum pool width to riffle width ratio uses the *mean* riffle width value.




Reach 1: Riffle STA 1+08
Ground Points
Bankfull Indicators
Water Surface Points
Inner Berm Indicators
Wbkf = 21.3
Wib = 18.4
Dbkf = 1.37
Dib = .46
Abkf = 29.2
Aib = 8.5
105
100
95
90
Elevation (ft)
0
10
20
30
40
50
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: MarshRun
Reach Name: Surveyed Reach
Cross Section Name: Riffle STA 1+08
Survey Date: 04/18/2013

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 6.52 ft

TAPE	FS	ELEV	NOTE
0	4.02	102.5	
1	4.09	102.43	
2	4.39	102.13	
2.8	4.91	101.61	
6.7	8.72	97.8	
7.4	8.94	97.58	IB
8	9.25	97.27	
11	9.4	97.12	
13	9.33	97.19	
15.8	9.65	96.87	TW
17	9.61	96.91	
17.8	9.32	97.2	
19	9.48	97.04	
21	9.44	97.08	
23.5	9.36	97.16	
25.7	9.3	97.22	
25.75	9	97.52	REW
26	8.84	97.68	
26.3	8.67	97.85	
26.7	8.43	98.09	
26.8	7.99	98.53	
27.2	7.91	98.61	BKF
27.8	7.78	98.74	
29	7.6	98.92	
29.6	7.49	99.03	
31	6.87	99.65	
34	5.5	101.02	
36.3	4.62	101.9	
40	4.33	102.19	

Cross Sectional Geometry

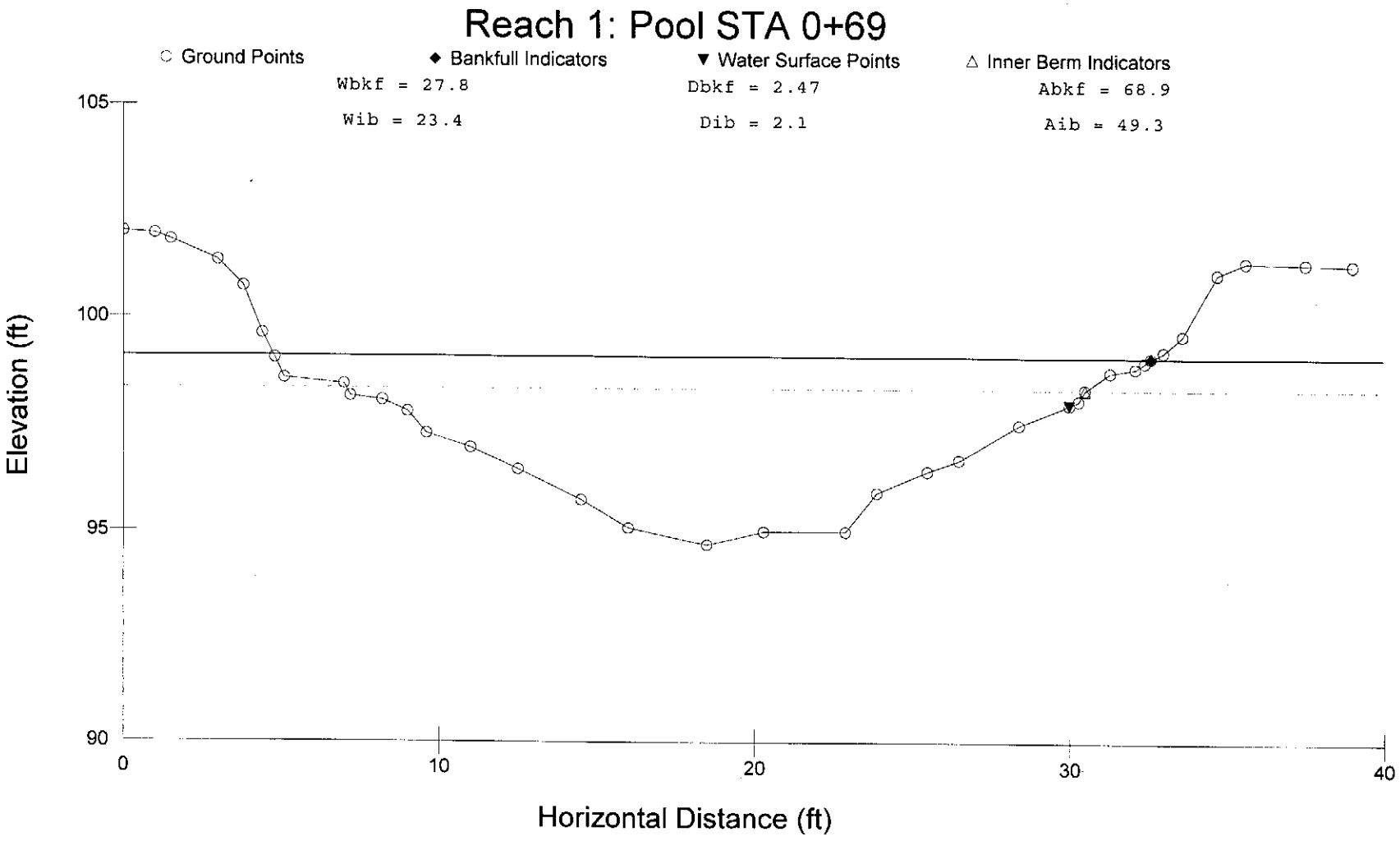
	Channel	Left	Right
Floodprone Elevation (ft)	100.35	100.35	100.35
Bankfull Elevation (ft)	98.61	98.61	98.61
Floodprone Width (ft)	28.44	-----	-----
Bankfull Width (ft)	21.33	10.9	10.43
Entrenchment Ratio	1.33	-----	-----
Mean Depth (ft)	1.37	1.37	1.37
Maximum Depth (ft)	1.74	1.74	1.71
Width/Depth Ratio	15.57	7.95	7.61
Bankfull Area (sq ft)	29.18	14.94	14.24
Wetted Perimeter (ft)	22.63	13.07	12.97
Hydraulic Radius (ft)	1.29	1.14	1.1

Begin BKF Station	5.87	5.87	16.77
End BKF Station	27.2	16.77	27.2

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


Reach 1: Pool STA 0+69
Ground Points
Bankfull Indicators
Water Surface Points
Inner Berm Indicators
Wbkf = 27.8
Wib = 23.4
Dbkf = 2.47
Dib = 2.1
Abkf = 68.9
Aib = 49.3
105
100
95
90
Elevation (ft)
0
10
20
30
40
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: MarshRun
Reach Name: Surveyed Reach
Cross Section Name: Pool STA 0+69
Survey Date: 04/18/2013

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 5.49 ft

TAPE	FS	ELEV	NOTE
0	3.48	102.01	
1	3.53	101.96	
1.5	3.67	101.82	
3	4.15	101.34	
3.8	4.75	100.74	
4.4	5.87	99.62	
4.8	6.44	99.05	
5.1	6.91	98.58	
7	7.05	98.44	
7.2	7.33	98.16	
8.2	7.42	98.07	
9	7.68	97.81	ignore LEW - ignore
9.6	8.2	97.29	
11	8.53	96.96	
12.5	9.03	96.46	
14.5	9.74	95.75	
16	10.4	95.09	
18.5	10.8	94.69	
20.3	10.48	95.01	TW
22.9	10.48	95.01	
23.9	9.56	95.93	
25.5	9.06	96.43	
26.5	8.79	96.7	
28.4	7.97	97.52	
30	7.49	98	REW
30.3	7.39	98.1	
30.5	7.14	98.35	IB
31.3	6.73	98.76	
32.1	6.63	98.86	
32.4	6.49	99	
32.6	6.39	99.1	BKF
33	6.25	99.24	
33.6	5.87	99.62	
34.7	4.43	101.06	
35.6	4.17	101.32	
37.5	4.2	101.29	
39	4.23	101.26	

Cross Sectional Geometry

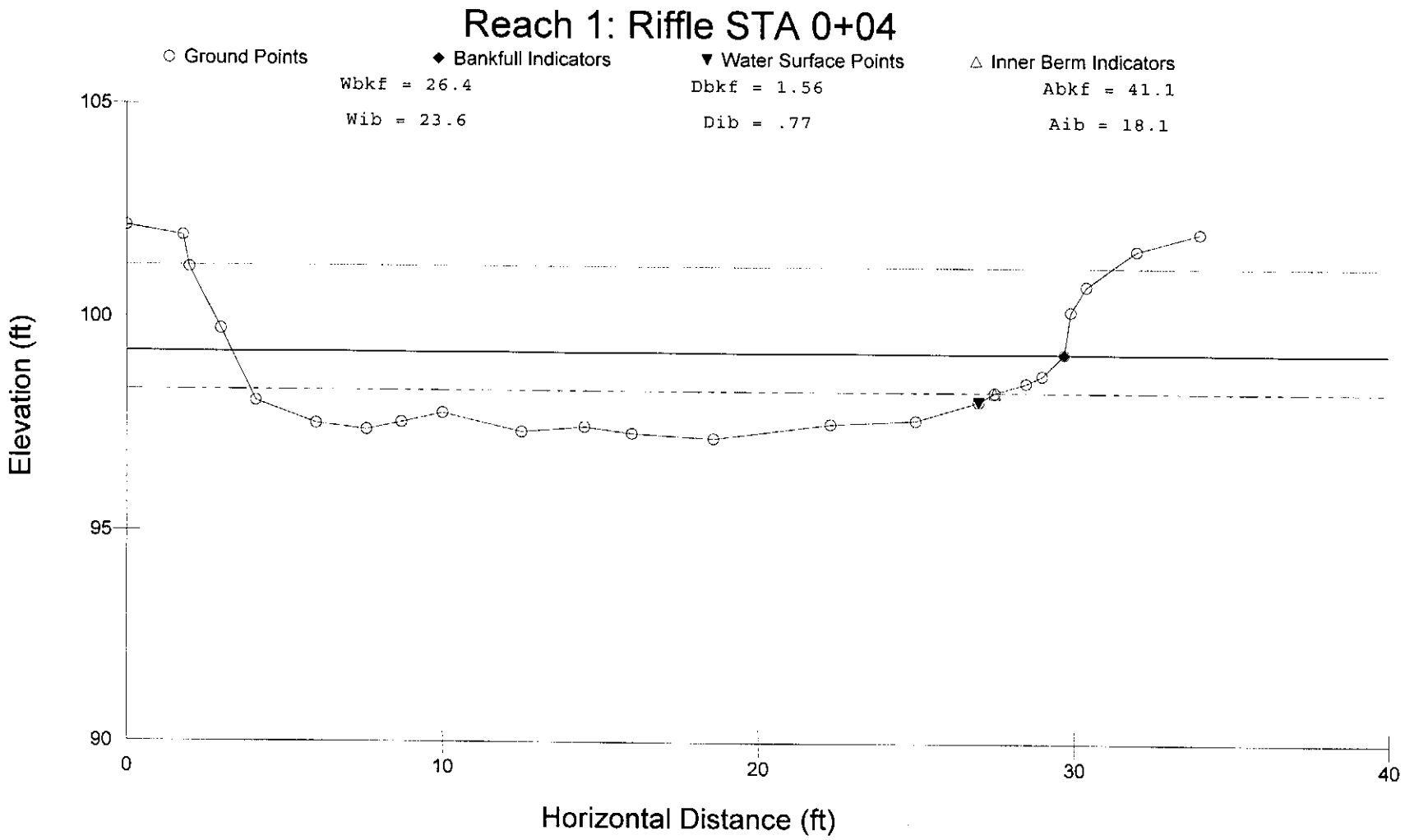
	Channel	Left	Right
Floodprone Elevation (ft)	103.51	103.51	103.51
Bankfull Elevation (ft)	99.1	99.1	99.1
Floodprone Width (ft)	39	-----	-----

Bankfull Width (ft)	27.84	13.92	13.92
Entrenchment Ratio	1.4	-----	-----
Mean Depth (ft)	2.47	2.4	2.55
Maximum Depth (ft)	4.41	4.41	4.38
Width/Depth Ratio	11.27	5.8	5.46
Bankfull Area (sq ft)	68.86	33.39	35.47
Wetted Perimeter (ft)	29.95	19.38	19.33
Hydraulic Radius (ft)	2.3	1.72	1.84
Begin BKF Station	4.76	4.76	18.68
End BKF Station	32.6	18.68	32.6

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


Reach 1: Riffle STA 0+04
Ground Points
Bankfull Indicators
Water Surface Points
Inner Berm Indicators
Wbkf = 26.4
Wib = 23.6
Dbkf = 1.56
Dib = .77
Abkf = 41.1
Aib = 18.1
105
100
95
90
Elevation (ft)
0
10
20
30
40
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: MarshRun
Reach Name: Surveyed Reach
Cross Section Name: Riffle STA 0+04
Survey Date: 04/18/2013

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 6.52 ft

TAPE	FS	ELEV	NOTE
0	4.38	102.14	LEP
1.8	4.6	101.92	LT/TOB
2	5.35	101.17	
3	6.79	99.73	
4.1	8.49	98.03	
6	9.01	97.51	
7.6	9.15	97.37	
8.7	8.98	97.54	
10	8.76	97.76	
12.5	9.19	97.33	
14.5	9.07	97.45	
16	9.22	97.3	
18.6	9.33	97.19	TW
22.3	8.98	97.54	
25	8.89	97.63	
27	8.45	98.07	REW
27.5	8.23	98.29	IB
28.5	8	98.52	
29	7.82	98.7	
29.7	7.32	99.2	BKF
29.9	6.33	100.19	
30.4	5.72	100.8	LT
32	4.91	101.61	
34	4.5	102.02	REP

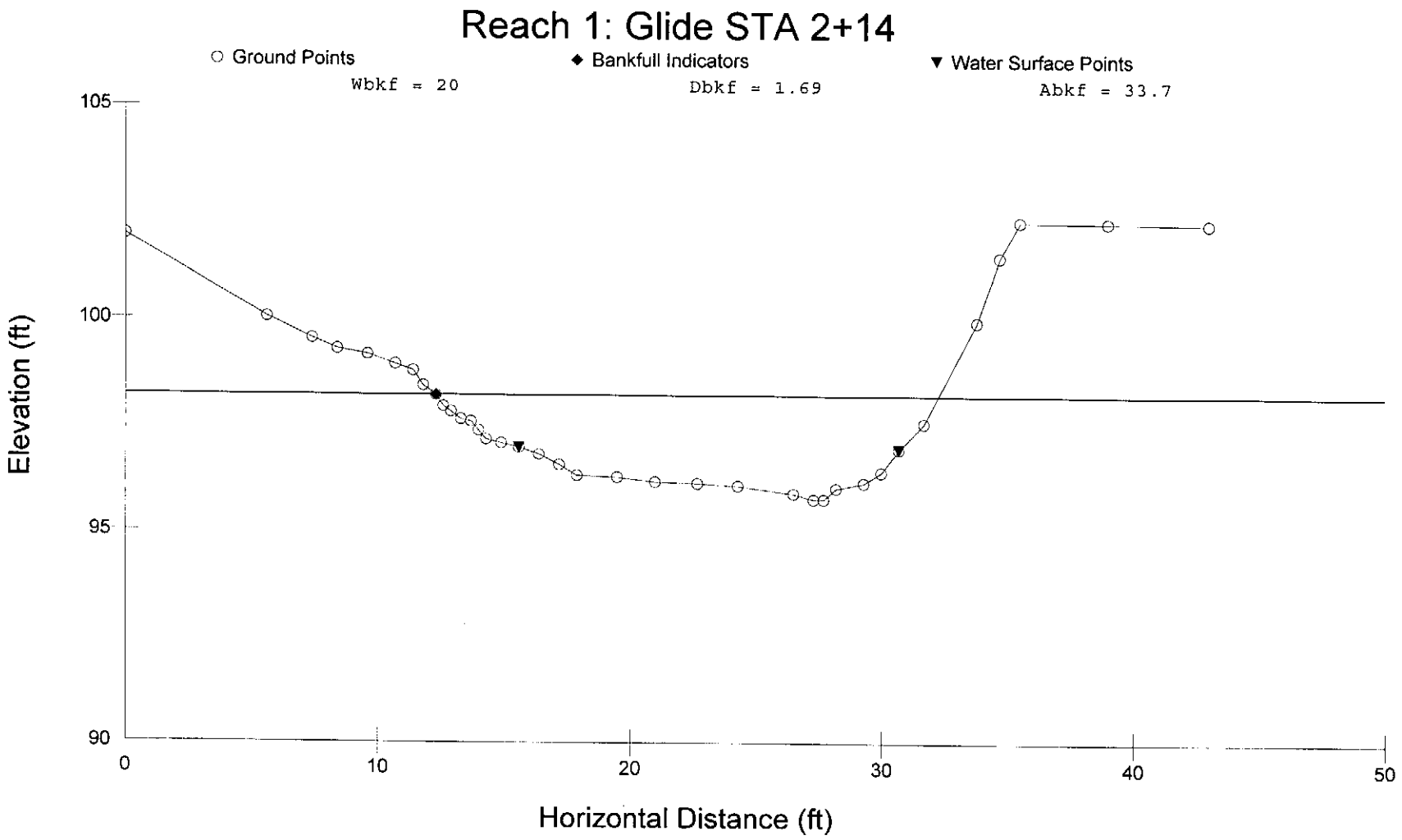
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	101.21	101.21	101.21
Bankfull Elevation (ft)	99.2	99.2	99.2
Floodprone Width (ft)	29.22	-----	-----
Bankfull Width (ft)	26.36	12.99	13.37
Entrenchment Ratio	1.11	-----	-----
Mean Depth (ft)	1.56	1.62	1.5
Maximum Depth (ft)	2.01	1.91	2.01
Width/Depth Ratio	16.9	8.02	8.91
Bankfull Area (sq ft)	41.11	21.03	20.08
Wetted Perimeter (ft)	27.48	15.69	15.62
Hydraulic Radius (ft)	1.5	1.34	1.29
Begin BKF Station	3.34	3.34	16.33
End BKF Station	29.7	16.33	29.7

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


Reach 1: Glide STA 2+14
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 20
Dbkf = 1.69
Abkf = 33.7
105
100
95
90
Elevation (ft)
0
10
20
30
40
50
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: MarshRun
Reach Name: Surveyed Reach
Cross Section Name: Glide STA 2+14
Survey Date: 04/18/2013

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 6.51 ft

TAPE	FS	ELEV	NOTE
0	4.56	101.95	
5.6	6.47	100.04	
7.4	6.97	99.54	
8.4	7.22	99.29	
9.6	7.35	99.16	
10.7	7.58	98.93	
11.4	7.73	98.78	
11.8	8.08	98.43	
12.3	8.3	98.21	BKF
12.6	8.57	97.94	
12.9	8.69	97.82	
13.3	8.87	97.64	
13.7	8.92	97.59	
14	9.13	97.38	
14.3	9.34	97.17	
14.9	9.43	97.08	
15.6	9.53	96.98	LEW
16.4	9.69	96.82	
17.2	9.94	96.57	
17.9	10.19	96.32	
19.5	10.23	96.28	
21	10.34	96.17	
22.7	10.37	96.14	
24.3	10.43	96.08	
26.5	10.61	95.9	
27.3	10.74	95.77	
27.7	10.74	95.77	
28.2	10.48	96.03	
29.3	10.35	96.16	
30	10.1	96.41	
30.7	9.56	96.95	REW
31.7	8.94	97.57	
33.8	6.56	99.95	
34.7	5.07	101.44	
35.5	4.24	102.27	
39	4.26	102.25	
43	4.29	102.22	

Cross Sectional Geometry

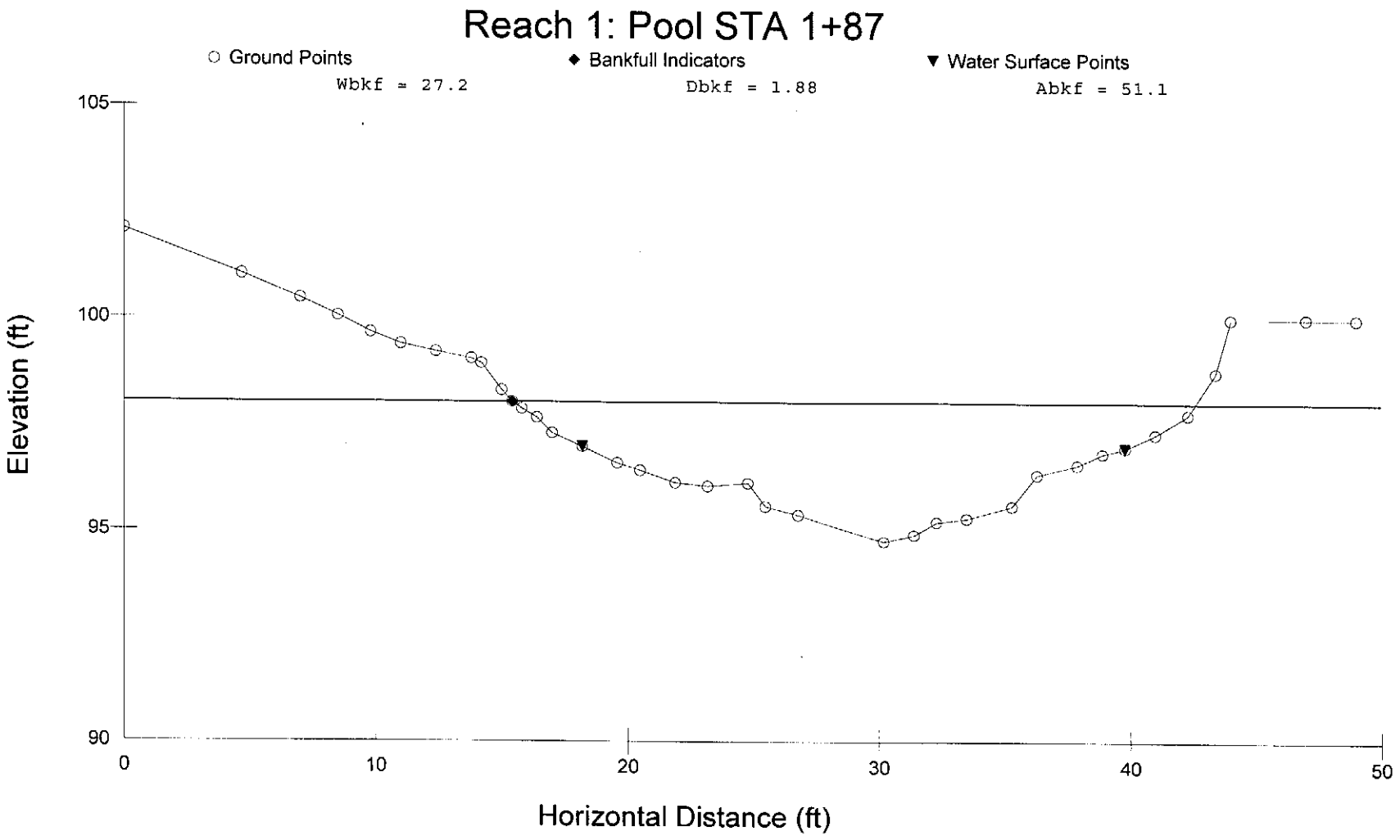
	Channel	Left	Right
Floodprone Elevation (ft)	100.65	100.65	100.65
Bankfull Elevation (ft)	98.21	98.21	98.21
Floodprone Width (ft)	30.41	-----	-----

Bankfull Width (ft)	19.96	10.23	9.73
Entrenchment Ratio	1.52	-----	-----
Mean Depth (ft)	1.69	1.49	1.9
Maximum Depth (ft)	2.44	2.07	2.44
Width/Depth Ratio	11.81	6.88	5.12
Bankfull Area (sq ft)	33.72	15.22	18.5
Wetted Perimeter (ft)	21.16	12.71	12.58
Hydraulic Radius (ft)	1.59	1.2	1.47
Begin BKF Station	12.3	12.3	22.53
End BKF Station	32.26	22.53	32.26

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


Reach 1: Pool STA 1+87
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 27.2
Dbkf = 1.88
Abkf = 51.1
105
100
95
90
Elevation (ft)
0
10
20
30
40
50
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: MarshRun
Reach Name: Surveyed Reach
Cross Section Name: Pool STA 1+87
Survey Date: 04/18/2013

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 6.51 ft

TAPE	FS	ELEV	NOTE
0	4.44	102.07	
4.7	5.5	101.01	
7	6.04	100.47	
8.5	6.46	100.05	
9.8	6.85	99.66	
11	7.12	99.39	
12.4	7.3	99.21	
13.8	7.46	99.05	
14.2	7.57	98.94	
15	8.2	98.31	xs BKF old
15.42	0	98.04	BKF lp
15.8	8.63	97.88	
16.4	8.84	97.67	
17	9.21	97.3	
18.2	9.52	96.99	LEW
19.6	9.91	96.6	
20.5	10.08	96.43	
21.9	10.37	96.14	
23.2	10.45	96.06	
24.8	10.38	96.13	
25.5	10.93	95.58	
26.8	11.13	95.38	
30.2	11.77	94.74	
31.4	11.61	94.9	
32.3	11.29	95.22	
33.5	11.21	95.3	
35.3	10.92	95.59	
36.3	10.17	96.34	
37.9	9.94	96.57	
38.9	9.66	96.85	
39.8	9.53	96.98	REW
41	9.21	97.3	
42.3	8.74	97.77	
43.4	7.76	98.75	
44	6.51	100	
47	6.5	100.01	
49	6.51	100	

Cross Sectional Geometry

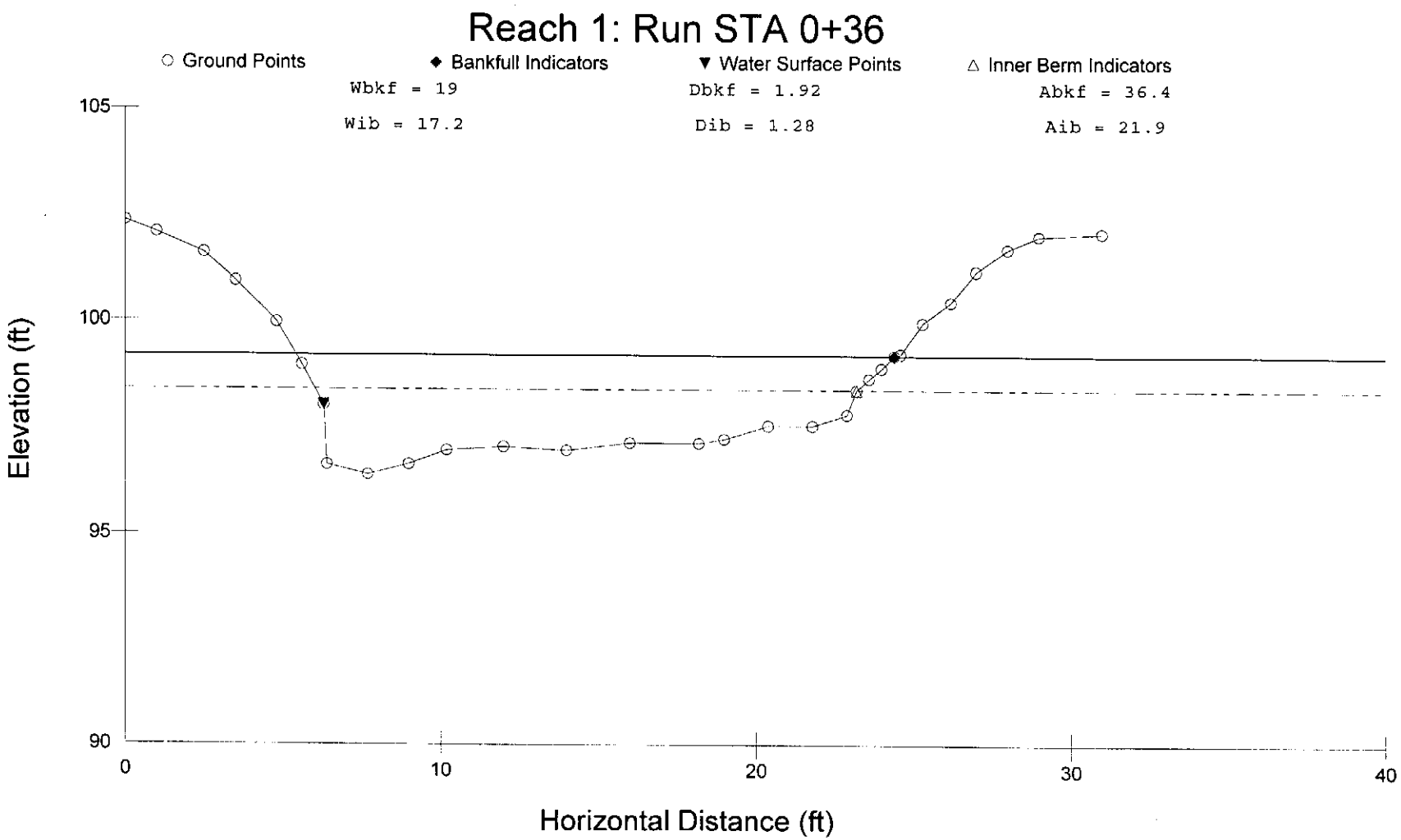
	Channel	Left	Right
Floodprone Elevation (ft)	101.34	101.34	101.34
Bankfull Elevation (ft)	98.04	98.04	98.04
Floodprone Width (ft)	45.76	-----	-----

Bankfull Width (ft)	27.18	7.11	20.07
Entrenchment Ratio	1.68	-----	-----
Mean Depth (ft)	1.88	1.18	2.13
Maximum Depth (ft)	3.3	1.94	3.3
Width/Depth Ratio	14.46	6.03	9.42
Bankfull Area (sq ft)	51.08	8.38	42.7
Wetted Perimeter (ft)	28.4	9.36	22.91
Hydraulic Radius (ft)	1.8	0.89	1.86
Begin BKF Station	15.42	15.42	22.53
End BKF Station	42.6	22.53	42.6

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


Reach 1: Run STA 0+36
Ground Points
Bankfull Indicators
Water Surface Points
Inner Berm Indicators
Wbkf = 19
Wib = 17.2
Dbkf = 1.92
Dib = 1.28
Abkf = 36.4
Aib = 21.9
105
100
95
90
Elevation (ft)
0
10
20
30
40
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: MarshRun
Reach Name: Surveyed Reach
Cross Section Name: Run STA 0+36
Survey Date: 04/18/2013

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 6.33 ft

TAPE	FS	ELEV	NOTE
0	3.98	102.35	LEP
1	4.26	102.07	
2.5	4.74	101.59	
3.5	5.4	100.93	
4.8	6.37	99.96	
5.6	7.36	98.97	
6.3	8.3	98.03	LEW
6.4	9.69	96.64	
7.7	9.93	96.4	TW
9	9.68	96.65	
10.2	9.35	96.98	
12	9.27	97.06	
14	9.35	96.98	
16	9.17	97.16	
18.2	9.18	97.15	
19	9.08	97.25	
20.4	8.76	97.57	
21.8	8.76	97.57	
22.9	8.5	97.83	
23.2	7.93	98.4	IB
23.6	7.66	98.67	
24	7.42	98.91	
24.4	7.13	99.2	BKF
24.6	7.09	99.24	
25.3	6.37	99.96	
26.2	5.89	100.44	
27	5.17	101.16	
28	4.66	101.67	
29	4.35	101.98	
31	4.28	102.05	REP

Cross Sectional Geometry

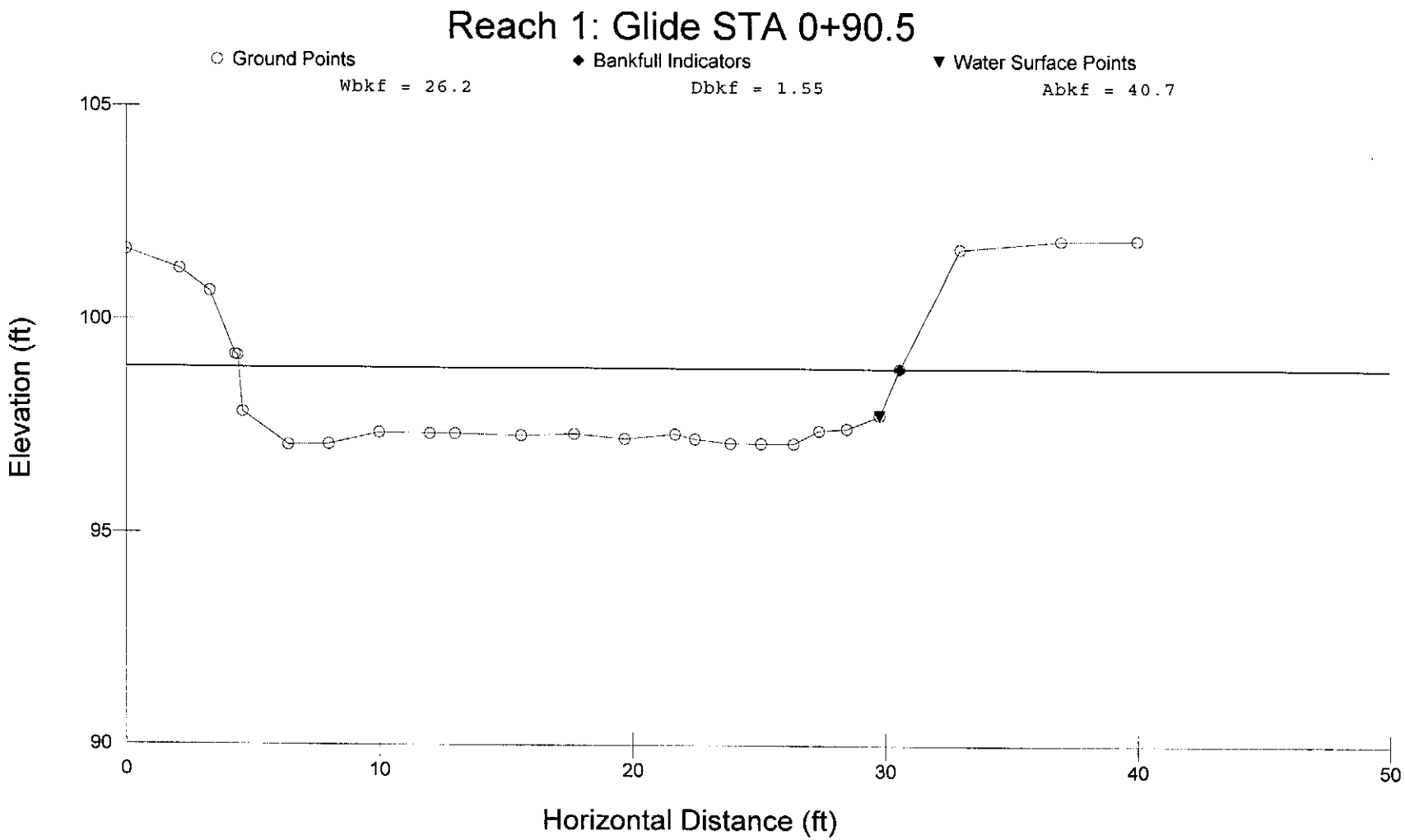
	Channel	Left	Right
Floodprone Elevation (ft)	102	102	102
Bankfull Elevation (ft)	99.2	99.2	99.2
Floodprone Width (ft)	28.35	-----	-----
Bankfull Width (ft)	18.99	9.5	9.49
Entrenchment Ratio	1.49	-----	-----
Mean Depth (ft)	1.92	2.19	1.65
Maximum Depth (ft)	2.8	2.8	2.14
Width/Depth Ratio	9.89	4.34	5.75
Bankfull Area (sq ft)	36.42	20.79	15.63
Wetted Perimeter (ft)	21.62	13.61	12.29

Hydraulic Radius (ft)	1.68	1.53	1.27
Begin BKF Station	5.41	5.41	14.91
End BKF Station	24.4	14.91	24.4

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


Reach 1: Glide STA 0+90.5
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 26.2
Dbkf = 1.55
Abkf = 40.7
105
100
95
90
Elevation (ft)
0
10
20
30
40
50
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: MarshRun
Reach Name: Surveyed Reach
Cross Section Name: Glide STA 0+90.5
Survey Date: 04/18/2013

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 7.05 ft

TAPE	FS	ELEV	NOTE
0	5.42	101.63	
2.1	5.87	101.18	
3.3	6.38	100.67	
4.3	7.87	99.18	
4.4	7.89	99.16	do not use BKF
4.6	9.22	97.83	
6.4	9.99	97.06	
8	9.97	97.08	
10	9.7	97.35	
12	9.72	97.33	
13	9.76	97.33	
15.6	9.72	97.29	
17.7	9.7	97.33	
19.7	9.83	97.22	
21.7	9.72	97.33	
22.5	9.83	97.22	
23.9	9.93	97.12	
25.1	9.93	97.12	
26.4	9.93	97.12	
27.4	9.63	97.42	
28.5	9.58	97.47	
29.8	9.27	97.78	REW
30.6	8.17	98.88	BKF
33	5.4	101.65	
37	5.2	101.85	
40	5.19	101.86	

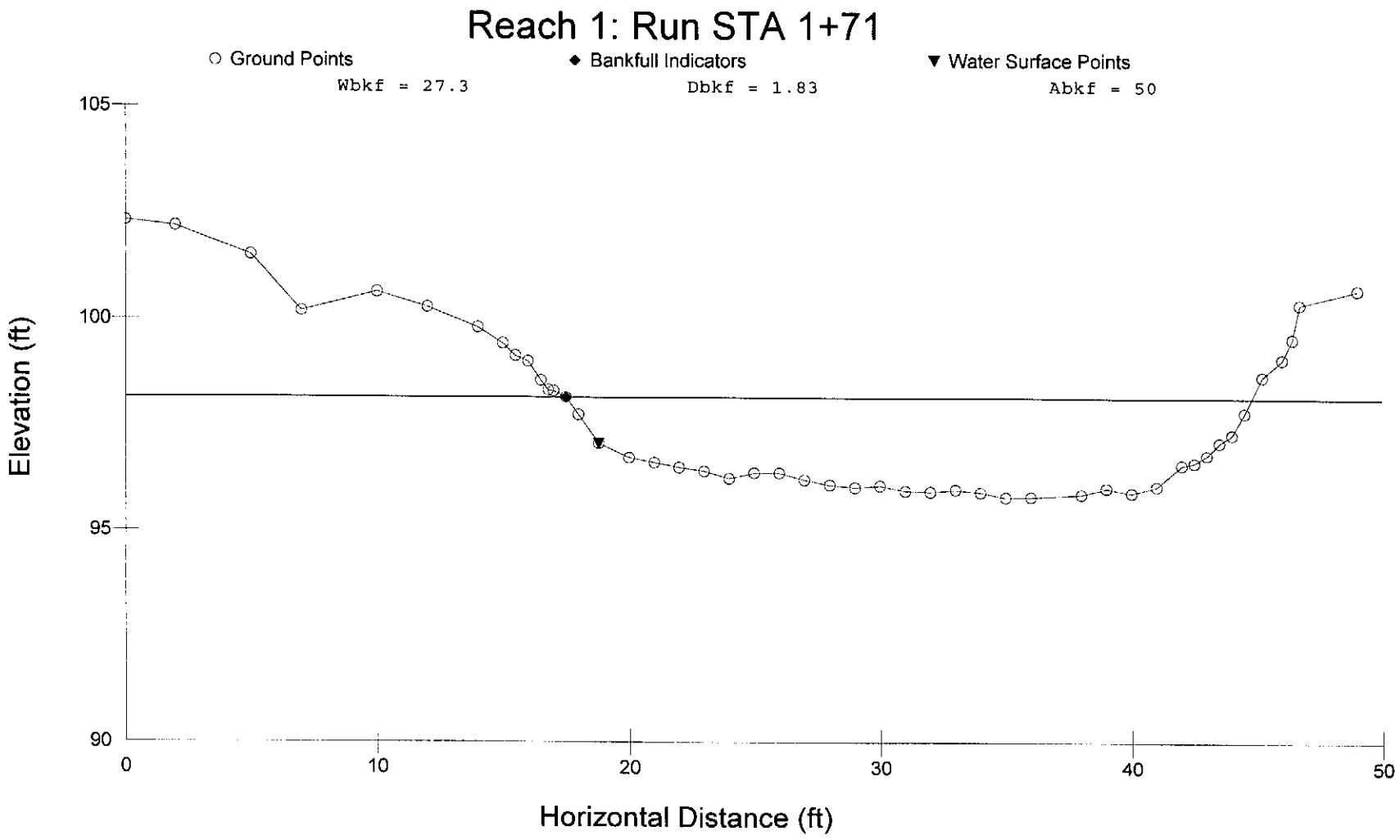
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	100.7	100.7	100.7
Bankfull Elevation (ft)	98.88	98.88	98.88
Floodprone Width (ft)	28.95	-----	-----
Bankfull Width (ft)	26.16	13.13	13.03
Entrenchment Ratio	1.11	-----	-----
Mean Depth (ft)	1.55	1.58	1.53
Maximum Depth (ft)	1.82	1.82	1.76
Width/Depth Ratio	16.88	8.33	8.52
Bankfull Area (sq ft)	40.66	20.7	19.96
Wetted Perimeter (ft)	27.9	15.76	15.24
Hydraulic Radius (ft)	1.46	1.31	1.31
Begin BKF Station	4.44	4.44	17.57
End BKF Station	30.6	17.57	30.6

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


Reach 1: Run STA 1+71
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 27.3
Dbkf = 1.83
Abkf = 50
105
100
95
90
Elevation (ft)
0
10
20
30
40
50
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: MarshRun
Reach Name: Surveyed Reach
Cross Section Name: Run STA 1+71
Survey Date: 04/18/2013

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 5.04 ft

TAPE	FS	ELEV	NOTE
0	2.75	102.29	
2	2.88	102.16	
5	3.55	101.49	
7	4.85	100.19	
10	4.4	100.64	
12	4.76	100.28	
14	5.24	99.8	
15	5.61	99.43	
15.5	5.9	99.14	
16	6.03	99.01	
16.5	6.47	98.57	
16.8	6.7	98.34	
17	6.72	98.32	
17.5	6.87	98.17	BKF
18	7.28	97.76	
18.8	7.96	97.08	LEW
20	8.3	96.74	
21	8.42	96.62	
22	8.53	96.51	
23	8.62	96.42	
24	8.79	96.25	
25	8.66	96.38	
26	8.66	96.38	
27	8.82	96.22	
28	8.94	96.1	
29	9	96.04	
30	8.96	96.08	
31	9.08	95.96	
32	9.1	95.94	
33	9.05	95.99	
34	9.11	95.93	
35	9.23	95.81	
36	9.22	95.82	
38	9.16	95.88	
39	9.01	96.03	
40	9.12	95.92	
41	8.97	96.07	
42	8.46	96.58	
42.5	8:4	96.64	
43	8.22	96.82	
43.5	7.92	97.12	
44	7.73	97.31	
44.5	7.21	97.83	
45.2	6.36	98.68	
46	5.95	99.09	
46.4	5.48	99.56	
46.7	4.67	100.37	

49	4.33	100.71

Cross Sectional Geometry

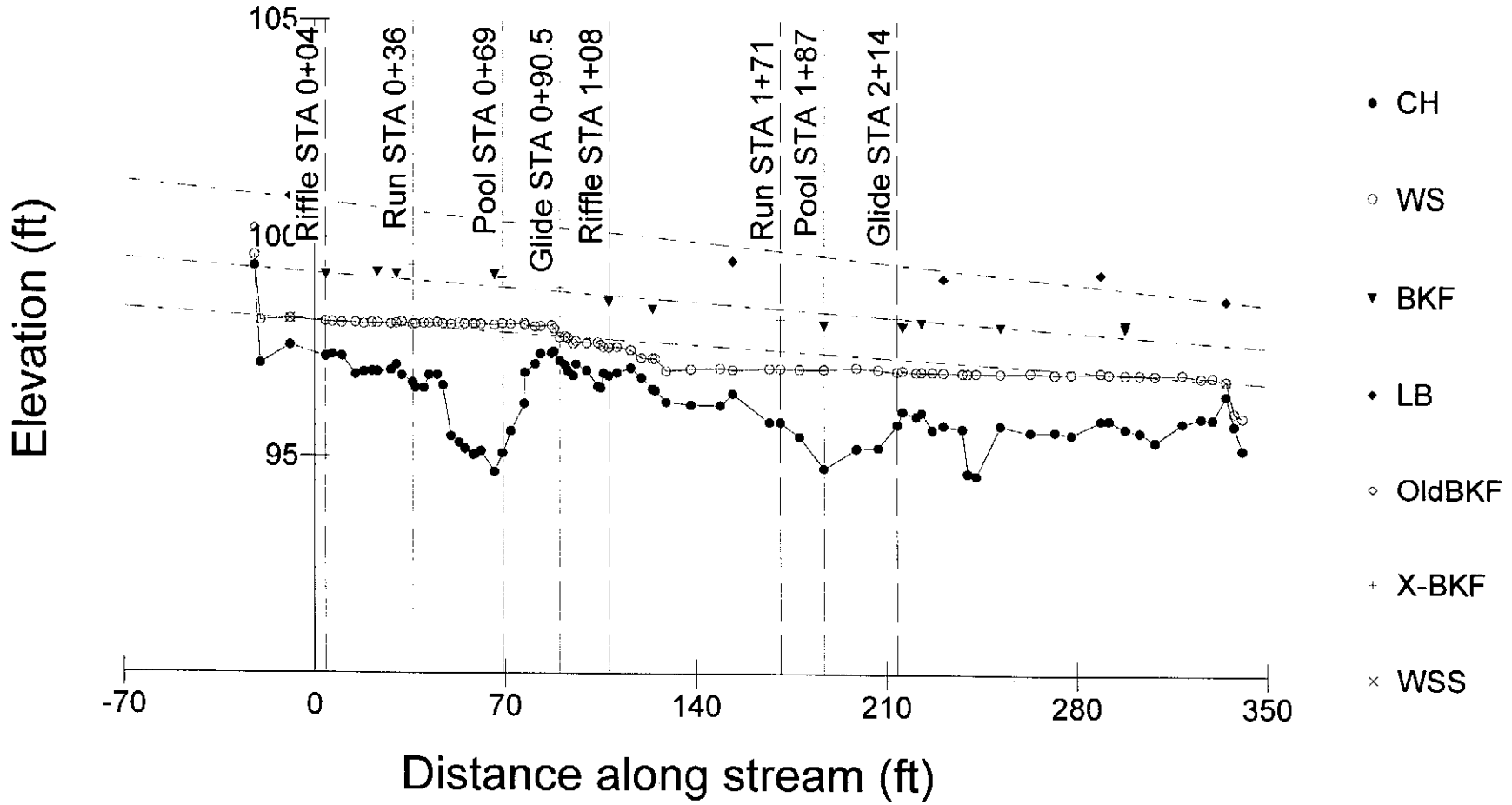
	Channel	Left	Right
Floodprone Elevation (ft)	100.53	100.53	100.53
Bankfull Elevation (ft)	98.17	98.17	98.17
Floodprone Width (ft)	39.96	-----	-----
Bankfull Width (ft)	27.28	13.64	13.64
Entrenchment Ratio	1.46	-----	-----
Mean Depth (ft)	1.83	1.69	1.98
Maximum Depth (ft)	2.36	2.21	2.36
Width/Depth Ratio	14.91	8.07	6.89
Bankfull Area (sq ft)	50.02	23.04	26.98
Wetted Perimeter (ft)	28.49	16.37	16.55
Hydraulic Radius (ft)	1.76	1.41	1.63
Begin BKF Station	17.5	17.5	31.14
End BKF Station	44.78	31.14	44.78

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

Team 1 - Reach 1 - Long Profile



RIVERMORPH PROFILE SUMMARY

River Name: MarshRun
Reach Name: Surveyed Reach
Profile Name: Long Profile
Survey Date: 04/18/2013

Survey Data

DIST	CH	WS	BKF	LB	OldBKF	X-BKF	WSS
-22.2	99.35	99.58			100.22		
-20	97.13	98.11					
-9	97.55	98.16		100.92			98.16
4	97.29	98.09	99.15			99.2	
6.5	97.34	98.08					
10	97.3	98.06					
15	96.88	98.07					
18	96.94	98.04					
21	96.96	98.06					
23	96.95	98.06	99.22				
28	96.98	98.04					
30	97.11	98.05	99.18				
32	96.86	98.08					
36	96.7	98.03				99.37	
37	96.58	98.04					
40	96.57	98.05					
42	96.87	98.05					
45	96.87	98.07					
47	96.64	98.04					
50	95.47	98.03					
53	95.32	98.06					
55	95.18	98.04					
58	95.04	98.04					
59	95.06	98.04					
61	95.13	98.04					
66	94.66	98.02	99.17	100.59			
69	95.08	98.05				99.1	
72	95.59	98.04					
77	96.22	98.06					
77.2	96.93	98.02					
81	97.13	97.99					
83	97.36	98					
87	97.38	98.02					
88	97.42	97.94					
90	97.2	97.74				98.88	
92	97.1	97.76					
93	96.97	97.73					
95	96.86	97.6					
96	97.13	97.65					
100	96.98	97.61					
104	96.62	97.62					
105	96.59	97.57					
106	96.92	97.52					
108	96.86	97.51	98.55			98.61	
111	96.93	97.52					
116	97.04	97.45					
120	96.82	97.27					
124	96.56	97.26	98.4				

125	96.53	97.26				
129	96.26	96.98				
138	96.2	97.02				
149	96.19	97.04				
153.5	96.46	97.01		99.49		
167	95.81	97.04				
171	95.81	97.04			98.17	
178	95.48	97.03				
187	94.75	97.03	98.04		98.04	
199	95.21	97.07				
207	95.23	97.03				
214	95.77	96.98			98.21	
216	96.07	97.01	98.01			
221	95.96	96.97				
223	96.05	96.98	98.1			
227	95.65	96.98				
231	95.75	96.97		99.11		
238	95.68	96.96				
240	94.65	96.95				
243	94.6	96.96				
252	95.75	96.95	98.01			
263	95.6	96.97				
272	95.61	96.94				
278	95.55	96.95				
289	95.88	96.98		99.22		
292	95.89	96.95				
298			98.06			
298	95.69	96.94	98			
303.3	95.61	96.94				
309	95.39	96.93				
319	95.83	96.95				
326	95.94	96.87				
330	95.92	96.88				
335	96.46	96.8		98.64		96.8
338	95.77	96.07				
341	95.21	95.96				

Cross Section / Bank Profile Locations

Name	Type	Profile Station
Pool STA 0+69	Pool XS	69
Riffle STA 1+08	Riffle XS	108
Riffle STA 0+04	Riffle XS	4
Glide STA 2+14	Glide XS	214
Pool STA 1+87	Pool XS	187
Run STA 0+36	Run XS	36
Glide STA 0+90.5	Glide XS	90.5
XS Run1+54 - don't use	Run XS	0
Run STA 1+71	Run XS	171

Measurements from Graph

Bankfull Slope: 0.00467

Variable	Min	Avg	Max
S riffle	0.00492	0.01271	0.02049
S pool	0.0001	0.00059	0.00155
S run	0.00208	0.00723	0.01237
S glide	0.00102	0.0061	0.00952
S step	0	0	0
P - P	121.12	121.12	121.12

Pool length	25.01	55.82	88.73
Riffle length	27.65	32.79	37.92
Dmax riffle	0.6	0.69	0.78
Dmax pool	2.31	2.68	3.36
Dmax run	0.52	0.85	1.28
Dmax glide	0	0	0
Dmax step	0	0	0
Low bank ht	0	0	0

Length and depth measurements in feet, slopes in ft/ft.

♀

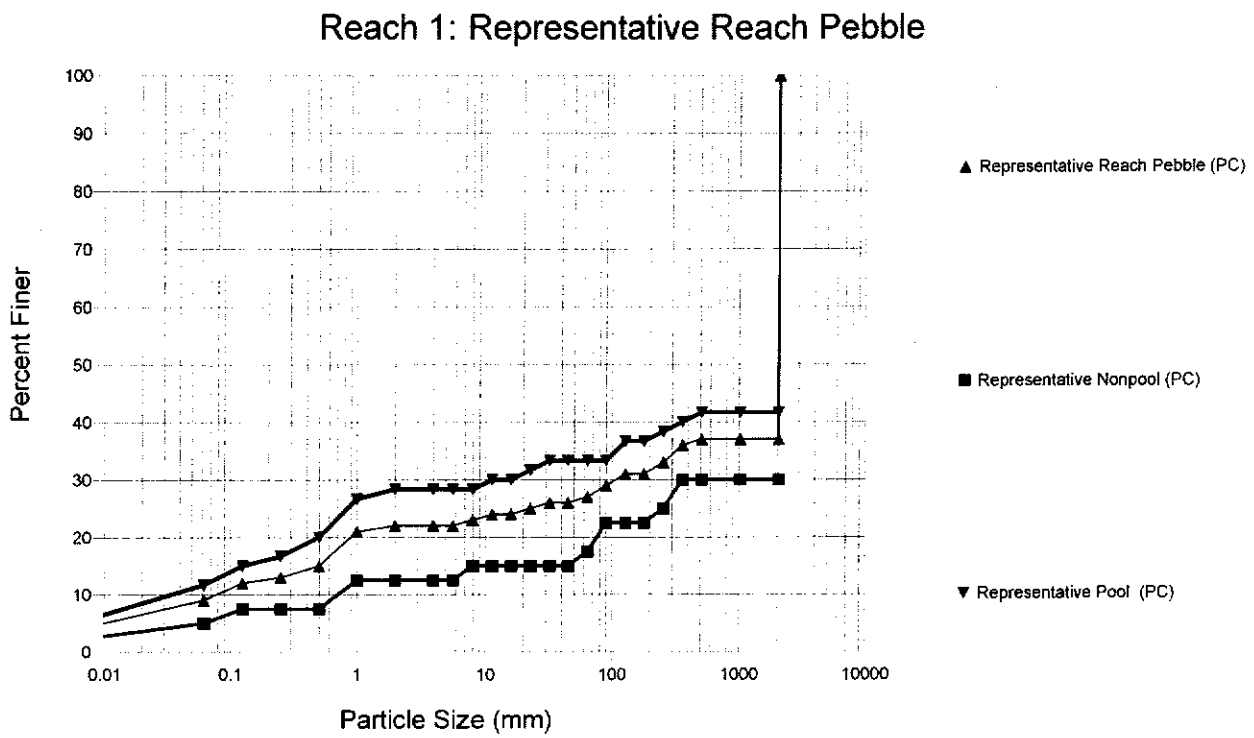
RIVERMORPH PROFILE SUMMARY

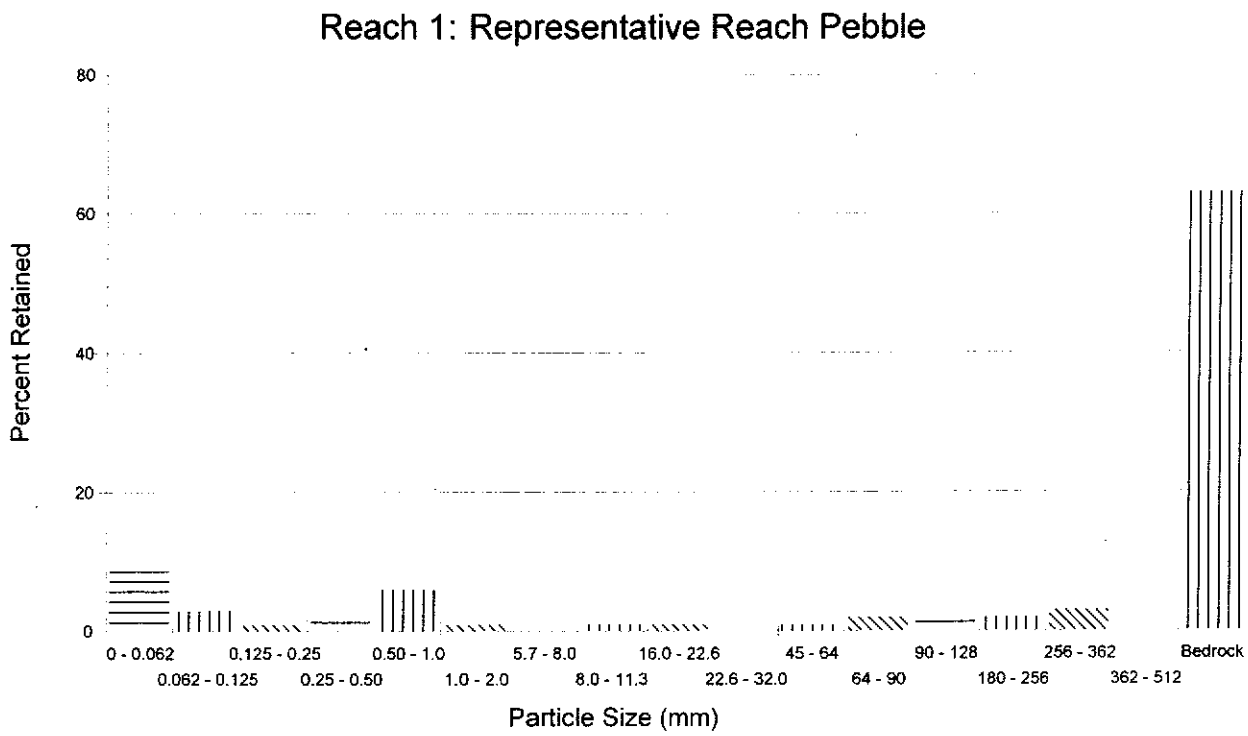
Notes

River Name: MarshRun
Reach Name: Surveyed Reach
Profile Name: Long Profile
Survey Date: 04/18/2013

DIST	Note
-22.2	top of check dam
-20	streambed below check dam
-9	just upstream of wooden bridge
4	riffle xs @ station 3.6; 1.06
23	1.16
30	1.13
36	run xs
50	pool
53	pool
55	pool
58	pool
59	pool
61	pool
66	pool; 1.15
69	pool, bottom; pool XS
72	glide
77	glide
77.2	glide, mid
81	glide
83	glide
87	glide
88	riffle, top
90	riffle
92	riffle
93	riffle
104	pool, small
105	pool, small
106	glide
108	riffle; riffle XS, 1.04
111	run, top
116	run
120	run
124	run; 1.14
125	run
129	run
138	run
149	run
153.5	run; run xs
171	xs run
178	pool
187	pool, pool xs; 1.01

199	glide, top
207	glide
214	xs glide
216	glide xs, 1.0
223	1.12
252	good bkf indicator; 1.06
298	staff gage reading 1.22 @14:00; 1.12
298	staff gage reading 1.22 @14:00; 1.06
309	pool
335	riffle, top
338	run, top
341	run


Reach 1: Representative Reach Pebble
Percent Finer
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)
▲ Representative Reach Pebble (PC)
■ Representative Nonpool (PC)
▼ Representative Pool (PC)


Reach 1: Representative Reach Pebble
Percent Retained
80
60
40
20
0
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.25 - 0.50
0.50 - 1.0
1.0 - 2.0
5.7 - 8.0
8.0 - 11.3
16.0 - 22.6
22.6 - 32.0
45 - 64
64 - 90
90 - 128
180 - 256
256 - 362
362 - 512
Bedrock
Particle Size (mm)

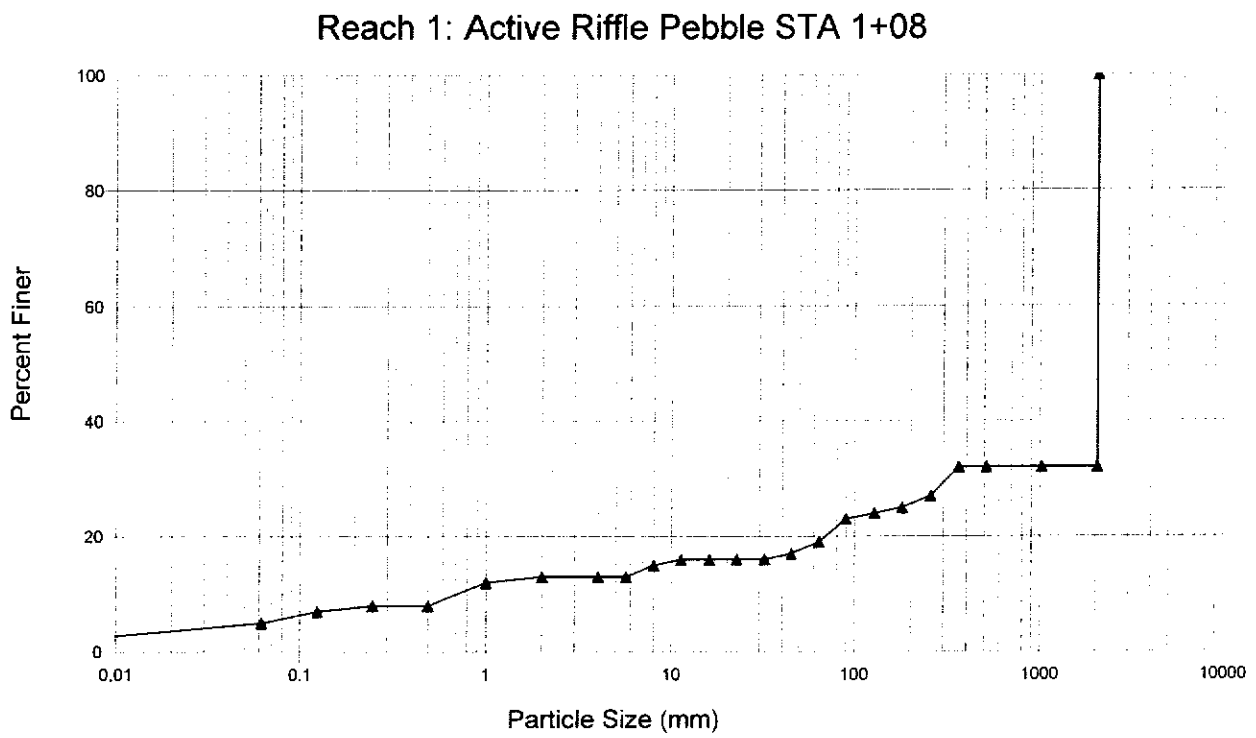
RIVERMORPH PARTICLE SUMMARY

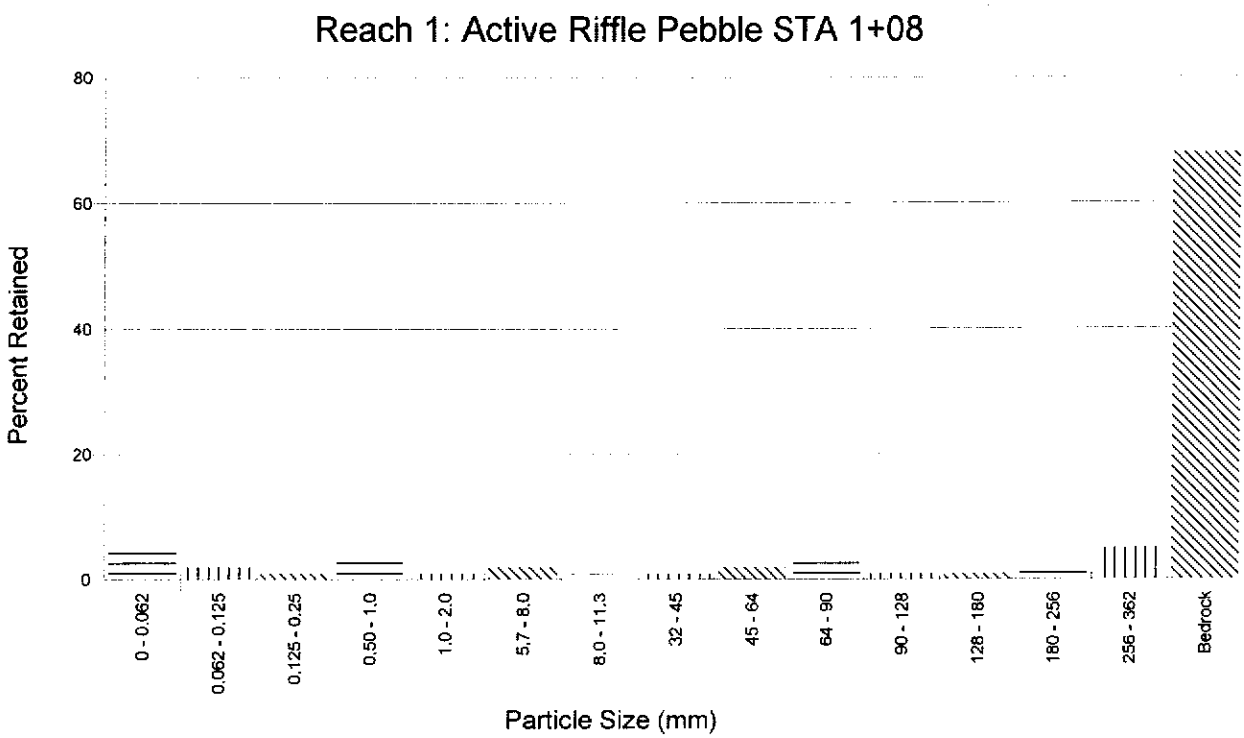
River Name: MarshRun
Reach Name: Surveyed Reach
Sample Name: Representative Reach Pebble
Survey Date: 04/18/2013

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	9	9.00	9.00
0.062 - 0.125	3	3.00	12.00
0.125 - 0.25	1	1.00	13.00
0.25 - 0.50	2	2.00	15.00
0.50 - 1.0	6	6.00	21.00
1.0 - 2.0	1	1.00	22.00
2.0 - 4.0	0	0.00	22.00
4.0 - 5.7	0	0.00	22.00
5.7 - 8.0	1	1.00	23.00
8.0 - 11.3	1	1.00	24.00
11.3 - 16.0	0	0.00	24.00
16.0 - 22.6	1	1.00	25.00
22.6 - 32.0	1	1.00	26.00
32 - 45	0	0.00	26.00
45 - 64	1	1.00	27.00
64 - 90	2	2.00	29.00
90 - 128	2	2.00	31.00
128 - 180	0	0.00	31.00
180 - 256	2	2.00	33.00
256 - 362	3	3.00	36.00
362 - 512	1	1.00	37.00
512 - 1024	0	0.00	37.00
1024 - 2048	0	0.00	37.00
Bedrock	63	63.00	100.00

D16 (mm)	0.58
D35 (mm)	326.67
D50 (mm)	Bedrock
D84 (mm)	Bedrock
D95 (mm)	Bedrock
D100 (mm)	Bedrock
Silt/Clay (%)	9
Sand (%)	13
Gravel (%)	5
Cobble (%)	6
Boulder (%)	4
Bedrock (%)	63

Total Particles = 100.


Reach 1: Active Riffle Pebble STA 1+08
Percent Finer
100
80
60
40
20
0
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)


Reach 1: Active Riffle Pebble STA 1+08
Percent Retained
80
60
40
20
0
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.50 - 1.0
1.0 - 2.0
5.7 - 8.0
8.0 - 11.3
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
Bedrock
Particle Size (mm)

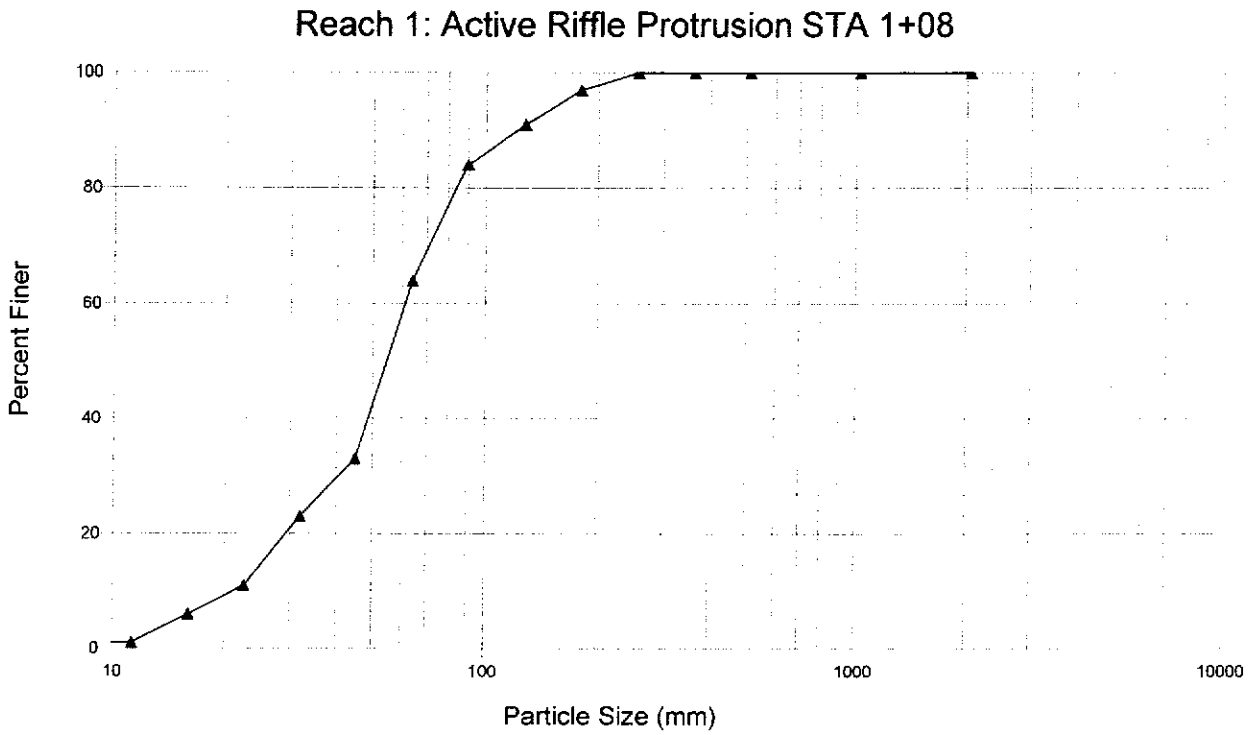
RIVERMORPH PARTICLE SUMMARY

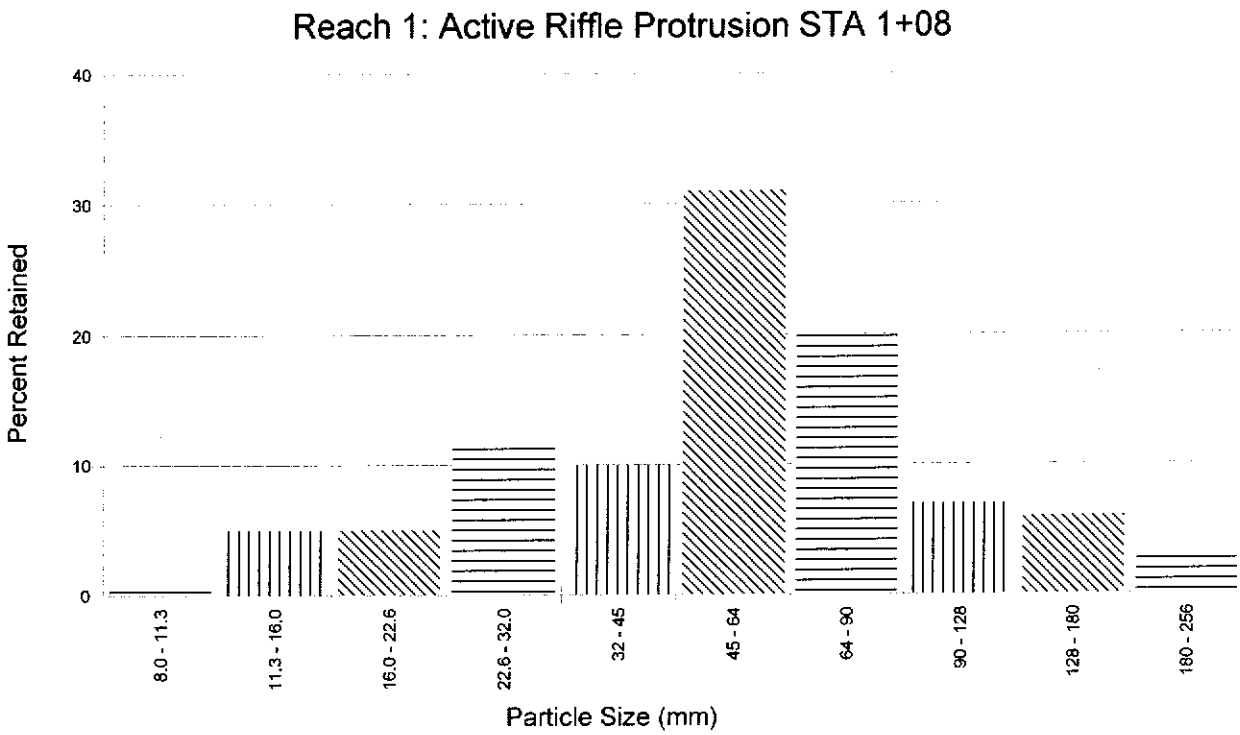
River Name: MarshRun
Reach Name: Surveyed Reach
Sample Name: Active Riffle Pebble STA 1+08
Survey Date: 04/18/2013

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	5	5.00	5.00
0.062 - 0.125	2	2.00	7.00
0.125 - 0.25	1	1.00	8.00
0.25 - 0.50	0	0.00	8.00
0.50 - 1.0	4	4.00	12.00
1.0 - 2.0	1	1.00	13.00
2.0 - 4.0	0	0.00	13.00
4.0 - 5.7	0	0.00	13.00
5.7 - 8.0	2	2.00	15.00
8.0 - 11.3	1	1.00	16.00
11.3 - 16.0	0	0.00	16.00
16.0 - 22.6	0	0.00	16.00
22.6 - 32.0	0	0.00	16.00
32 - 45	1	1.00	17.00
45 - 64	2	2.00	19.00
64 - 90	4	4.00	23.00
90 - 128	1	1.00	24.00
128 - 180	1	1.00	25.00
180 - 256	2	2.00	27.00
256 - 362	5	5.00	32.00
362 - 512	0	0.00	32.00
512 - 1024	0	0.00	32.00
1024 - 2048	0	0.00	32.00
Bedrock	68	68.00	100.00

D16 (mm)	11.3
D35 (mm)	Bedrock
D50 (mm)	Bedrock
D84 (mm)	Bedrock
D95 (mm)	Bedrock
D100 (mm)	Bedrock
Silt/Clay (%)	5
Sand (%)	8
Gravel (%)	6
Cobble (%)	8
Boulder (%)	5
Bedrock (%)	68

Total Particles = 100.


Reach 1: Active Riffle Protrusion STA 1+08
Percent Finer
100
80
60
40
20
0
10
100
1000
10000
Particle Size (mm)


Reach 1: Active Riffle Protrusion STA 1+08
Percent Retained
40
30
20
10
0
8.0 - 11.3
11.3 - 16.0
16.0 - 22.6
22.6 - 32.0
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
Particle Size (mm)

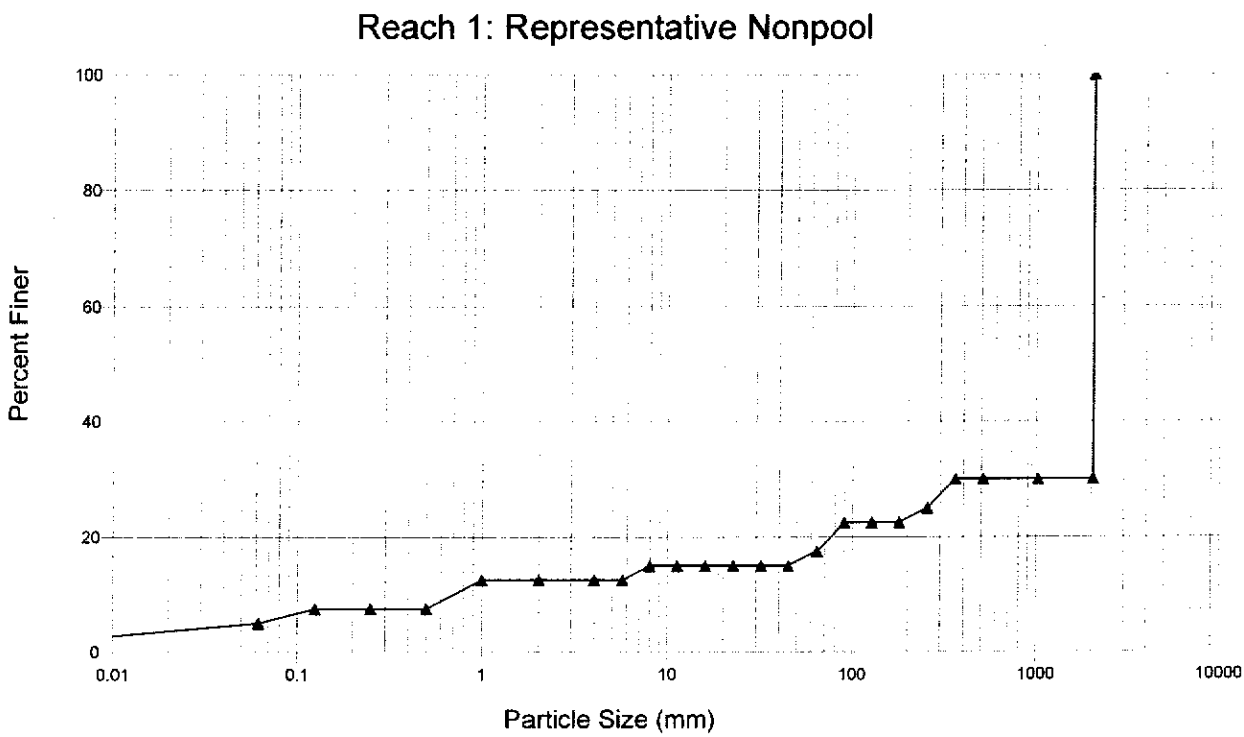
RIVERMORPH PARTICLE SUMMARY

River Name: MarshRun
Reach Name: Surveyed Reach
Sample Name: Active Riffle Protrusion STA 1+08
Survey Date: 04/18/2013

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	0	0.00	0.00
0.062 - 0.125	0	0.00	0.00
0.125 - 0.25	0	0.00	0.00
0.25 - 0.50	0	0.00	0.00
0.50 - 1.0	0	0.00	0.00
1.0 - 2.0	0	0.00	0.00
2.0 - 4.0	0	0.00	0.00
4.0 - 5.7	0	0.00	0.00
5.7 - 8.0	0	0.00	0.00
8.0 - 11.3	1	1.00	1.00
11.3 - 16.0	5	5.00	6.00
16.0 - 22.6	5	5.00	11.00
22.6 - 32.0	12	12.00	23.00
32 - 45	10	10.00	33.00
45 - 64	31	31.00	64.00
64 - 90	20	20.00	84.00
90 - 128	7	7.00	91.00
128 - 180	6	6.00	97.00
180 - 256	3	3.00	100.00
256 - 362	0	0.00	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	26.52
D35 (mm)	46.23
D50 (mm)	55.42
D84 (mm)	90
D95 (mm)	162.67
D100 (mm)	256
Silt/Clay (%)	0
Sand (%)	0
Gravel (%)	64
Cobble (%)	36
Boulder (%)	0
Bedrock (%)	0

Total Particles = 100.


Reach 1: Representative Nonpool
Percent Finer
100
80
60
40
20
0
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)

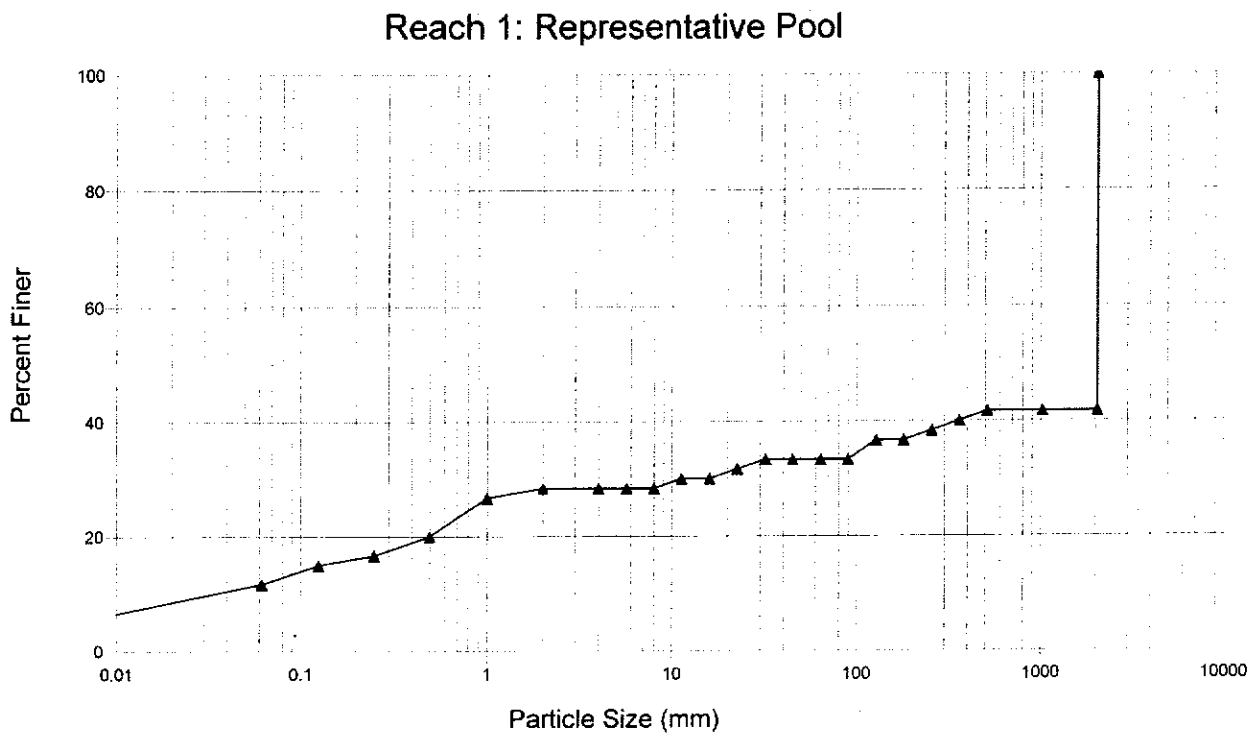
RIVERMORPH PARTICLE SUMMARY

River Name: MarshRun
Reach Name: Surveyed Reach
Sample Name: Representative Nonpool
Survey Date: 04/18/2013

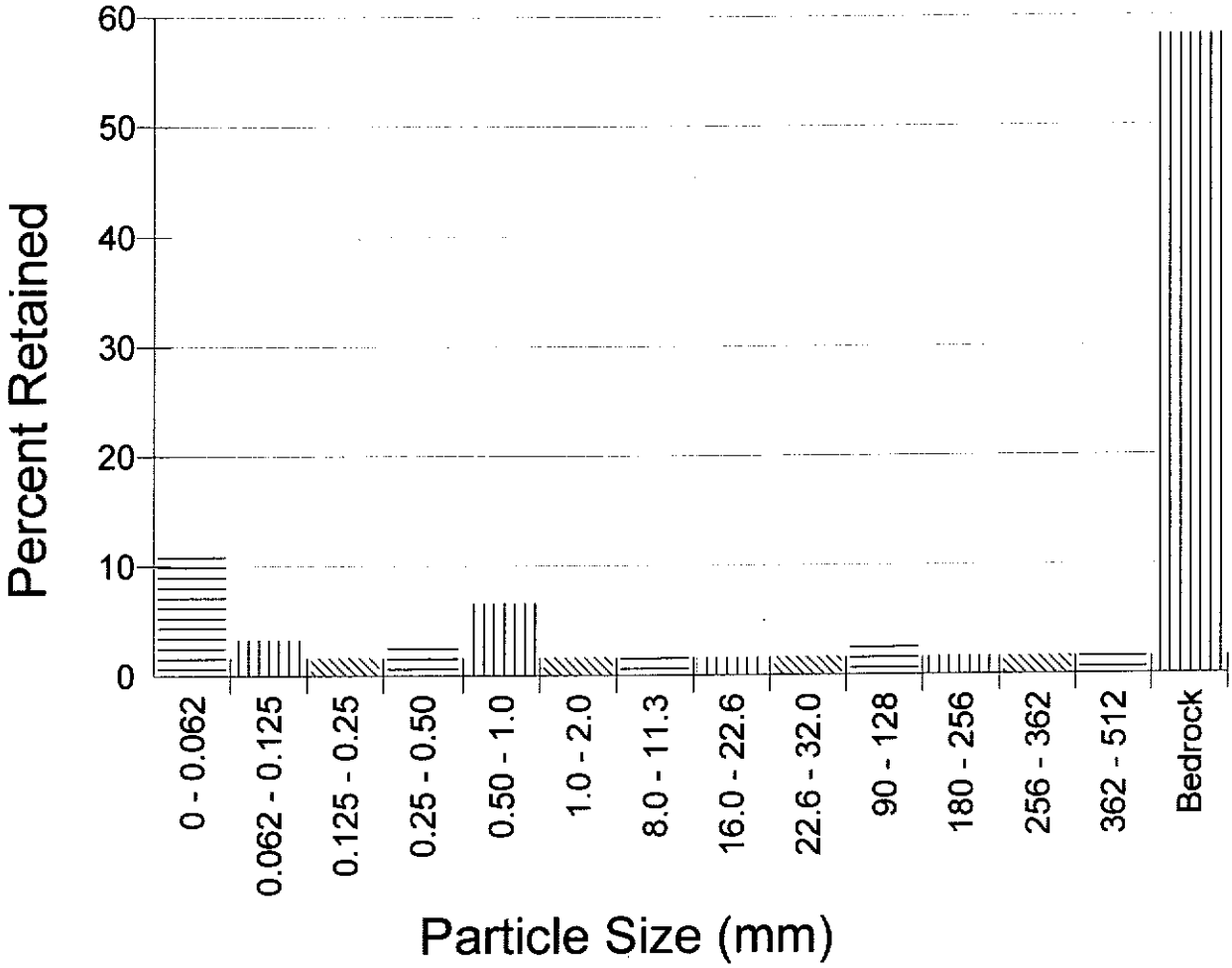
Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	2	5.00	5.00
0.062 - 0.125	1	2.50	7.50
0.125 - 0.25	0	0.00	7.50
0.25 - 0.50	0	0.00	7.50
0.50 - 1.0	2	5.00	12.50
1.0 - 2.0	0	0.00	12.50
2.0 - 4.0	0	0.00	12.50
4.0 - 5.7	0	0.00	12.50
5.7 - 8.0	1	2.50	15.00
8.0 - 11.3	0	0.00	15.00
11.3 - 16.0	0	0.00	15.00
16.0 - 22.6	0	0.00	15.00
22.6 - 32.0	0	0.00	15.00
32 - 45	0	0.00	15.00
45 - 64	1	2.50	17.50
64 - 90	2	5.00	22.50
90 - 128	0	0.00	22.50
128 - 180	0	0.00	22.50
180 - 256	1	2.50	25.00
256 - 362	2	5.00	30.00
362 - 512	0	0.00	30.00
512 - 1024	0	0.00	30.00
1024 - 2048	0	0.00	30.00
Bedrock	28	70.00	100.00

D16 (mm)	52.6
D35 (mm)	Bedrock
D50 (mm)	Bedrock
D84 (mm)	Bedrock
D95 (mm)	Bedrock
D100 (mm)	Bedrock
Silt/Clay (%)	5
Sand (%)	7.5
Gravel (%)	5
Cobble (%)	7.5
Boulder (%)	5
Bedrock (%)	70

Total Particles = 40 (need at least 60).


Reach 1: Representative Pool
Percent Finer
100
80
60
40
20
0
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)

REACH 1: Representative Pool



RIVERMORPH PARTICLE SUMMARY

River Name: MarshRun
Reach Name: Surveyed Reach
Sample Name: Representative Pool
Survey Date: 04/18/2013

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	7	11.67	11.67
0.062 - 0.125	2	3.33	15.00
0.125 - 0.25	1	1.67	16.67
0.25 - 0.50	2	3.33	20.00
0.50 - 1.0	4	6.67	26.67
1.0 - 2.0	1	1.67	28.33
2.0 - 4.0	0	0.00	28.33
4.0 - 5.7	0	0.00	28.33
5.7 - 8.0	0	0.00	28.33
8.0 - 11.3	1	1.67	30.00
11.3 - 16.0	0	0.00	30.00
16.0 - 22.6	1	1.67	31.67
22.6 - 32.0	1	1.67	33.33
32 - 45	0	0.00	33.33
45 - 64	0	0.00	33.33
64 - 90	0	0.00	33.33
90 - 128	2	3.33	36.67
128 - 180	0	0.00	36.67
180 - 256	1	1.67	38.33
256 - 362	1	1.67	40.00
362 - 512	1	1.67	41.67
512 - 1024	0	0.00	41.67
1024 - 2048	0	0.00	41.67
Bedrock	35	58.33	100.00

D16 (mm)	0.2
D35 (mm)	109
D50 (mm)	Bedrock
D84 (mm)	Bedrock
D95 (mm)	Bedrock
D100 (mm)	Bedrock
Silt/Clay (%)	11.67
Sand (%)	16.66
Gravel (%)	5
Cobble (%)	5
Boulder (%)	3.34
Bedrock (%)	58.33

Total Particles = 60.

Summary....*USGS GAGE STATION* Data / Records for STREAM CHANNEL CLASSIFICATION

Station NAME:	Team 2	Station Number:	01617800
LOCATION:	Marsh Run		
Period of Record:	48 yrs	Mean Annual DISCHARGE:	12.9 cfs
Drainage AREA:	acres / 18.9 mi²	Drainage Area Mn Elev:	ft
Reference REACH SLOPE:	.00467 ft/ft	Valley Type:	VM.C
Stream Type:	F1	HUC:	

"BANKFULL" CHARACTERISTICS

Determined from FIELD MEASUREMENT			Determined from GAGE DATA Analysis		
Bankfull WIDTH (W_{bkf})	21.33	ft	Bankfull WIDTH (W_{bkf})	24	ft
Bankfull Mean DEPTH (d_{bkf})	1.37	ft	Bankfull MEAN DEPTH (d_{bkf})	1.8	ft
Bankfull Xsec AREA (A_{bkf})	29.18	ft²	Bankfull Xsec AREA (A_{bkf})	40	ft²
Wetted PERIMETER (W_P)	24.04	ft	Wetted PERIMETER (W_P)	27.6	ft
Bankfull STAGE (Gage Ht)	2.34	ft	Bankfull STAGE (Gage Ht)	1.23	ft
Est. Mean VELOCITY (u)	3.592	ft/sec	Mean VELOCITY (u)	2.7	ft/sec
Est. Bkf. DISCHARGE (Q_{bkf})	104.813	cfs	Bankfull DISCHARGE (Q_{bkf})	107	cfs

Bankfull DISCHARGE associated with **"field-determined"** Bankfull STAGE (From Gage Height reading at Staff Plate and tabular Stage-Discharge curve data) — 102.8 cfs

Recurrence Interval (Log-Pearson) associated with **"field-determined"** Bankfull Discharge — 2.0 yrs

From the *Annual Peak Flow Frequency Analysis* data for the Gage Station, determine:

1.5 Year **R.I.** Discharge =	37.90?	cfs	**10** Year **R.I.** Discharge =	10.30	cfs
2.0 Year **R.I.** Discharge =	20.60	cfs	**25** Year **R.I.** Discharge =	4.12	cfs
5.0 Year **R.I.** Discharge =	23.30	cfs	**50** Year **R.I.** Discharge =	0.47	cfs

MEANDER GEOMETRY

Meander Wavelength (L_m)	117	ft	Radius of Curvature (R_C)	48	ft
Belt Width (W_{blt})	62	ft	Meander Width Ratio (W_{blt}/W_{bkf})	2.91	ft/ft

HYDRAULIC GEOMETRY

Based on *USGS Discharge Summary Notes* data (Form 9-207) and regression analyses of measured discharge (**Q**) with the hydraulic parameters of Width (**W**), Area (**A**), Mean Depth (**d**) & Mean Velocity (**u**), determine the *intercept coefficient* (**a**) and the *slope exponent* (**b**) values for a power function of the form $Y = aX^b$, when **Y** is one of the selected hydraulic parameters and **X** is a given discharge value (**Q**).

	Width (W)	Depth (d)	Area (A)	Velocity(u)
Intercept Coefficient **a**)	22	1.8	39	27 3.3 Bosart data
Slope Exponent **b**)	23.7	2.03	38.77	2.55

Hydraulic Radius $R = A / W_P$	1.45	ft	**Manning's "n"** at Bankfull Stage	0.048	Coeff.

$$\text{"n"} = 1.4895\,[(\text{Area})\,(\text{Hydraulic Radius}^{2/3})\,(\text{Slope})^{1/2}]\,/\,Q_{bkf}$$

Worksheet 5-3. Field form for Level II stream classification (Rosgen, 1996; Rosgen and Silvey, 2005).

Stream:	**MarshRun, Reach 1 - Surveyed Reach**				
Basin:	**Marsh Run**	Drainage Area:	**12096** acres	**18.9**	mi^2
Location:	**Reach 1**				
Twp.&Rge:	;	Sec.&Qtr.:	;		
Cross-Section Monuments (Lat./Long.):	**0 Lat / 0 Long**			Date:	**04/18/13**
Observers:	**Team 1**			Valley Type:	VIII(c)

Bankfull WIDTH (W_{bkf}) WIDTH of the stream channel at bankfull stage elevation, in a riffle section.	**21.33**	ft
Bankfull DEPTH (d_{bkf}) Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A / W_{bkf}$).	**1.37**	ft
Bankfull X-Section AREA (A_{bkf}) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	**29.18**	ft^2
Width/Depth Ratio (W_{bkf} / d_{bkf}) Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section.	**15.57**	ft/ft
Maximum DEPTH (d_{mbkf}) Maximum depth of the bankfull channel cross-section, or distance between the bankfull stage and Thalweg elevations, in a riffle section.	**1.74**	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.	**28.44**	ft
Entrenchment Ratio (ER) The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH (W_{fpa} / W_{bkf}) (riffle section).	**1.33**	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.	**2048**	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.	**0.00467**	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).	**1.18**	

Stream Type **F 1** (See **Figure 2-14**)

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Worksheet 2-2. Computations of velocity and bankfull discharge using various methods (Rosgen, 2006b; Rosgen and Silvey, 2007).

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	MarshRun			Location:	Reach - Surveyed Reach
Date:	4/18/2013	Stream Type:	F2	Valley Type:	VIII
Observers:	Team 1			HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	29.18	A_{bkf} (ft^2)	Bankfull Riffle Mean DEPTH	1.37	d_{bkf} (ft)
Bankfull Riffle WIDTH	21.33	W_{bkf} (ft)	Wetted PERMIMETER ~ $(2 * d_{bkf}) + W_{bkf}$	22.63	W_p (ft)
D_{84} at Riffle	90.00	Dia. (mm)	D_{84} (mm) / 304.8	0.30	D_{84} (ft)
Bankfull SLOPE	0.0047	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.29	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R(ft) / D_{84} (ft)	4.37	R / D_{84}
Drainage Area	18.9	DA (mi^2)	Shear Velocity $u^* = (gRS)^{½}$	0.440	u^* (ft/sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $u = [2.83 + 5.66 * Log\{R / D_{84}\}] u^*$	2.84	ft / sec	82.92	cfs
2. Roughness Coefficient: a) Manning's n from Friction Factor / Relative Roughness (Figs. 2-18, 2-19) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.0391	3.08	ft / sec	89.82	cfs
2. Roughness Coefficient: b) Manning's n from Stream Type (Fig. 2-20) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.076	1.58	ft / sec	46.19	cfs
2. Roughness Coefficient: c) Manning's n from Jarrett (USGS): $u = 1.49*R^{2/3}*S^{1/2}/n$ $n = 0.39*S^{0.38}*R^{-0.16}$ 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 $n =$ 0.049	2.47	ft / sec	72.10	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.) Darcy-Weisbach (Leopold, Wolman and Miller)	3.02	ft / sec	88.16	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.) Chezy C	0.00	ft / sec	0.00	cfs
4. Continuity Equations: a) Regional Curves $u = Q / A$ Return Period for Bankfull Discharge Q = 2.0 year	3.43	ft / sec	100.00	cfs
4. Continuity Equations: b) USGS Gage Data $u = Q / A$	3.67	ft / sec	107.00	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 2-2. Computations of velocity and bankfull discharge using various methods (Rosgen, 2006b; Rosgen and Silvey, 2007).

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	MarshRun			Location:	Reach 1 - Surveyed Reach
Date:	4/18/2013	Stream Type:	F1	Valley Type:	VIII
Observers:	Team 1			HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	29.18	A_{bkf} (ft^2)	Bankfull Riffle Mean DEPTH	1.37	d_{bkf} (ft)
Bankfull Riffle WIDTH	21.33	W_{bkf} (ft)	Wetted PERMIMETER ~ $(2 * d_{bkf}) + W_{bkf}$	22.63	W_p (ft)
D_{84} at Riffle	55.42	Dia. (mm)	D_{84} (mm) / 304.8	0.18	D_{84} (ft)
Bankfull SLOPE	0.0047	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.29	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R(ft) / D_{84} (ft)	7.09	R / D_{84}
Drainage Area	18.9	DA (mi^2)	Shear Velocity $u^* = (gRS)^{1/2}$	0.440	u^* (ft/sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $u = [2.83 + 5.66 * Log\{R / D_{84}\}] u^*$	3.37	ft / sec	98.23	cfs
2. Roughness Coefficient: a) Manning's n from Friction Factor / Relative Roughness (Figs. 2-18, 2-19) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.0335	3.59	ft / sec	104.82	cfs
2. Roughness Coefficient: b) Manning's n from Stream Type (Fig. 2-20) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.076	1.58	ft / sec	46.19	cfs
2. Roughness Coefficient: c) Manning's n from Jarrett (USGS): $u = 1.49*R^{2/3}*S^{1/2}/n$ $n = 0.39*S^{0.38}*R^{-0.16}$ 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 $n =$ 0.049	2.47	ft / sec	72.10	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.) Darcy-Weisbach (Leopold, Wolman and Miller)	3.57	ft / sec	104.17	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.) Chezy C	0.00	ft / sec	0.00	cfs
4. Continuity Equations: a) Regional Curves $u = Q / A$ Return Period for Bankfull Discharge Q = 2.0 year	3.43	ft / sec	100.00	cfs
4. Continuity Equations: b) USGS Gage Data $u = Q / A$	3.67	ft / sec	107.00	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-4. Procedure to validate hydraulic relations using gage station data.

1. Obtain the drainage area associated with the gaging station.
2. Obtain the field-determined bankfull discharge at the gaging station (**Figure B-43**).
3. Obtain the bankfull channel dimensions from the gaging station hydraulic geometry relationships (discharge vs. width, depth, area and velocity).
4. Measure the average water surface slope.
5. Perform an active bed pebble count on the riffle to obtain D_{84}.
6. Determine the stream type.
7. Solve for Manning's 'n' at the bankfull stage: $n = (1.49R^{2/3}S^{1/2})/\bar{u}$ (use the bankfull mean velocity from Step 3).

   1.185, 0628 = $\frac{0.1109}{\bar{u}}$ = 0.0444

8. Calculate relative roughness: R/D_{84}. Make sure that D_{84} is converted from millimeters to feet. Hydraulic radius (R) and mean depth (d_{bkf}) are often used interchangeably when width/depth ratios are greater than 12.
9. Calculate shear velocity: $u^* = (gRS)^{1/2}$.
10. Calculate friction factor: $\bar{u}/u^*$.

    32.13 = g

11. Plot bankfull discharge as a function of drainage area on the appropriate regional curve.
12. Plot bankfull channel dimensions as a function of drainage area on the appropriate regional curve (note stream type of plotted values using unique symbols).
13. Plot relative roughness by friction factor (**Figure B-34**) (Example in **Figure B-39**).
14. Plot Manning's 'n' by friction factor (**Figure B-35**) (Example in **Figure B-40**).
15. Plot Manning's 'n' by stream type (**Figure B-36**) (Example in **Figure B-41**).

Gaging Station Name: Marsh Run at Grimes, MD **Gaging Station Number:** 01617800

Drainage Area (mi^2)	Bankfull Discharge Q_{bkf} (cfs)	Bankfull Width W_{bkf}	Bankfull Mean Depth d_{bkf} (ft)	Bankfull Area A_{bkf} (ft^2)	Bankfull Velocity $\bar{u}_{bkf}$ (ft/s)	Ave. Water Surface Slope S (ft/ft)	D_{84} (mm)	D_{84} (ft)	Stream Type	Manning's 'n'	Relative Roughness R/D_{84} (ft/ft)	Shear Velocity u^* (ft/s)	Friction Factor $\bar{u}/u^*$
18.9	107.2	24.0	1.7	40.0	2.5	.00395	90	0.295	F1	0.044	4.37	0.405	6.17

R = 1.29

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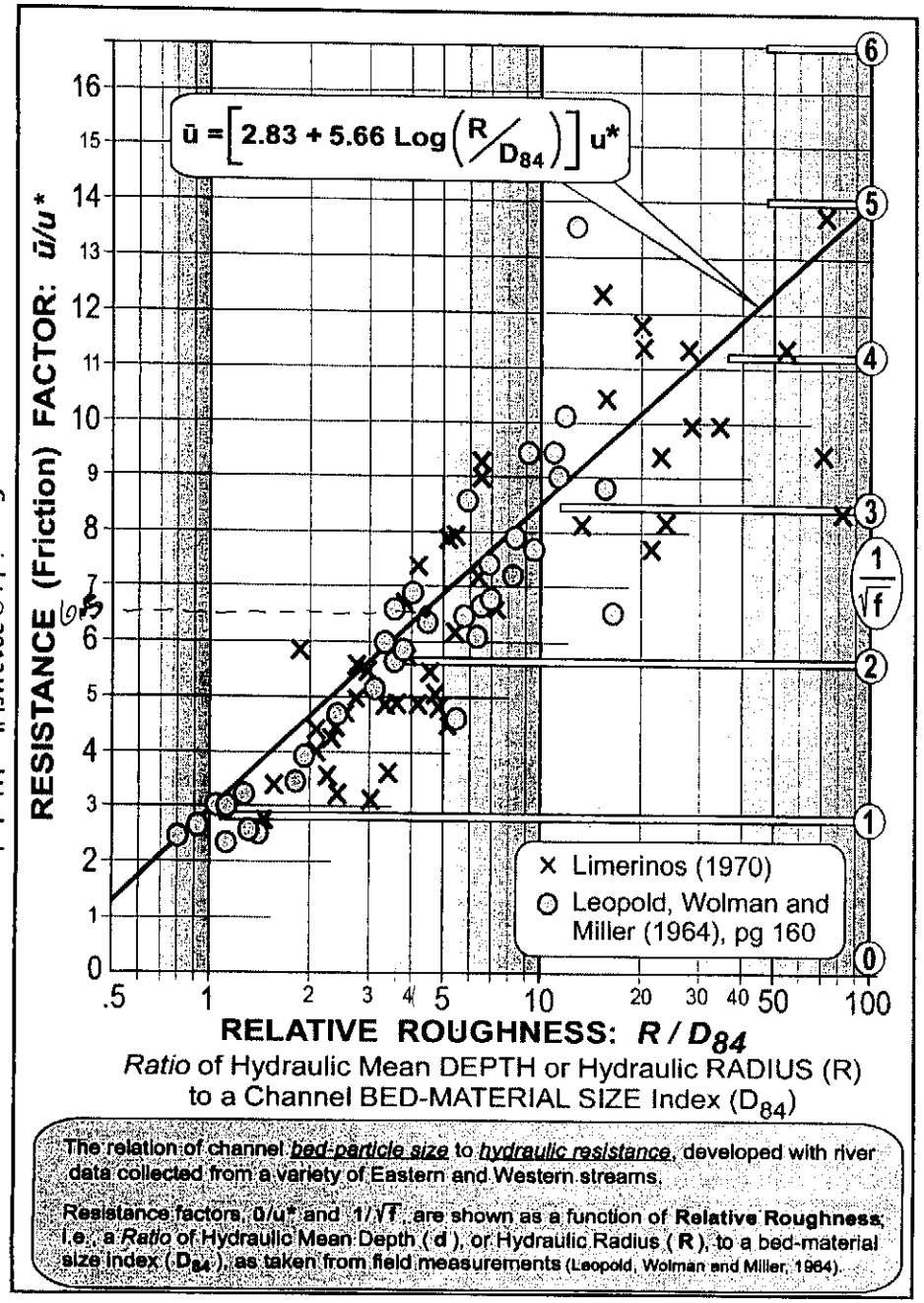

Figure B-34. Relative roughness (R/D_{84}) *vs.* friction factor ($\bar{u}/u^*$).

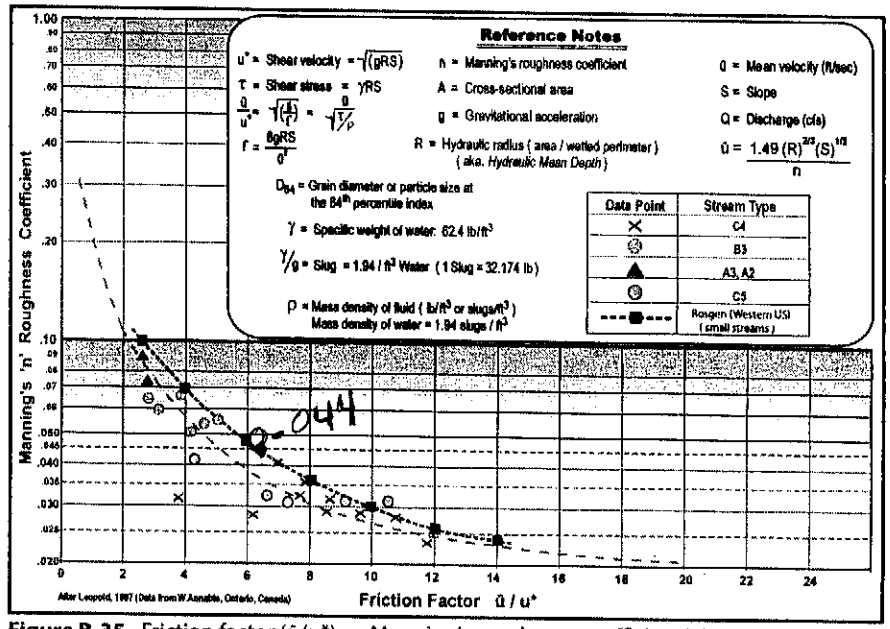

Figure B-35. Friction factor ($\bar{u}/u^*$) *vs.* Manning's roughness coefficient 'n'.

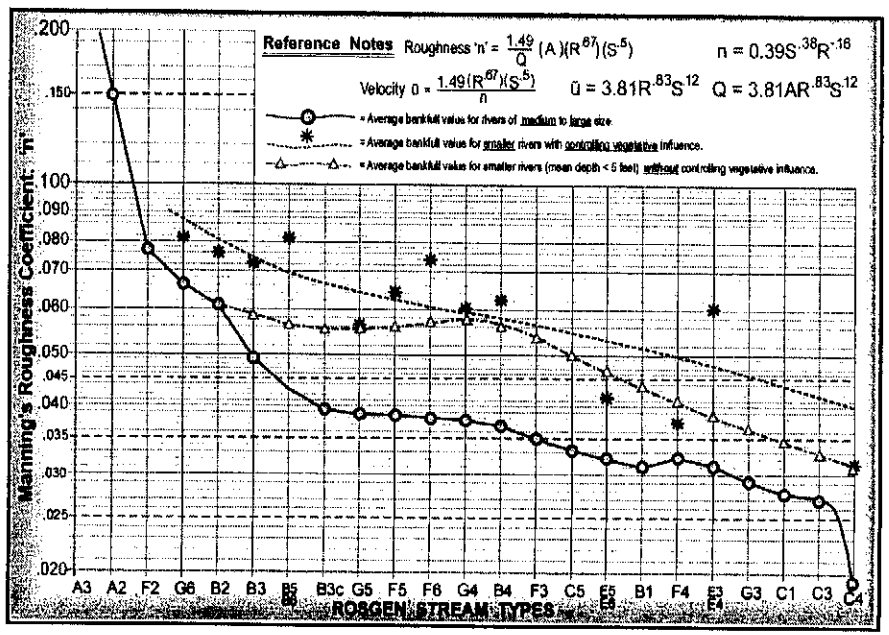

Figure B-36. Manning's 'n' roughness coefficient by stream type.

N/A
F1 not shown

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ARC length - outside of Bend

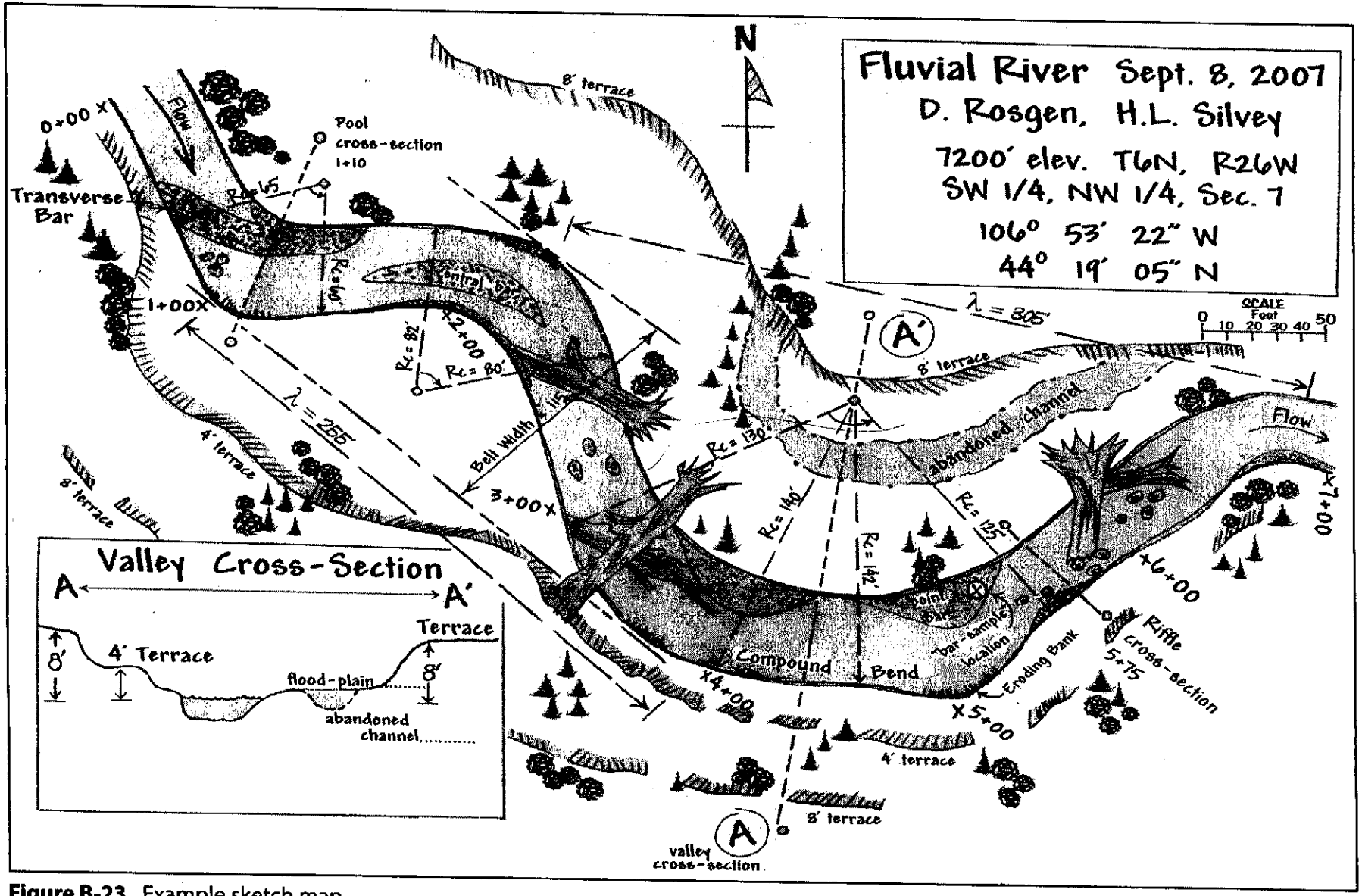

Figure B-23. Example sketch map.

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128'

SURVEY DATA → CROSS - SECTION 2

SITE: Marsh Run RIFFLE (STA 0+03.6) Date: 4/18/13

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29	0			4.38		LEP
30	1.8			4.60		TOB / Terrace
31	2			5.35		eroded bank
32	3			6.79		
33	4.1			8.49		TOS
34	6			9.01		
35	7.6			9.15		
36	8.7			8.98		
37	10			8.76		
38	12.5			9.19		
39	14.5			9.07		
40	16			9.22		dS of rock
41	18.6			9.33		0.88-0.9 H_2O depth
42	22.3			8.98		
43	25			8.89		
44	27			8.45		REW / H_2O Surface
45	27.5			8.23		Lip bench/berm
46	28.5			8.00		
47	29			7.82		back berm
48	29.7			7.32		BKF (?)
49	29.9			6.33		
50	30.4			5.72		TOB
51	32.0			4.91		
52	34.			4.50		REP
53						
54						
55						
56						
57						
58						
59						

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SURVEY DATA → **CROSS - SECTION 3**

SITE: Meroh Run Run XS (STA 0+36) Date: 4/18/13

BS to TBM 6.33

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES / COMMENTS / REMARKS
29	0			3.98		LEP
30	1			4.26		
31	2.5			4.74		
32	3.5			5.40		
33	4.8			6.37		
34	5.6			7.36		
35	6.3			8.3		Water surface / LEW
36	6.4			9.69		
37	7.7			9.93		
38	9			9.68		
39	10.2			9.35		
40	12			9.27		
41	14			9.35		
42	16			9.17		
43	18.2			9.18		bar forming
44	19			9.08		
45	20.4			8.76		
46	21.8			8.76		
47	22.9			8.50	8.31 Water surface	REW
48	23.2			7.93		top berm
49	23.6			7.66		
50	24	24.4		7.42	7.13	BKF (inc in slope
51	24.6			7.09		
52	25.3			6.37		
53	26.2			5.89		
54	27			5.17		
55	28			4.66		
56	29			4.35		
57	31			4.28		REP
58						
59						

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SURVEY DATA → CROSS - SECTION 4

SITE: Marsh Run Pool Sta 0+69 **Date:** 41

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES / COMMENTS / REMARKS
29	BM			6.49		
30	0			3.48		
31	1			3.53		
32	1.5			3.67		
33	3			4.15		
34	3.8			4.75		Roots
35	4.4			5.87		Below Root
36	5.1			6.44		LTOE
37	7			6.91		
38	7.2			7.05		Above log
39	8.2			7.33		Below log
40	9			7.42		LEW/WS
41	9.6			7.68		
42	11			8.20		
43	12.5			8.53		
44	14.5			9.03		
45	16			9.74		
46	18.5			10.40		
47	20.3			10.80		T
48	22.9			10.48		Woody debris in channel
49	23.9			9.56		
50	25.5			9.06		
51	26.5			8.79		
52	28.4			7.97		
53	30			7.49		REW/WS
54	30.3			7.39		
55	30.5			7.14		Top Berm
56	31.3			6.73		
57	32.1			6.63		
58	32.4			6.49		
59	32.6			6.39		BKF?

48 6.26

Pt Bar Slop 0.351

Sta	Rod
33	6.25
33.6	5.87
34.7	4.43
35.6	4.17
37.5	4.2
39	4.23

Notes: Extent of Bank Erosion RTOB

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BKF Width 21.6

32 FT2
14 W/D
3.3 FPS
1.31E Ratio
FP Width = 28.2

SURVEY DATA → CROSS - SECTION 1

SITE: Marsh Run Date: 4/18/13

Location: Reach 1 / Team 1 Riff Classification

Party / Notes: Sta 1+08 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 BM = 6.52
1	0+00			4.02		
2	0+01			4.09		LTOB
3	0+02			4.39		
4	0+02.8			4.91		Exposed roots on bank
5	0+06.7			8.72		LTOE
6	0+07.4			8.94		LEW/WS
7	0+08			9.25		
8	0+11			9.40		
9	0+13			9.33		
10	0+15.8			9.65		T
11	0+17			9.61		
12	0+17.8			9.32		
13	0+19			9.48		
14	0+21			9.44		
15	0+23.5			9.36		
16	0+25.7			9.30		RTOE
17	0+25.7			9.00		REW/WS
18	0+26			8.84		
19	0+26.3			8.67		
20	0+26.7			8.43		
21	0+26.8			7.99		
22	0+27.2			7.91		BKF
23	0+27.8			7.78		Bench/BKF?
24	0+29			7.60		Bench
25	0+29.6			7.49		Bench toe
26	0+31			6.87		
27	0+34			5.50		
28	0+36.3			4.62		RTOB

5.6

0+40

4.33

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SURVEY DATA → CROSS - SECTION 5

SITE: ~~15~~ XS - ~~154~~ 154 Run. Libby & Melissa Date: 4/18/13

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29	0	6.51	106.51	5.85		
30	1.9			6.08		
31	4.1			6.40		
32	6.0			6.84		
33	7.0			7.12		~~BKFl~~ ?
34	7.8			9.72		
35	8.3			9.88		
36	10.3			10.19		
37	11.8			10.19		
38	12.9			10.01		Rif 0+04
39	14.1			10.02		Pool 69
40	15.5			10.05		Run 36
41	17.3			9.99		Glide 91
42	20.5			10.03		Rif 1+08
43	22.3			10.03		Rifr 1+71
44	23.6			10.17		Pool 187
45	25.2			10.17		Glide 214
46	27.2			10.15		
47	28.8			10.08		
48	30.1			9.54		REW
49	33.7			6.05		TO Bank
50	36.0			5.23		
51	39.0			5.21		
52		Undercut banks on LEW:				
53	~~800~~ 7.9	undercut		9.72		
54		-0.65		9.72 - 0.27		Cross section was taken
55		-1.88		9.72 - 0.73		at TOP of Run instead
56		-0.83		9.72 - 1.66		off middle.
57		-0		9.72 - 2.4		Did another run at
58						STA 1+71
59						

7.54
+2
2.42

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Need to extrapolate BKFl - no indicator

— gt Point bar Slope —

SURVEY DATA ⟹ CROSS - SECTION 6

SITE: XS-187 Pool Date: 4/18/13

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
29	0			4.44		Lbank
30	4.7			5.5		
31	7.0			6.04		
32	8.5			6.46		
33	9.8			6.85		
34	11.0			7.12		
35	12.4			7.30		
36	13.8			7.46		
37	14.2			7.57		
38	15			8.20		BKF
39	15.8			8.63		
40	16.4			8.84		
41	17.0			9.21		
42	18.[illegible]2			9.52		LEW
43	19.6			9.91		
44	20.5			10.08		
45	21.9			10.37		
46	23.2			10.45		
47	24.8			10.38		
48	25.5			10.93		
49	26.8			11.13		
50	30.2			11.77		Trees blocking laser
51	31.4			11.61		
52	32.3			11.29		
53	33.5			11.21		
54	35.3			10.92		
55	36.3			10.17		
56	37.9			9.41		
57	38.9			9.66		
58	39.8			9.52		REW
59	41.0			9.21		
60	42.3					
61	33.4					

	SI	FS
62	44	6.51
63	47	6.50
[illegible]	-19	6.51

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2

Sheet 1 of 4

SURVEY DATA → LONGITUDINAL PROFILE 1

SITE: Marsh Run — Date: 4/18/13

Location: Reach 1

Party / Notes: Team 1 — HUC:

top of driving pin BM = 100

	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	-9.0	6.50	106.50	8.95		8.34				5.58		Just upstream of wooden bridge	
2	2.0			9.21		8.41		7.35 ?				riffle XS 23.6	1.06
3	6.5			9.16		8.42							
4	10.0			9.20		8.44							
5	15.0			9.62		8.43							
6	18.0			9.56		8.46							
7	21.0			9.54		8.44							
8	23.0			9.55		8.44		7.28		5.46			1.16
9	28.0			9.52		8.46							
10	30.0			9.39		8.45		7.32					1.13
11	32.0			9.64		8.42							
12	36.0			9.80		8.47						run XS	
13	37.0			9.92		8.46							
14	40.0			9.93		8.45							
15	42.0			9.63		8.45							
16	45.0			9.63		8.43							
17	-22.2			7.15		6.92		6.28 ?				Top of [illegible] dam, log, check dam	
18	-20.0			9.37		8.39						step at base of check dam	
19	47.0			9.86		8.46							
20	50.0			11.03		8.47						pool	
21	53.0			11.18		8.44						pool	
22	55.0			11.32		8.46						pool	
23	58.0			11.46		8.46						pool	
24	59.0			11.44		8.46						pool	
25	61.0			11.37		8.46						pool	
26	66.0			11.84		8.98		7.33		5.91		~~[illegible]~~ pool	1.15
27	69.0			11.42		8.45						bottom pool	pool XS

backwater pool just downstream of check dam caused by in channel debris and lateral scour pool

went back to start of LP to shoot ☆ ☆

measured height of dam = 5.13 ft.

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SURVEY DATA → LONGITUDINAL PROFILE 2

SITE: Marsh Run — Date: 4/18/13

Location: Reach 1

Party / Notes: Team 1 — 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	
28	72.0	6.5	106.50	10.91		8.46						glide	
29	77.0			10.28		8.44						glide	
30	77.2			9.57		8.48						bedrock mid glide	
31	81.0			9.37		8.51						glide	
32	83.0			9.14		8.50						glide	
33	87.0			9.12		8.48						glide	
34	88.0			9.08		8.56						top riffle	
35	90.0			9.30		8.76						riffle	
36	92.0			9.40		8.74						riffle	
37	93.0			9.53		8.77				5.06		riffle	
38	95.0			9.64		8.90						feature? run?	
39	96.0			9.37		8.85						" run?	
40	100.0			9.52		8.81						" run?	
41	104.0			9.88		8.88						pool -small	
42	105.0			9.91		8.93						pool small	
43	106.0			9.58		8.98						slide	
44	108.0			9.64		8.99		7.95				riffle XS station	1.04
45	111.0			9.57		8.93						Tupinn	
46	116.0			9.46		9.05						run	
47	120.0			9.68		9.23						run	
48	124.0			9.94		9.24		8.10				"	1.14
49	125.0			9.97		9.24						"	
50	129.0			10.24		9.52						"	
51	138.0			10.30		9.48						"	
52	149.0			10.31		9.46						"	
53	153.5			10.04		9.49				7.01		run XS	
54	167			10.69		9.46							

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SURVEY DATA ⟶ LONGITUDINAL PROFILE 3

SITE: Marsh Run **Date:** 4/18/13

Location: Reach 1

Party / Notes: Team 1 **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	
55	178.0	6.50	106.50	11.02		9.47						pool	
56	187.0			11.75		9.47		8.46				pool XS	1.01
57	199.0			11.29		9.43						Top glide	
58	207.0			11.27		9.47						glide	
59	216.0			10.43		9.49		8.49				glide XS	1.0
60	221.0			10.54		9.53							
61	223.0			10.45		9.52		8.40					1.12
62	227.0			10.35		9.52							
63	231.0			10.75		9.53				7.39			
64	238.0			10.82		9.54							
65	240.0			11.85		9.55							
66	243.0			11.90		9.54							
67	252.0			10.75		9.55		8.49				good BKF indicator	1.06
68	TP	BS = 7.11	FS = 6.50										
69	303.3	7.11		BM 9.37 → staff gage reads 2.0 ft. BM 8.37 → " " " 3.0 ft.								gage reading @ 13:45	1.22
70	303.3			BM 10.49 → upper intake "T" center									
71	303.3			BM 11.06 → lower intake "T" center									
72	263.0			11.51		10.14							
73	272.0			11.50		10.17							
74	278.0			11.56		10.16							
75	289.0			11.23		10.13				7.89			
76	292.0			11.22		10.16		9.05					
77	298.0			11.42		10.17		9.11				staff gage reading @ 14:00	1.12 1.06 1.22 @ 14:00
78	303.3			11.50		10.17							
79	309.0			11.72		10.18						pool	
80	319.0			11.28		10.16							
81	326.0			11.17		10.21							

6.50

7.11

turning point & BM's

staff gage →

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Page 4 of 4

SURVEY DATA → LONGITUDINAL PROFILE 4

SITE: Marsh Run Date: 4/18/13

Location: Reach 1

Party / Notes: Team 1 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	330.0			11.19		10.23						
83	335.0			10.65		10.31				8.47		Top riffle
84	338.0			11.34		11.04						Top run
85	341.0			11.90		11.15						run
86												
87												
88												
89												
90												
91												
92												
93												
94												
95												
96												
97												
98												
99												
100												
101												
102												
103												
104												
105												
106												
107												
108												

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SURVEY DATA ⟶ **CROSS - SECTION 8**

SITE: Glide XS-90.5 (Sight Level) **Date:** 4/18/13

Item	STATION ft	~~BS~~ FS ft 7.05	HI ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29		~~[illegible]~~	107.50			Benchmark
30	0	5.42				
31	2.1	5.87				
32	3.3	6.38				undrwt - no LEW
33	4.3	7.87				
34	4.4	7.89				BKF ?
35	4.6	9.22				
36	6.4	9.99				
37	8.0	9.79				
38	10.0	9.70				
39	12.0	9.72				
40	13.0	9.76				
41	15.6	9.72				
42	17.7	9.70				
43	19.7	9.83				
44	21.7	9.72				
45	~~21.0~~					
46	22.5	9.83				
47	23.9	9.93				
48	25.1	9.93				
49	26.4	9.93				
50	27.4	9.63				
51	28.5	9.58				
52	29.8	9.27				REW) Elev = 1.1
53	30.6	8.17				BKF
54	33.0	5.40				
55	37.0	5.20				
56	40.0	5.19				
57						
58						
59						

4

1.05

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Benchmark 6.51

SURVEY DATA → CROSS - SECTION 7

SITE: XS-214 Glide Date: 4/18/13

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
29	0			4.56		Left
30	5.6			6.47		
31	7.4			6.97		
32	8.4			7.22		
33	9.6			7.35		
34	10.7			7.58		
35	11.4			7.73		
36	11.8			8.08		
37	12.3			8.30		
38	12.6			8.57		
39	12.9			8.69		
40	13.3			8.87		BKF ? no clear indicators
41	13.7			8.92		
42	14.0			9.13		
43	14.3			9.34		
44	14.9			9.43		
45	15.6			9.53		LEW
46	16.4			9.69		Station FS
47	17.2			9.94		64 4.24
48	17.9			10.19		65 4.26
49	19.5			10.23		66 4.29
50	21.0			10.34		
51	22.7			10.37		
52	24.3			10.43		
53	~~25.4~~					Tree
54	26.5			10.61		
55	27.3			10.74		
56	27.7			10.74		
57	28.2			10.48		
58	29.3			10.35		
59	30.0			10.10		
60	30.7			9.56		REW
61	31.7			8.94		
62	33.8			6.56		
63	34.7			5.07		

Notes edge of row bank grass

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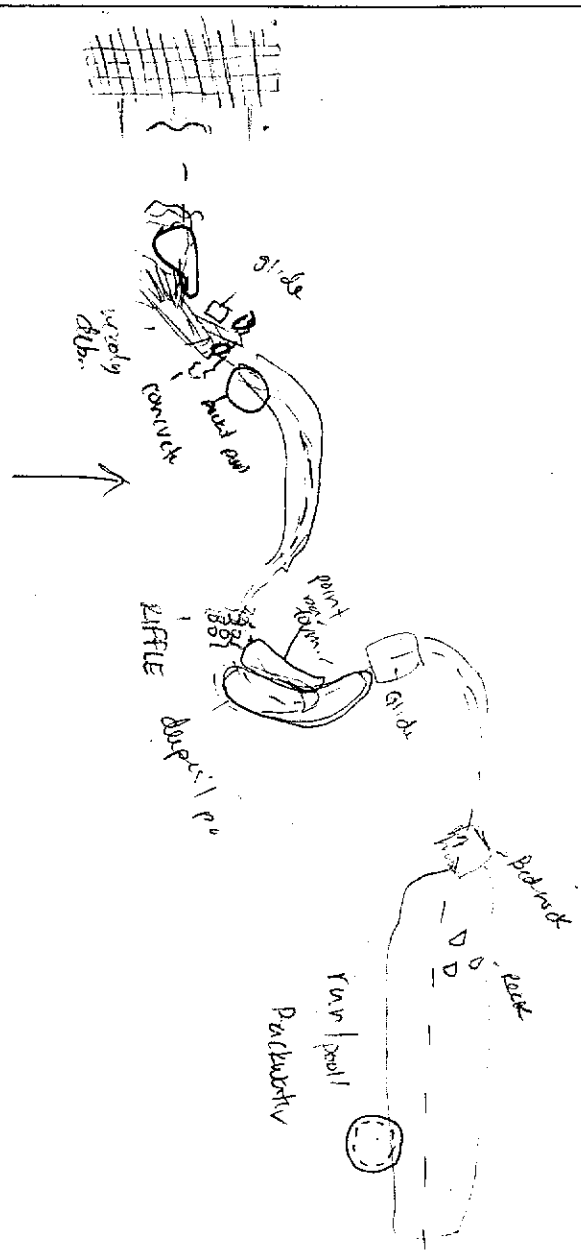
3

→ OVER

AREA-SITE LOCATION....REACH MAP

Stream: _____ Reach: _____

Drawn By: _____ Date: _____



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Stream length - 337'
valley length - 285'
Meander length - 108'
(λ)

RAY

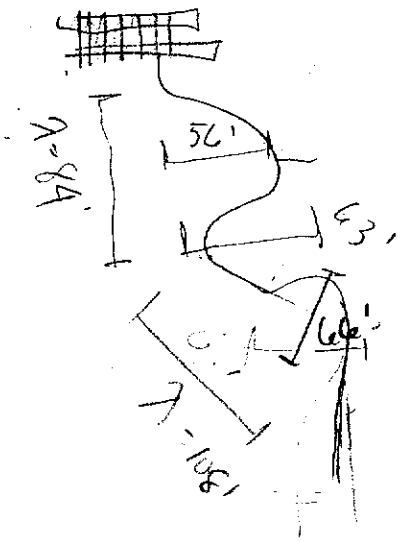
1st RC = 68'

Geometry & Sketch Map

Geometry Instructions.....B109

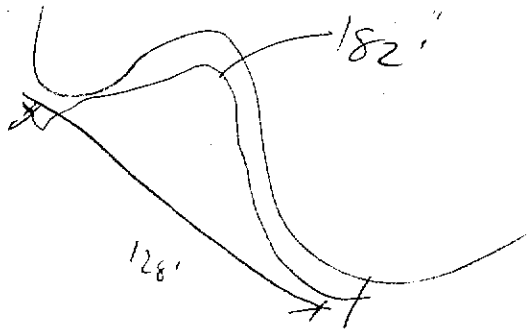
Sketch Map – *First Field Day*.....B111

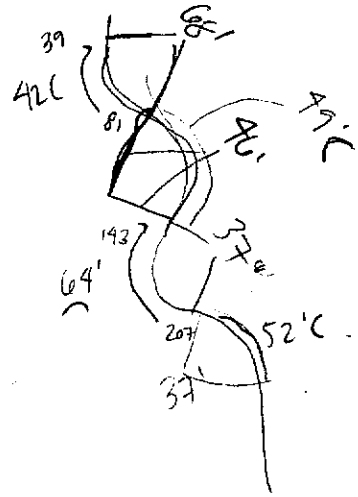
Sketch Map – *Second Field Day*.....B112



downstream λ length
122 - 246
(124')

upstream λ run
62 - 171
(109)





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

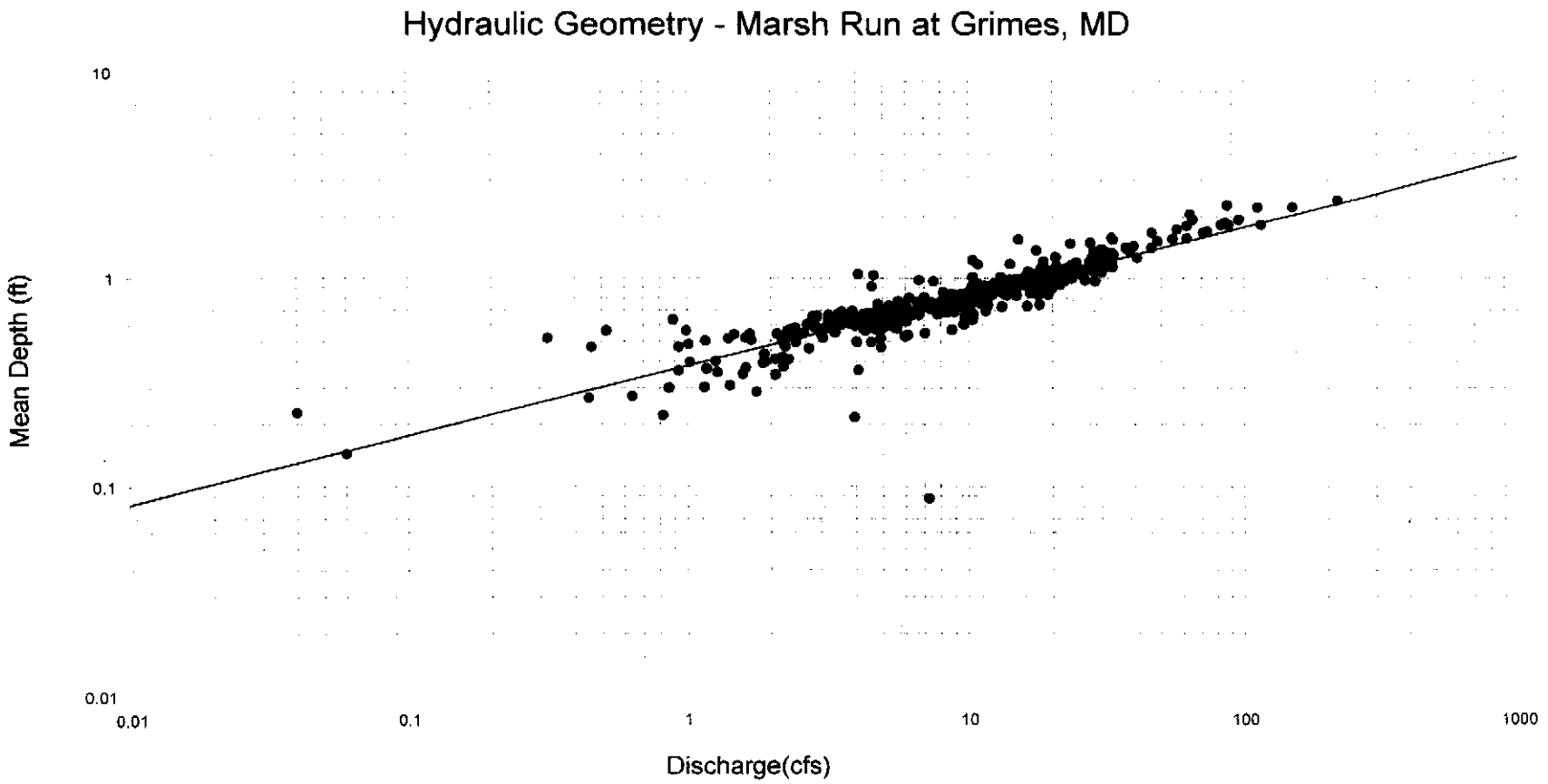
<u>Team 1</u> Breakout Room 151A-IW

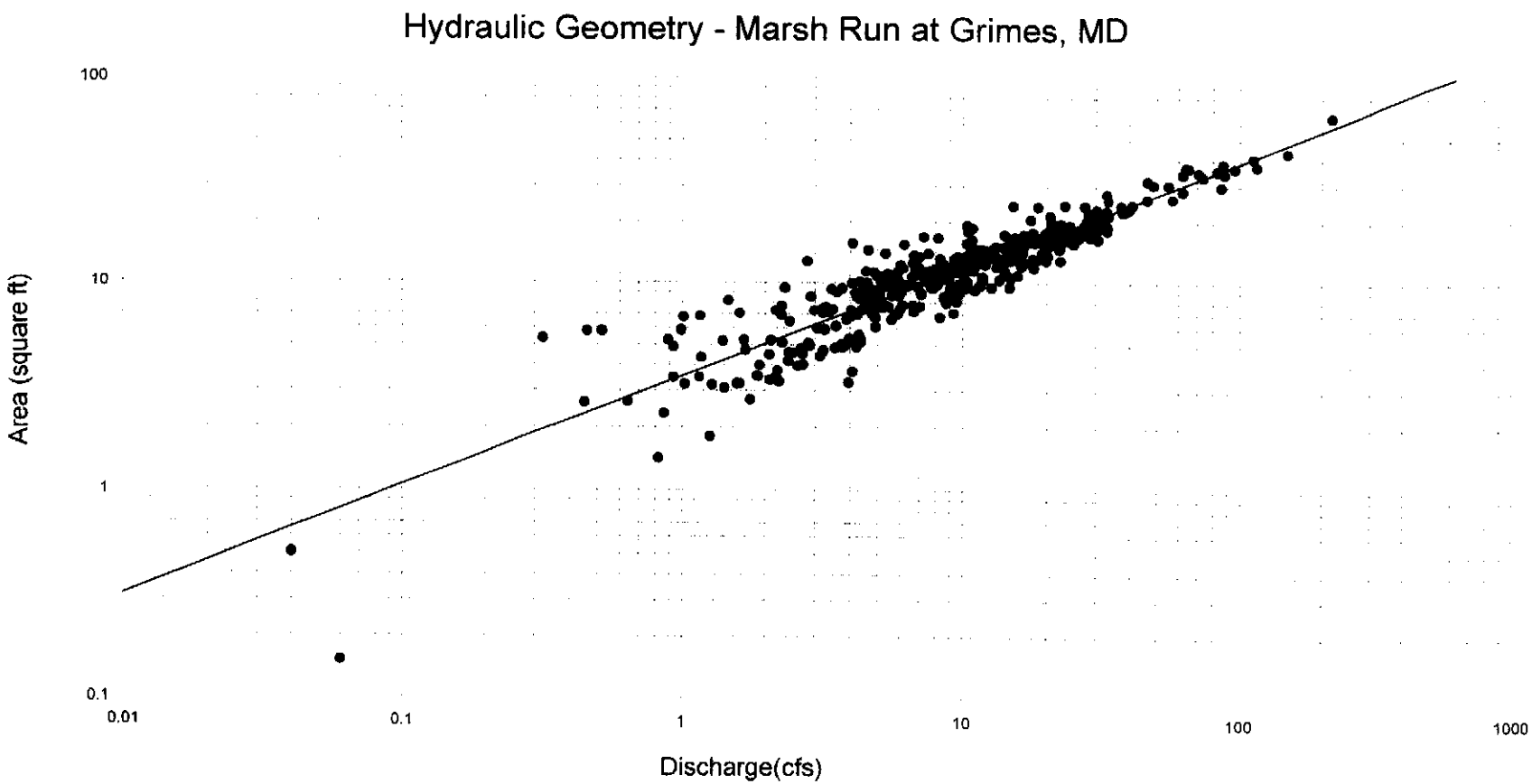
Michael Aust
Matthew Bennett
Elizabeth Benolkin
Melissa Harlinski
Sarah Look
Jason Mays
John Nelson
Ashley Pliner
Kevin Verweire
Kathryn Tomlinson

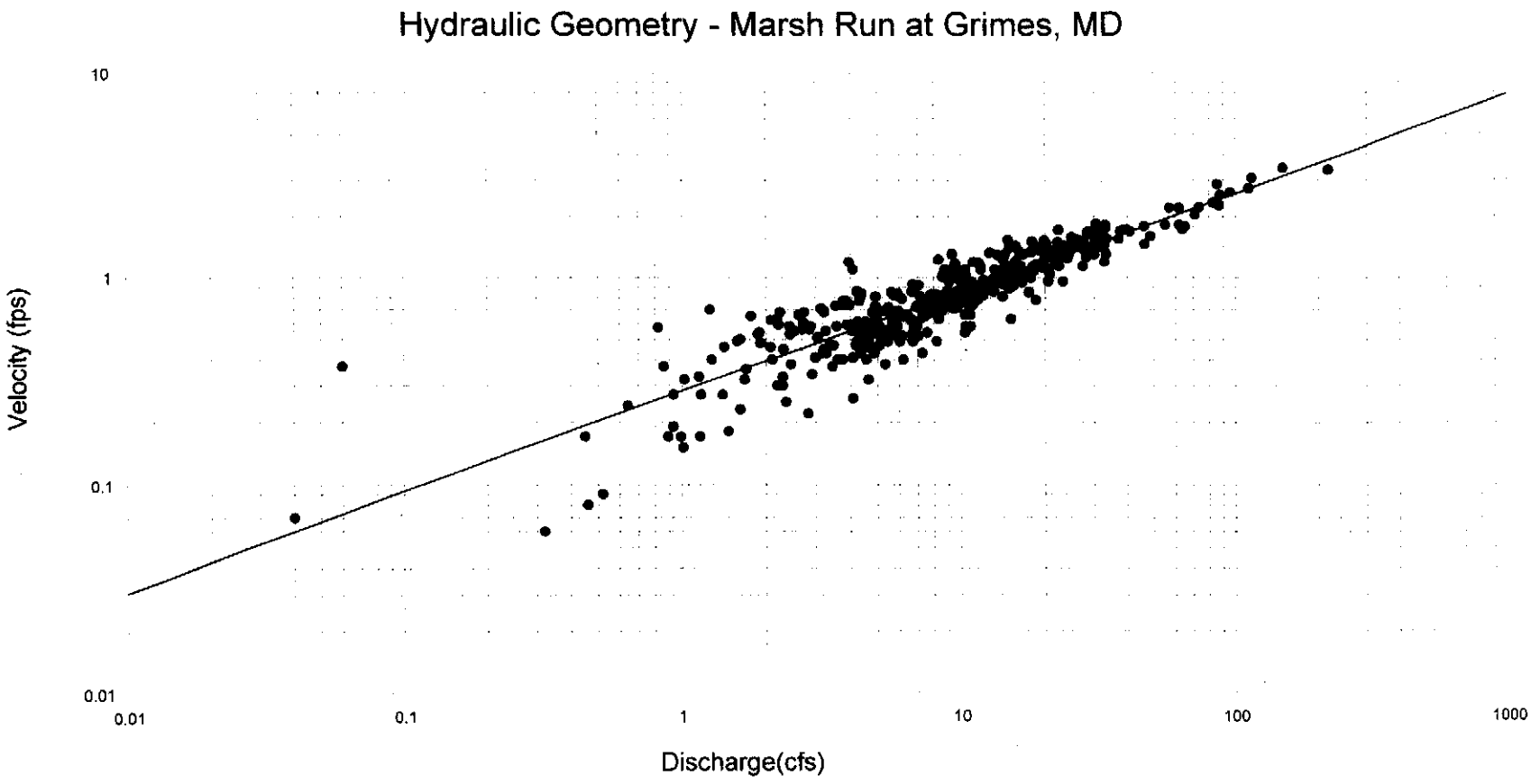
Each team is responsible for identifying a **FOLDER HOLDER** and an **EQUIPMENT PERSON.**

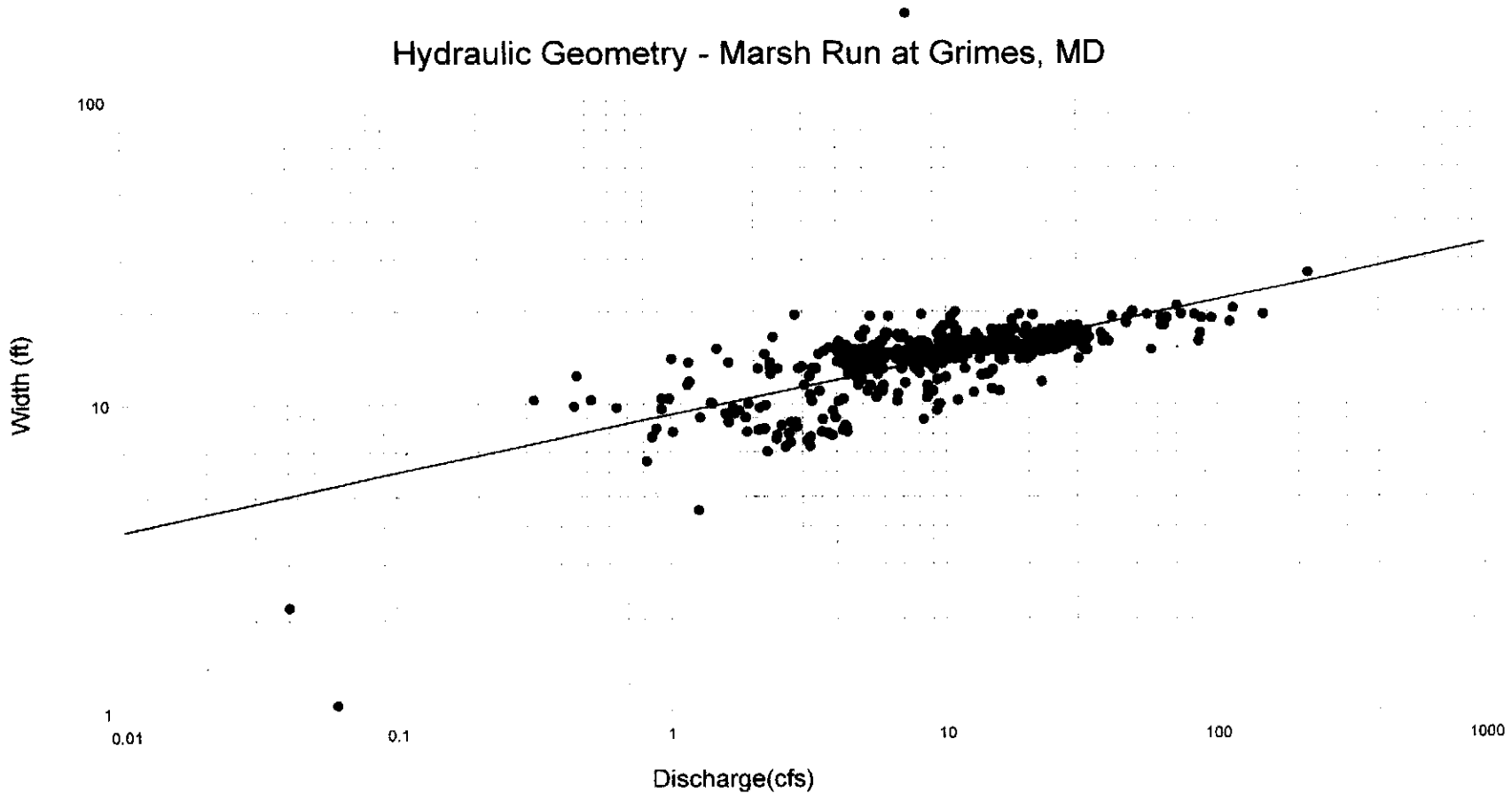
The **FOLDER HOLDER** on each team will be responsible for collecting photo copies of raw data from field books, cross sections, longitudinal profiles, pebble counts, bank profiles and photo copies of all completed forms and finalized plots, making sure they are inserted into the appropriate team field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


Hydraulic Geometry - Marsh Run at Grimes, MD
Mean Depth (ft)
10
1
0.1
0.01
0.01
0.1
1
10
100
1000
Discharge(cfs)


Hydraulic Geometry - Marsh Run at Grimes, MD
Area (square ft)
100
10
1
0.1
0.01
0.1
1
10
100
1000
Discharge(cfs)

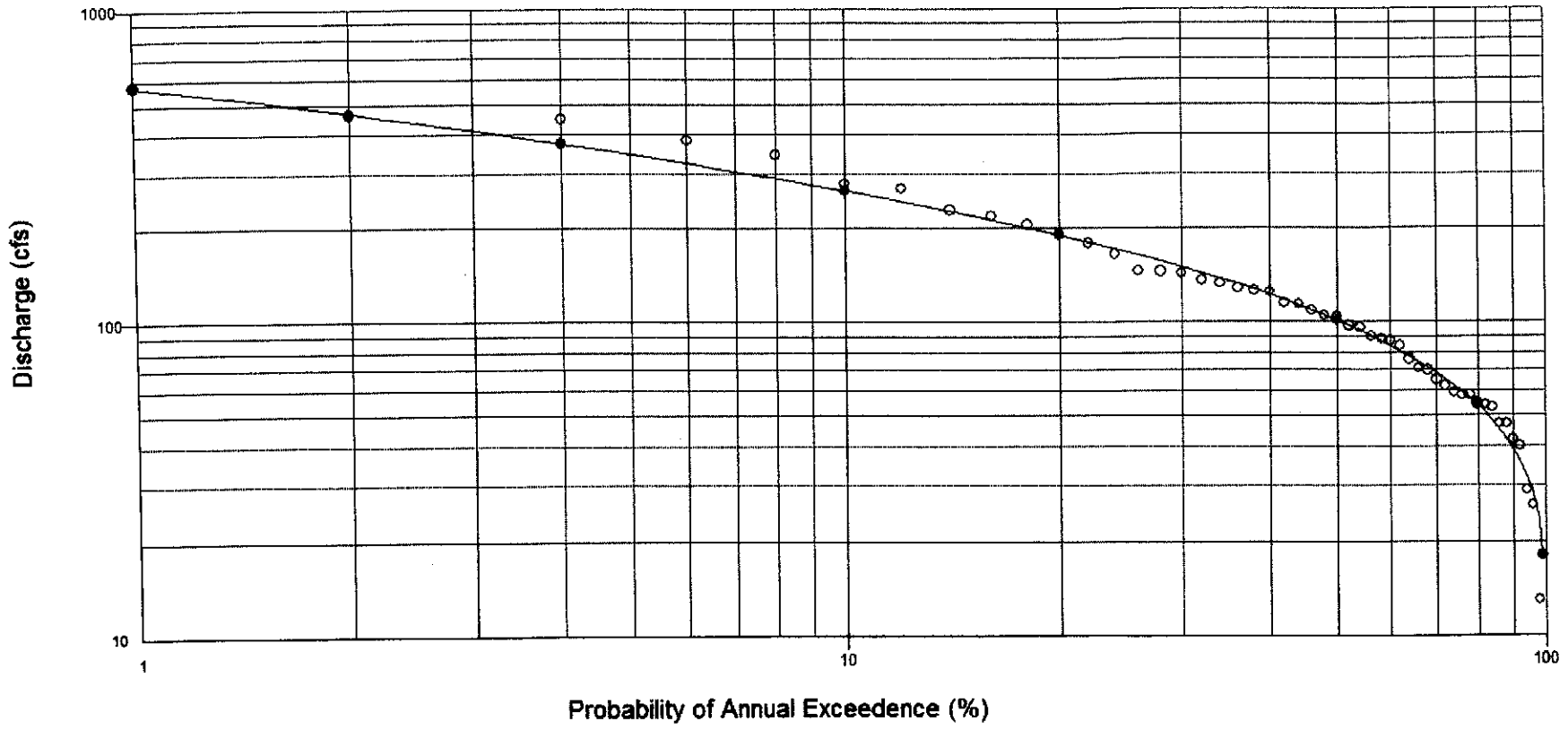

Hydraulic Geometry - Marsh Run at Grimes, MD
Velocity (fps)
10
1
0.1
0.01
0.01
0.1
1
10
100
1000
Discharge(cfs)

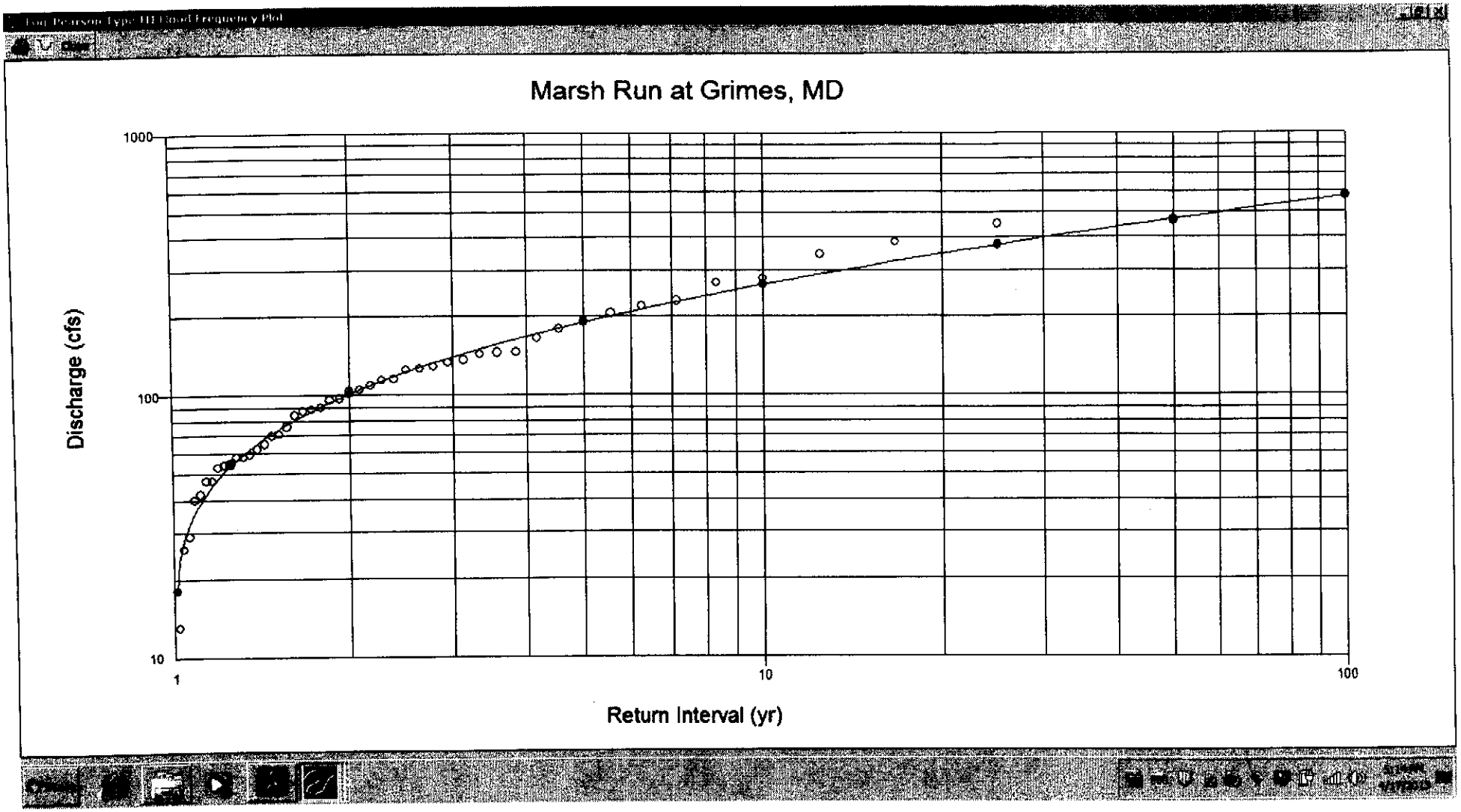

Hydraulic Geometry - Marsh Run at Grimes, MD
100
10
1
Width (ft)
0.01
0.1
1
10
100
1000
Discharge(cfs)

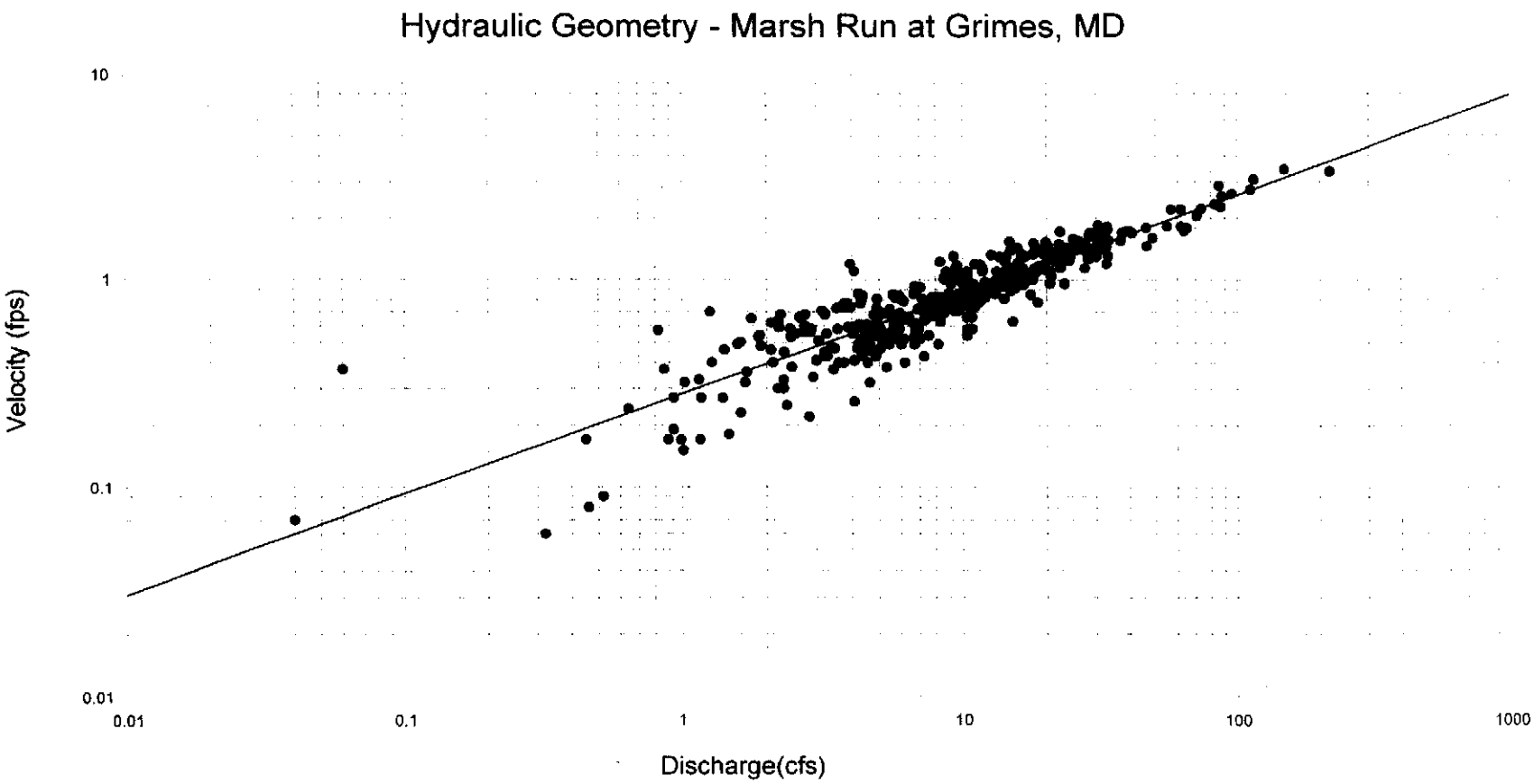
Log Pearson Type III Flood Frequency Plot

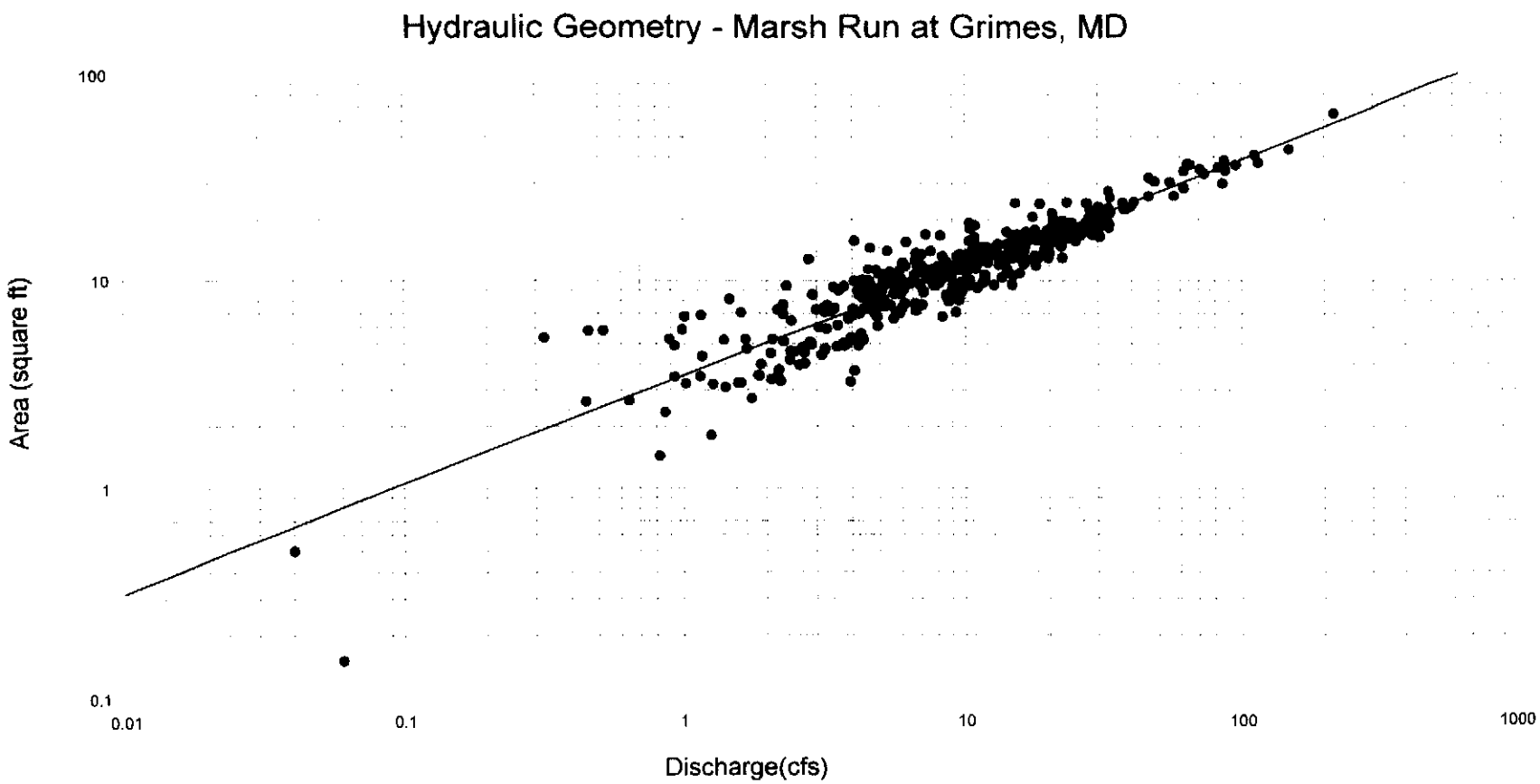
Close Graph

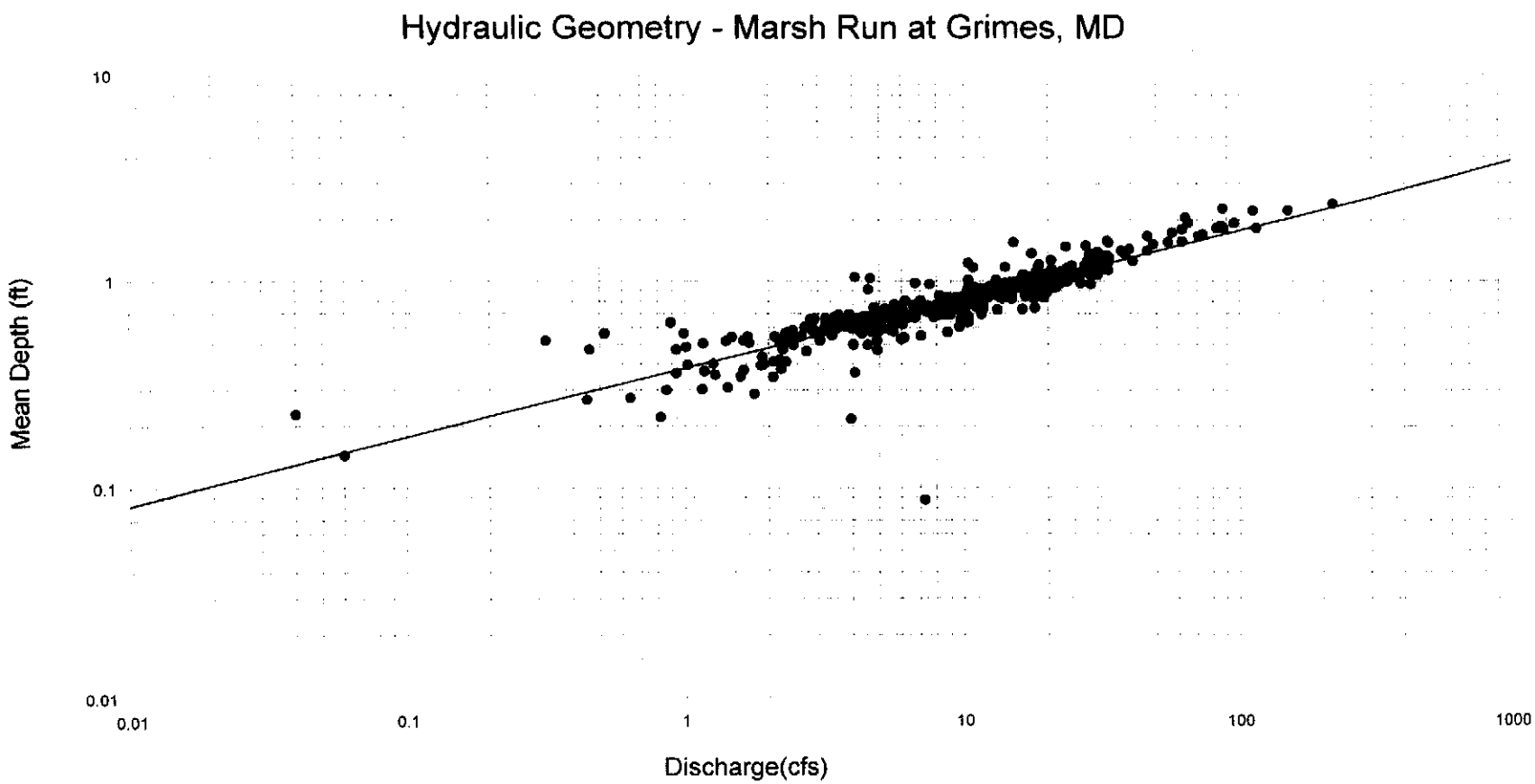
Marsh Run at Grimes, MD

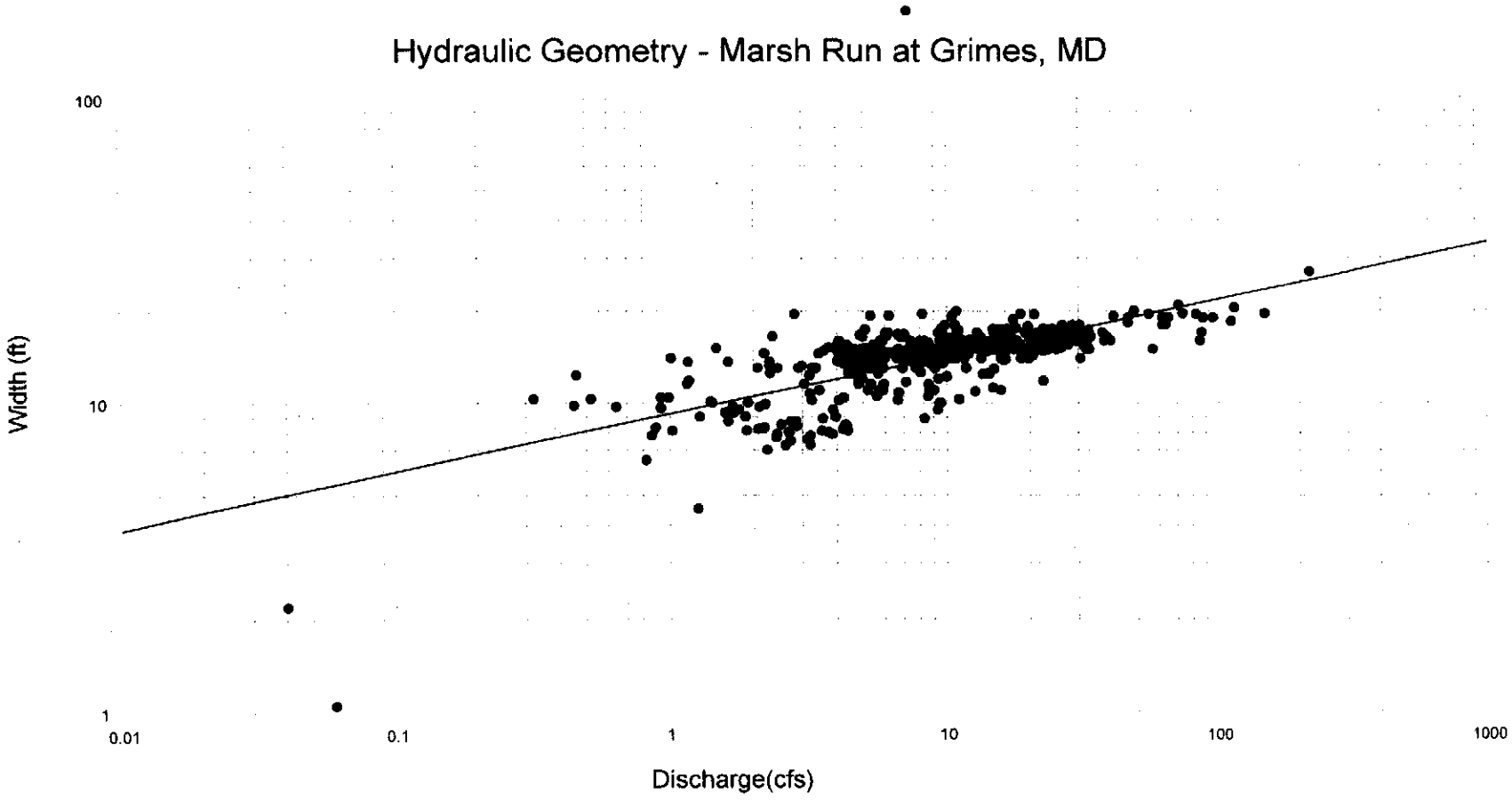


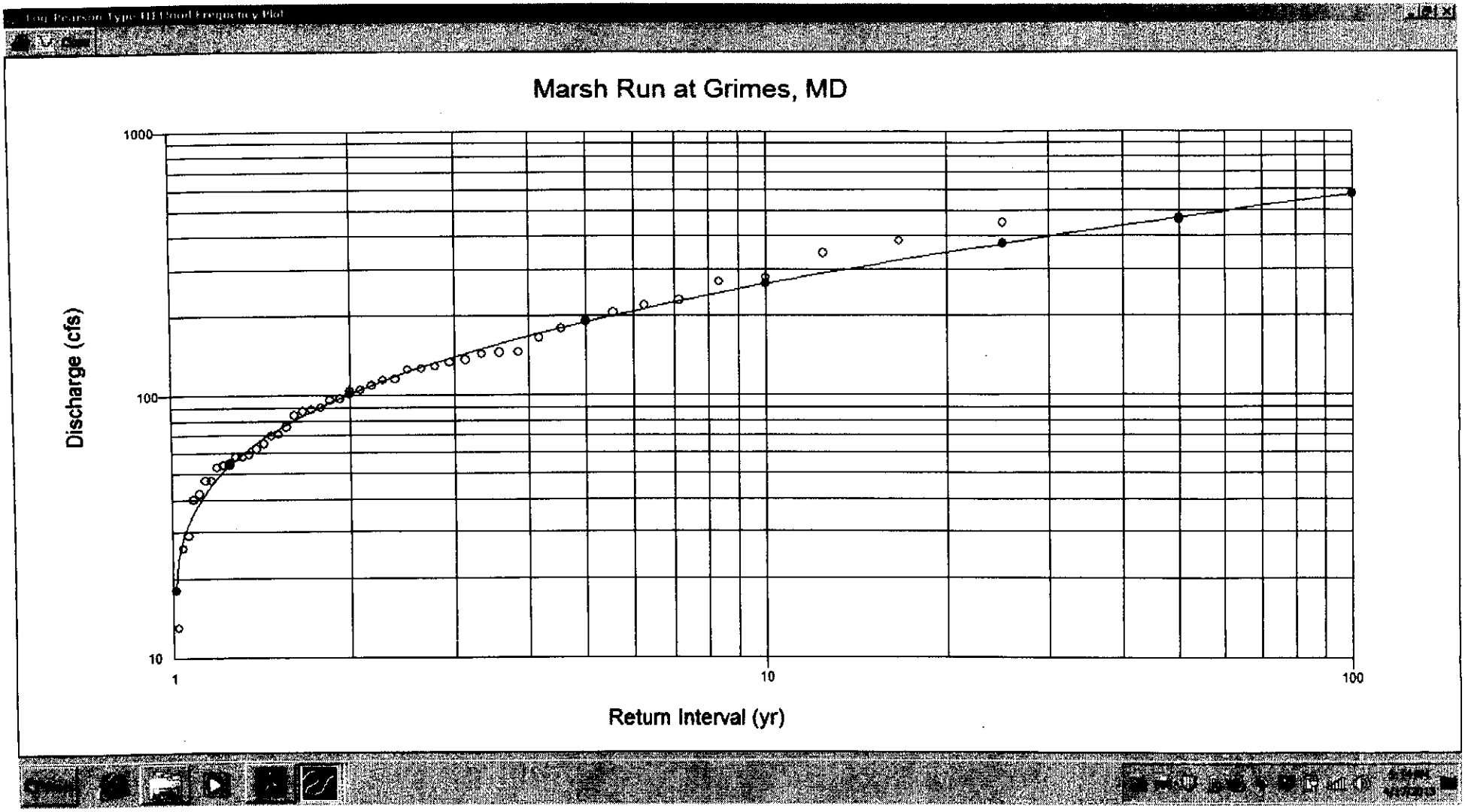

Marsh Run at Grimes, MD
Discharge (cfs)
1000
100
10
1
10
100
Return Interval (yr)


Hydraulic Geometry - Marsh Run at Grimes, MD
Velocity (fps)
10
1
0.1
0.01
0.01
0.1
1
10
100
1000
Discharge(cfs)


Hydraulic Geometry - Marsh Run at Grimes, MD
Area (square ft)
100
10
1
0.1
0.01
0.1
1
10
100
1000
Discharge(cfs)

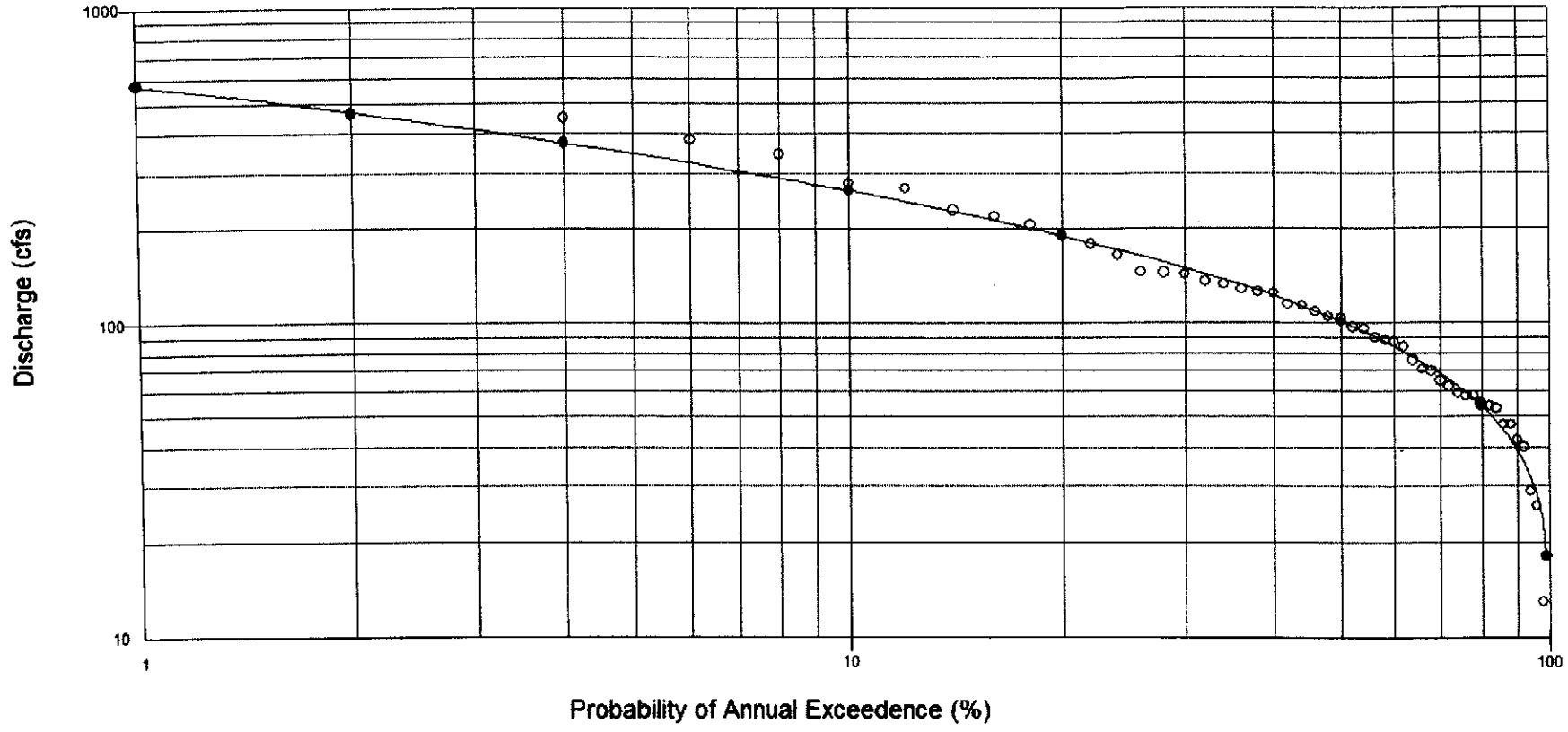

Hydraulic Geometry - Marsh Run at Grimes, MD
Mean Depth (ft)
10
1
0.1
0.01
0.01
0.1
1
10
100
1000
Discharge(cfs)

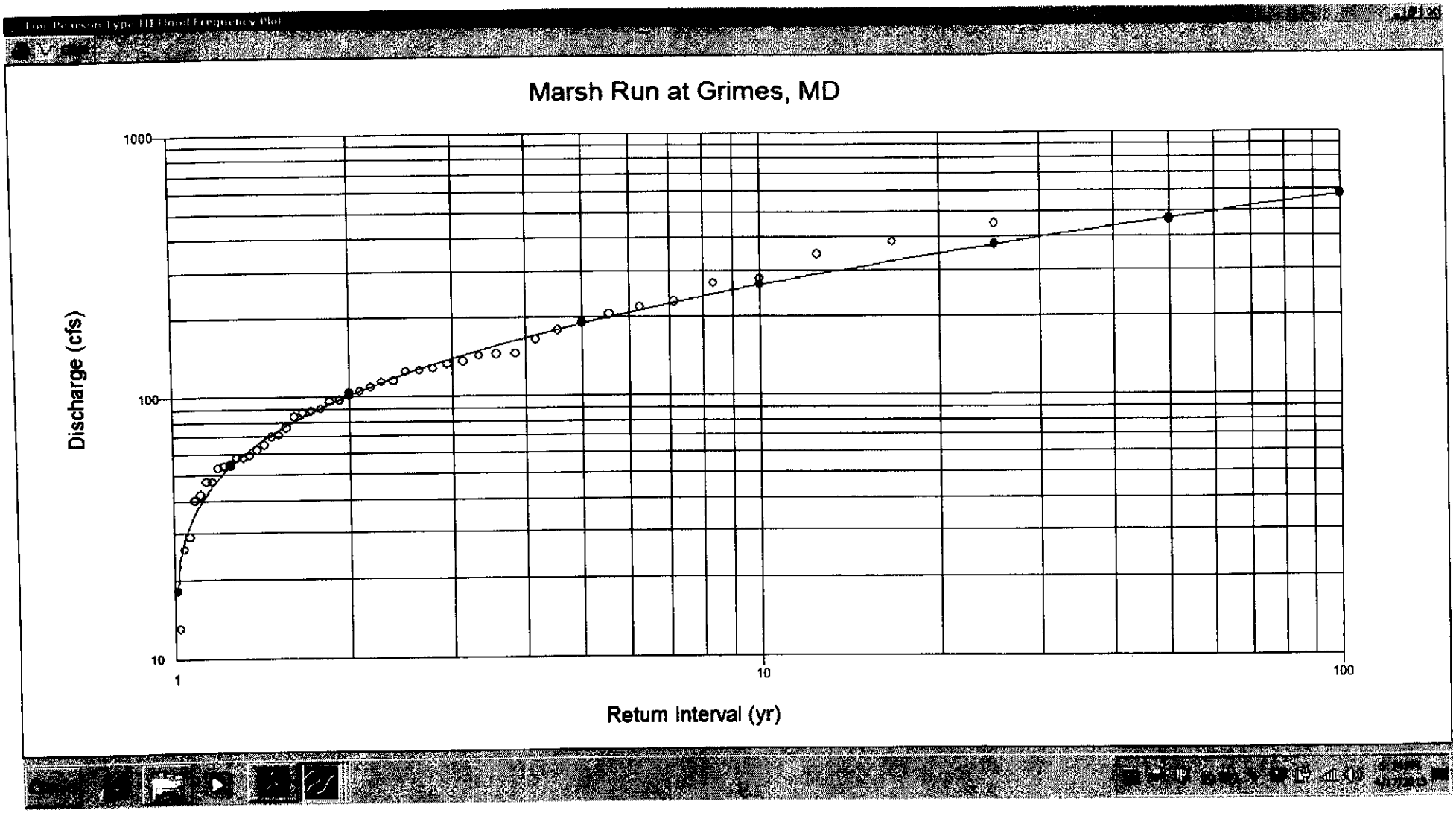

Hydraulic Geometry - Marsh Run at Grimes, MD
100
10
1
Width (ft)
0.01
0.1
1
10
100
1000
Discharge(cfs)


Marsh Run at Grimes, MD
Discharge (cfs)
1000
100
10
1
10
100
Return Interval (yr)

Close Graph

Marsh Run at Grimes, MD

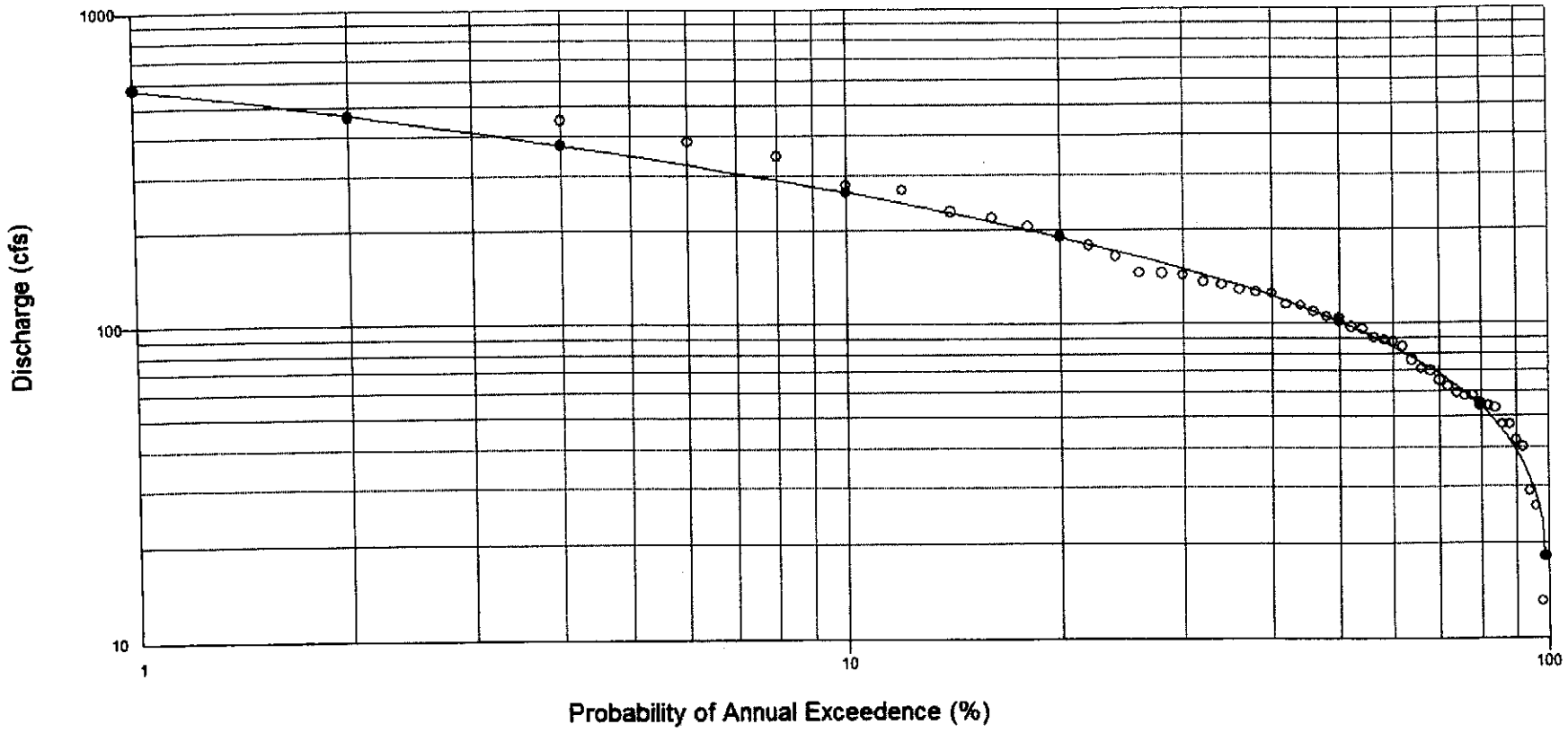


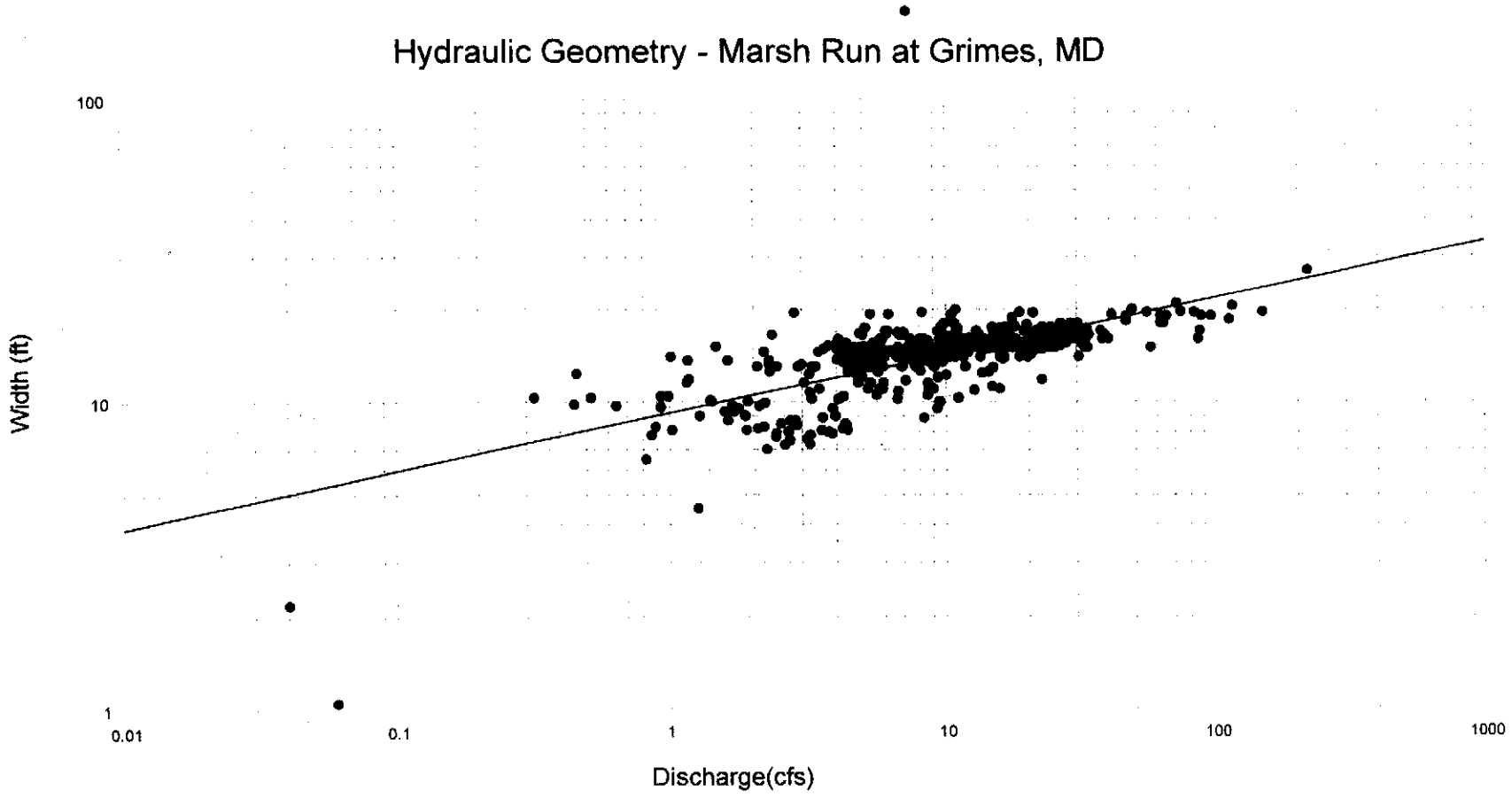

Log Pearson Type III Flood Frequency Plot
Marsh Run at Grimes, MD
Discharge (cfs)
1000
100
10
1
10
100
Return Interval (yr)

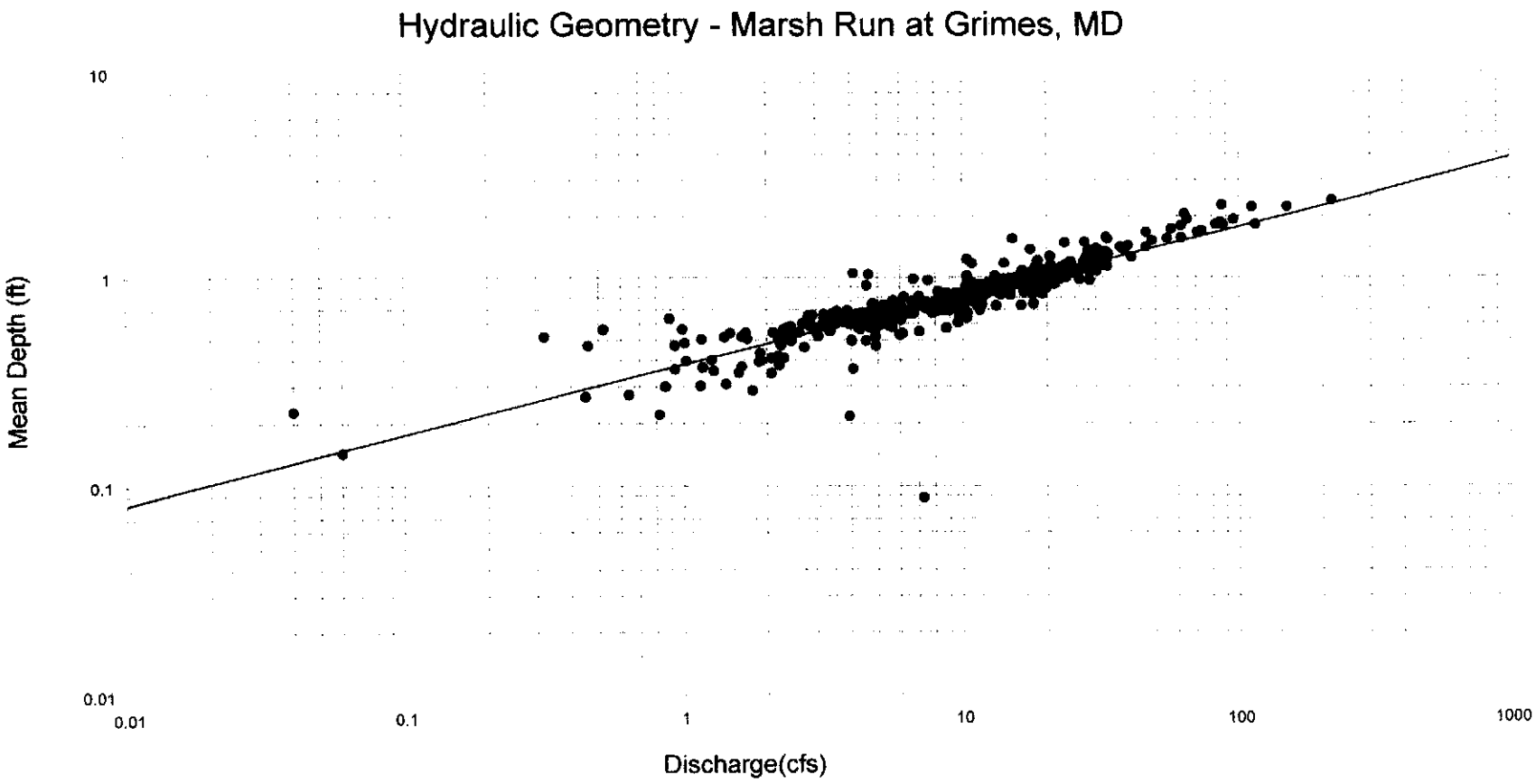
Log Pearson Type III Flood Frequency Plot

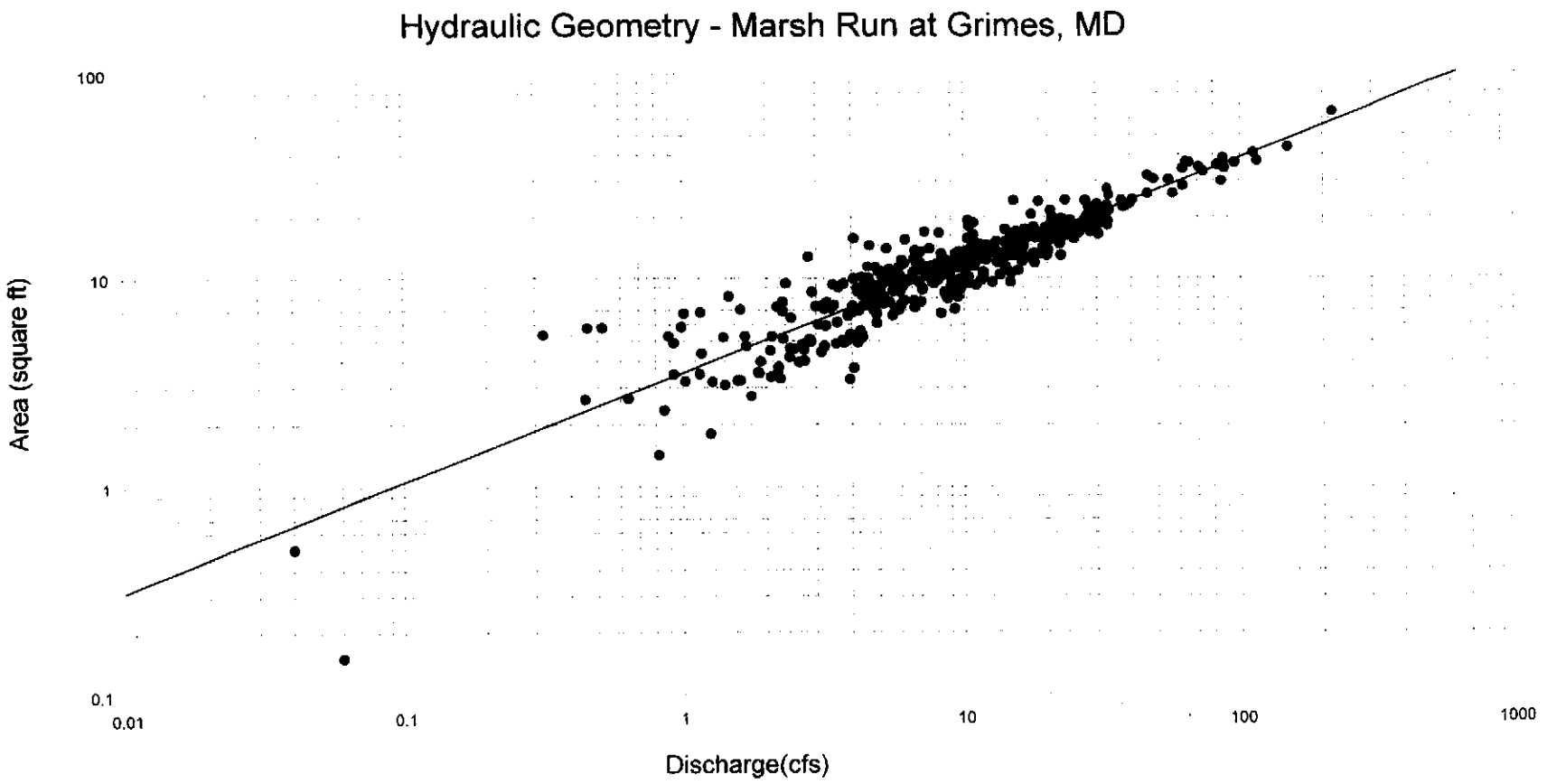
Close Graph

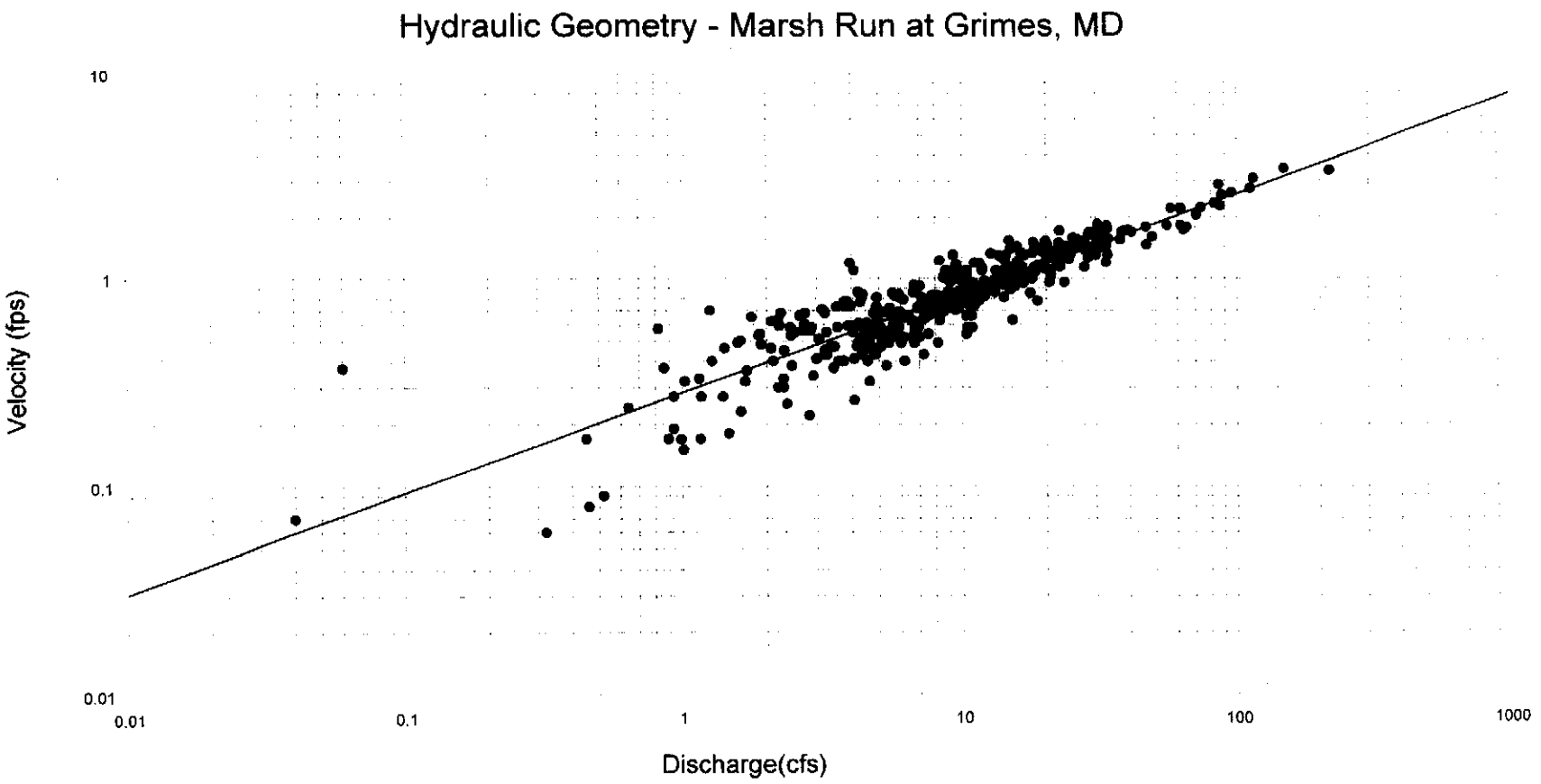
Marsh Run at Grimes, MD

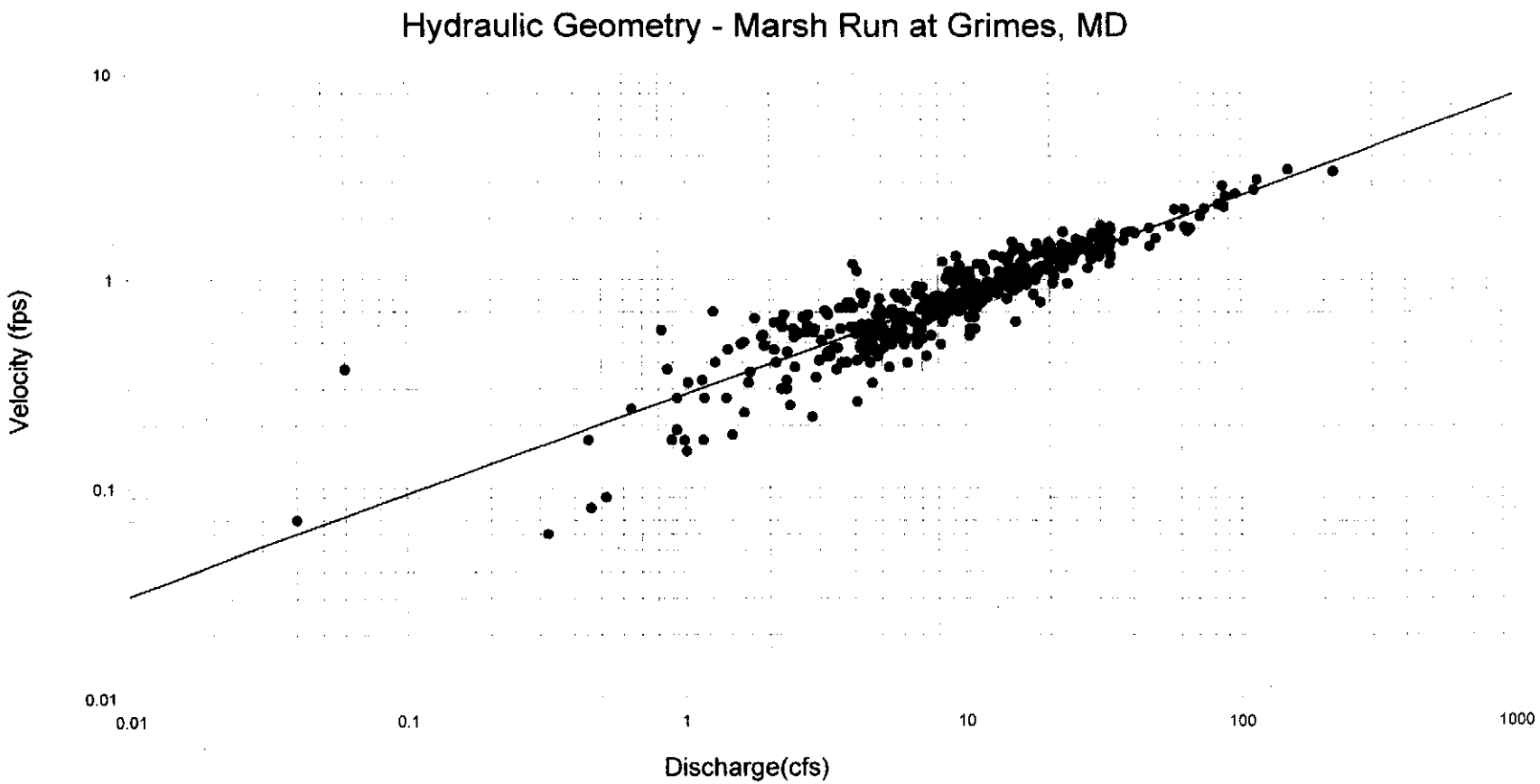


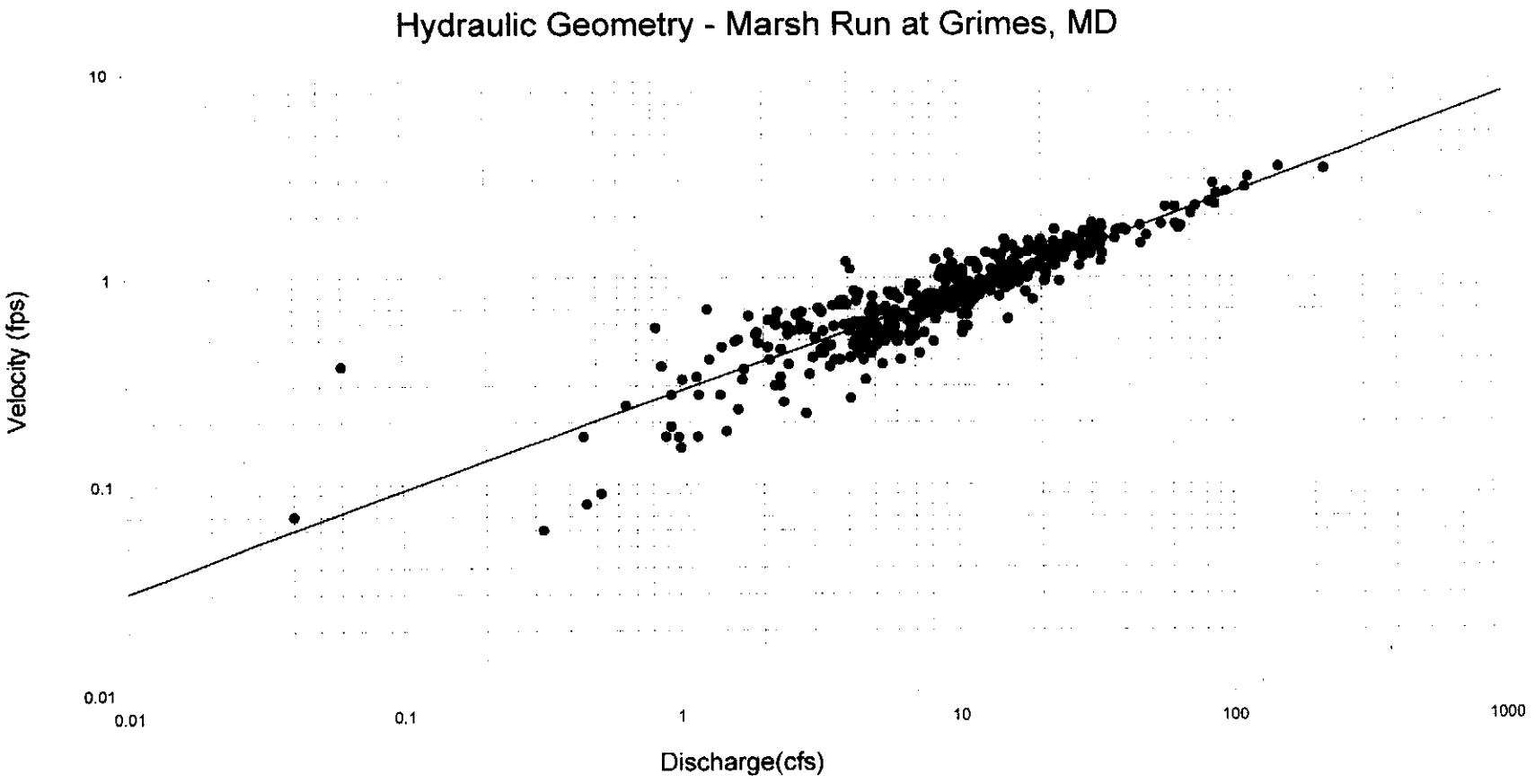

Hydraulic Geometry - Marsh Run at Grimes, MD
Width (ft)
100
10
1
0.01
0.1
1
10
100
1000
Discharge(cfs)


Hydraulic Geometry - Marsh Run at Grimes, MD
Mean Depth (ft)
10
1
0.1
0.01
0.01
0.1
1
10
100
1000
Discharge(cfs)


Hydraulic Geometry - Marsh Run at Grimes, MD
Area (square ft)
100
10
1
0.1
0.01
0.1
1
10
100
1000
Discharge(cfs)

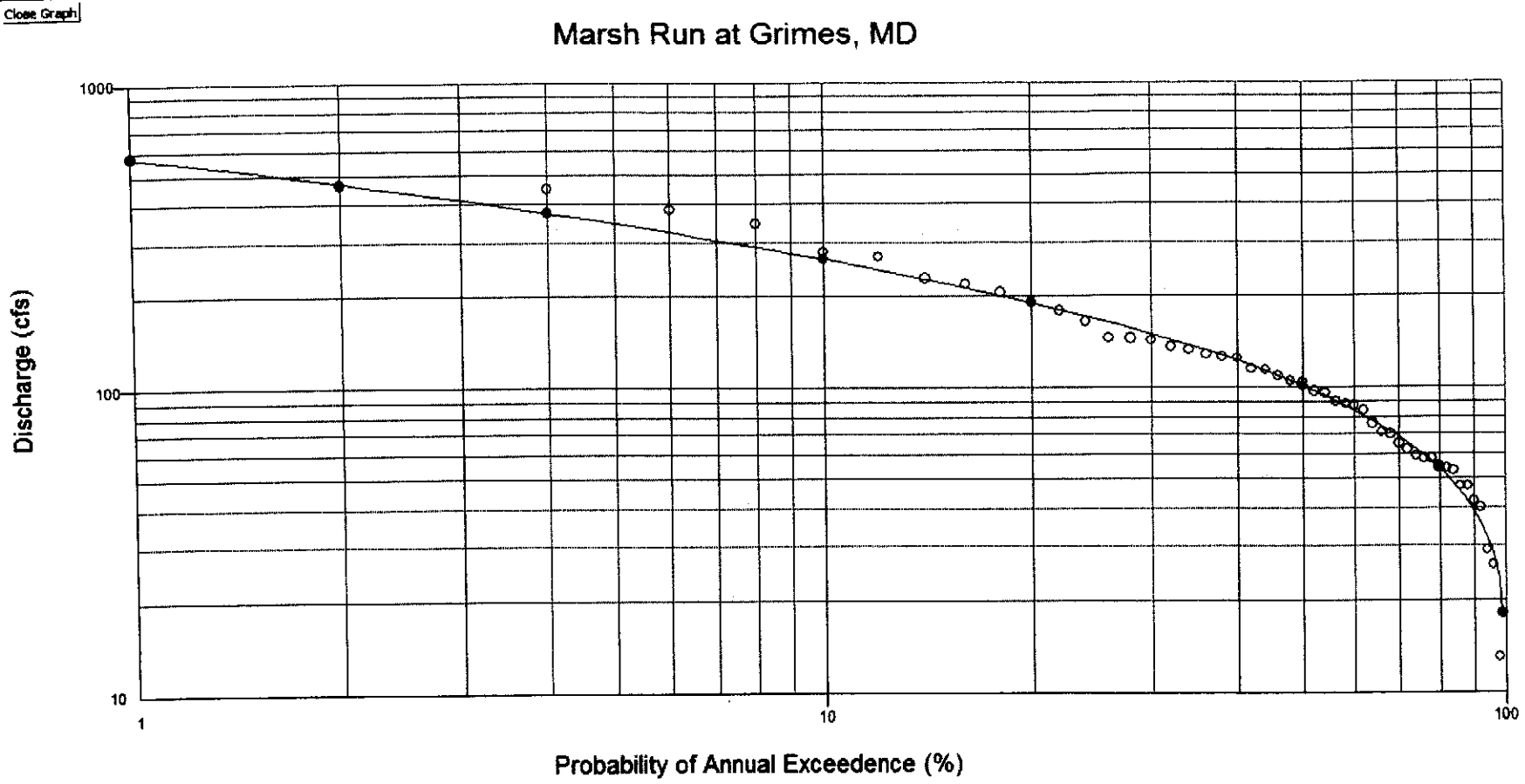

Hydraulic Geometry - Marsh Run at Grimes, MD
Velocity (fps)
10
1
0.1
0.01
0.01
0.1
1
10
100
1000
Discharge(cfs)


Hydraulic Geometry - Marsh Run at Grimes, MD
Velocity (fps)
10
1
0.1
0.01
0.01
0.1
1
10
100
1000
Discharge(cfs)


Hydraulic Geometry - Marsh Run at Grimes, MD
Velocity (fps)
10
1
0.1
0.01
0.01
0.1
1
10
100
1000
Discharge(cfs)

Log Pearson Type III Flood Frequency Plot

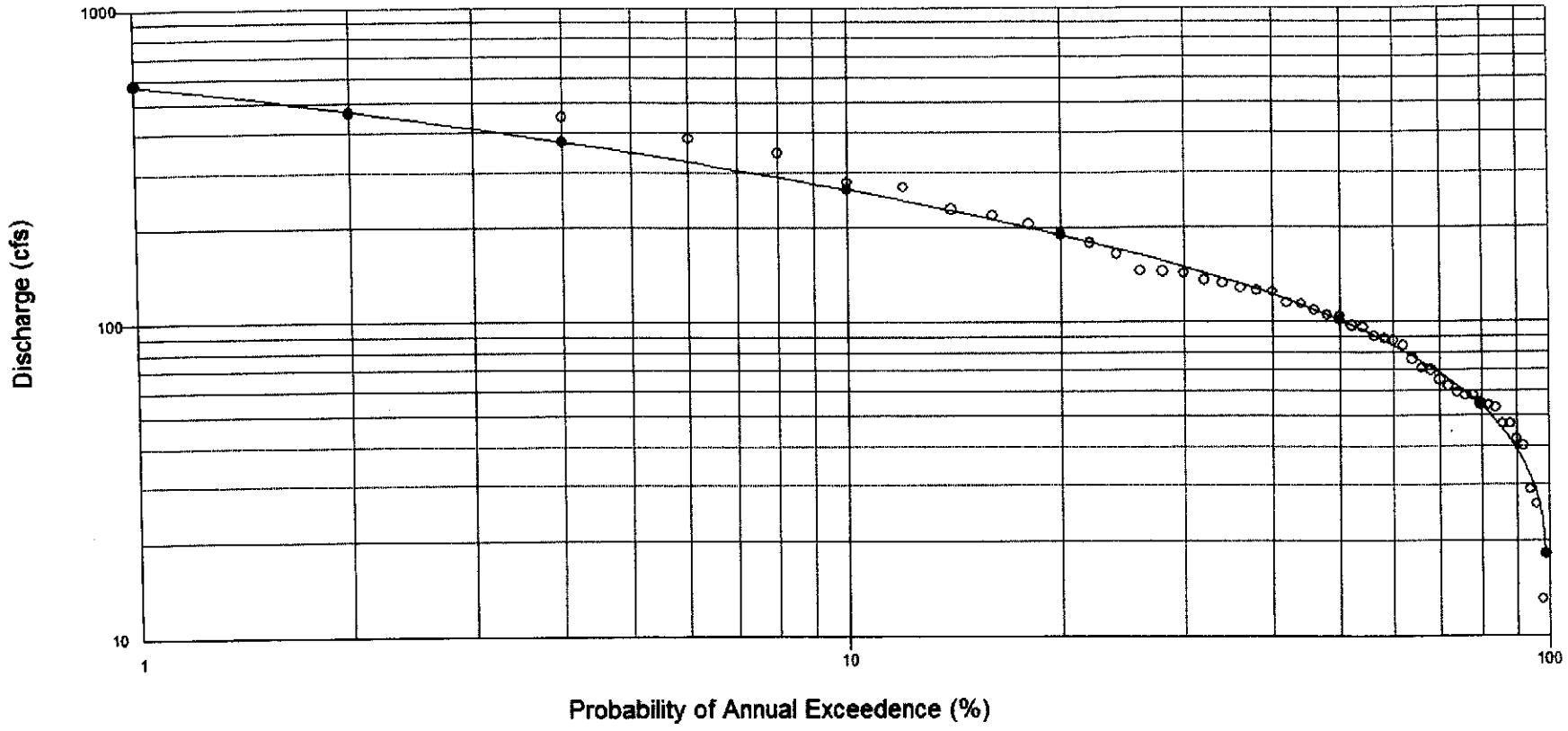
Close Graph

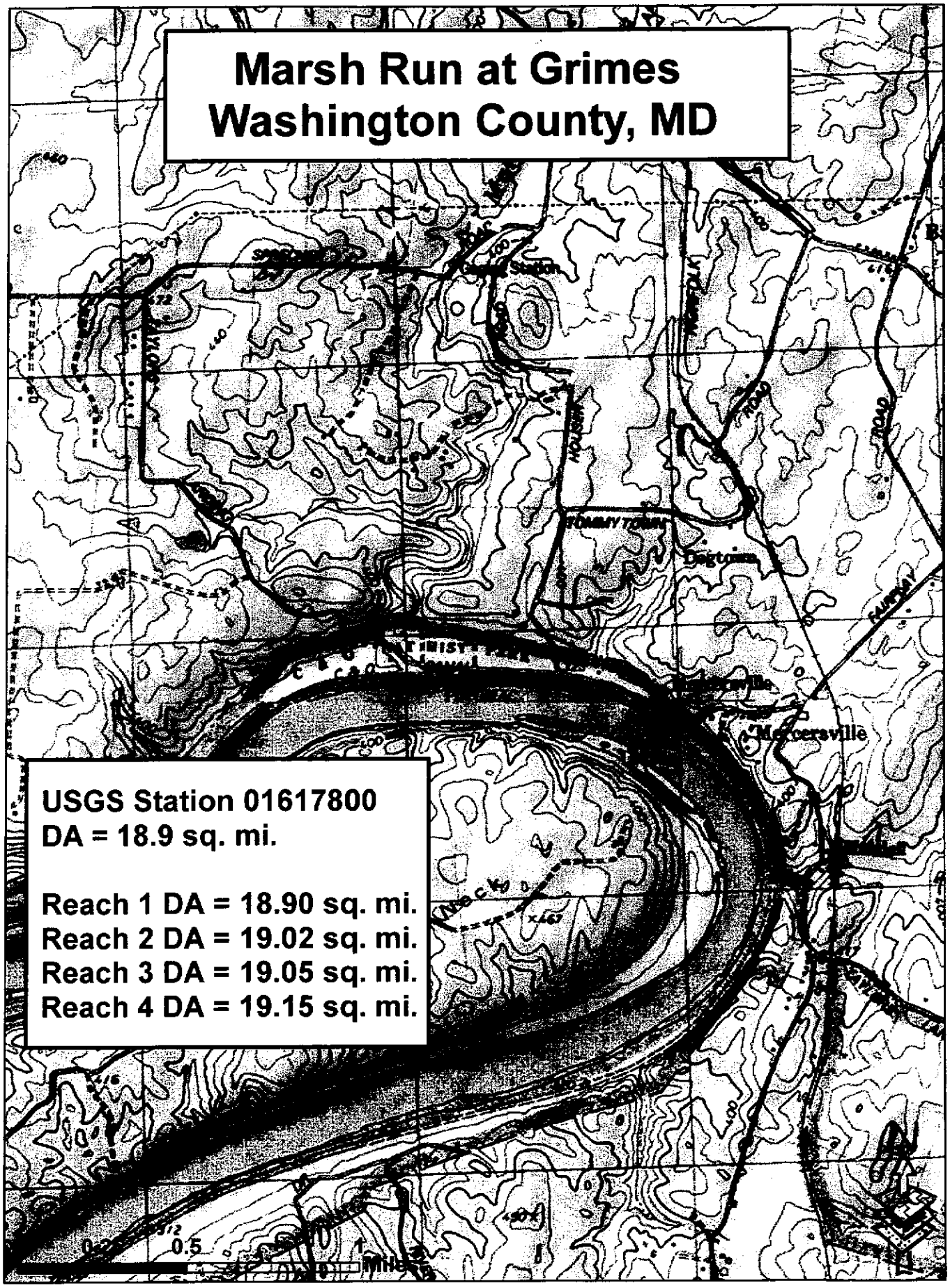


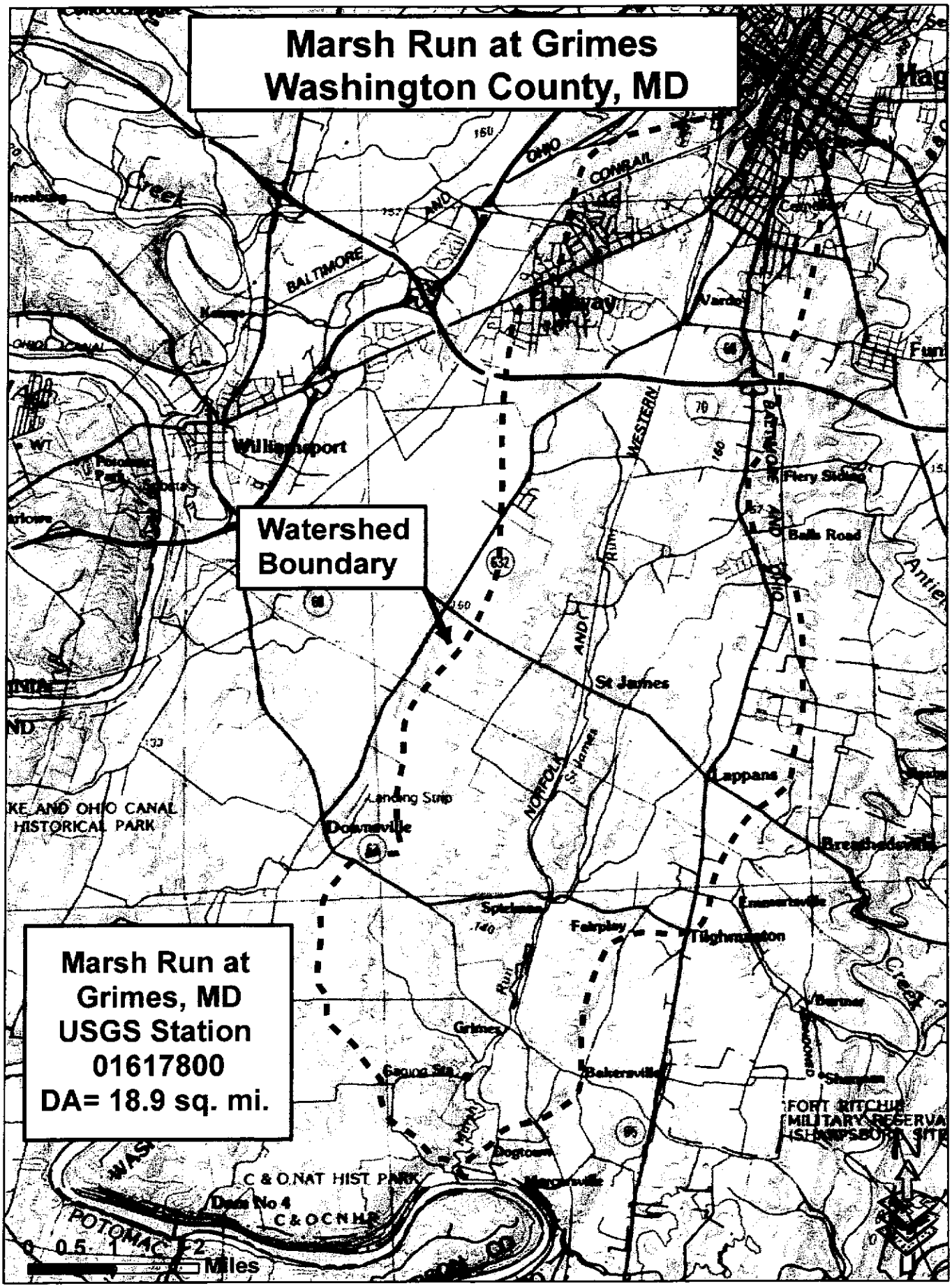
Log Pearson Type III Flood Frequency Plot

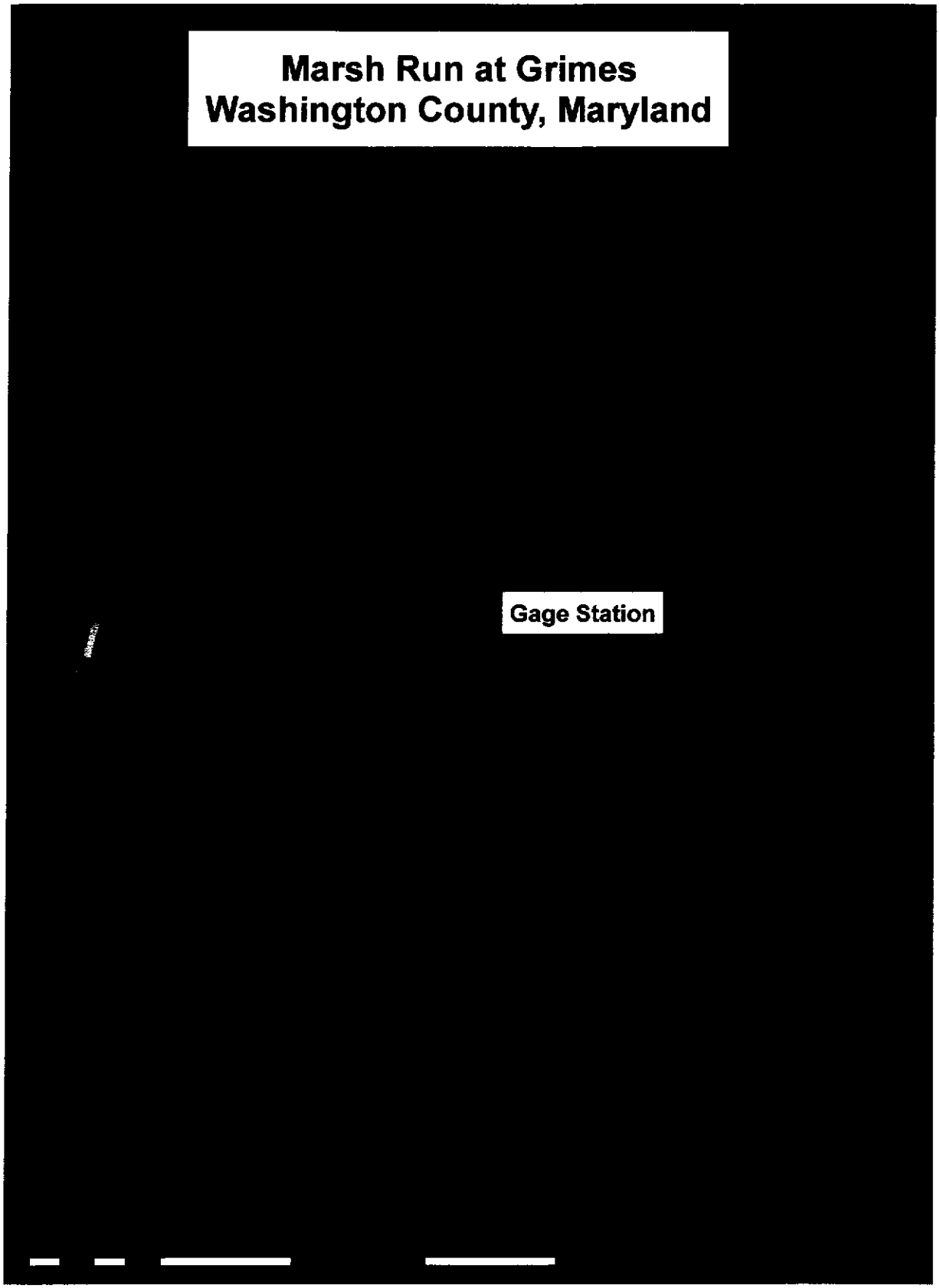
Close Graph

Marsh Run at Grimes, MD




Marsh Run at Grimes
Washington County, MD
USGS Station 01617800
DA = 18.9 sq. mi.
Reach 1 DA = 18.90 sq. mi.
Reach 2 DA = 19.02 sq. mi.
Reach 3 DA = 19.05 sq. mi.
Reach 4 DA = 19.15 sq. mi.
Mercersville
0.5
1
Miles


Marsh Run at Grimes
Washington County, MD
Watershed Boundary
Marsh Run at Grimes, MD
USGS Station
01617800
DA= 18.9 sq. mi.
Williamsport
Hallway
St James
Lappans
Downsville
Fairplay
Tilghmanton
Grimes
Bakersville
Dogtown
Fiery Siding
Balls Road
Landing Strip
Spielman
Emmertsville
Breathedsville
Burtner
Sharpsburg
Marcersville
Dam No 4
C & O NAT HIST PARK
C & O C N H P
POTOMAC
KE AND OHIO CANAL
HISTORICAL PARK
FORT RITCHIE
MILITARY RESERVA
(SHARPSBURG SITE
BALTIMORE AND OHIO
CONRAIL
NORFOLK AND WESTERN
0 0.5 1 2
Miles



USGS Gage 01617800
DA = 18.9 sq. mi.