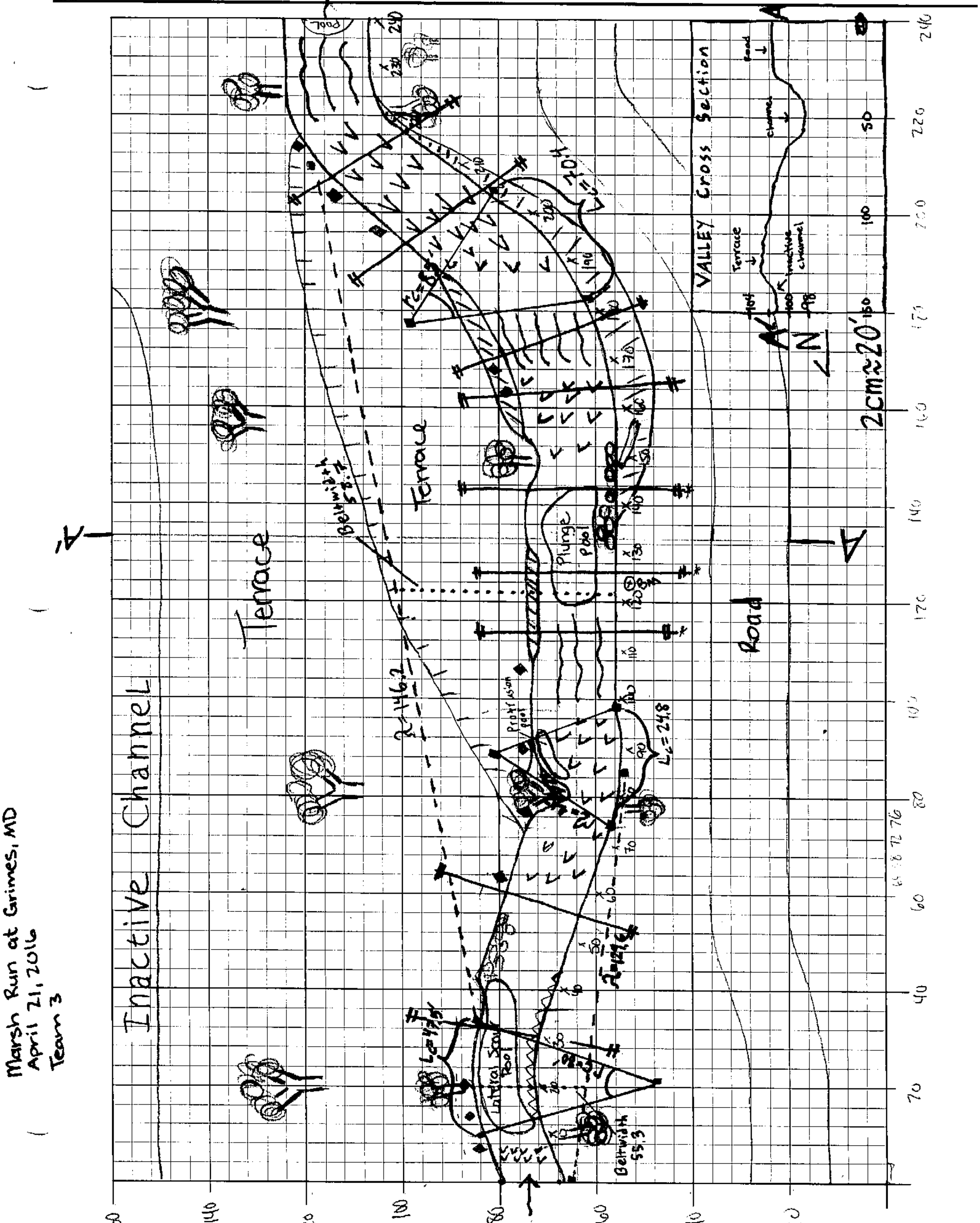
LEGEND

- Pebble Count Transects
- Pebble Count Active Bed Transects
- Cross-section
- Riffle
- Run
- Pool
- Rocks
- Inner Berm
- Tree
- Gently Sloping
- Inner Berm
- Stream Direction
- Large Woody Debris
- Bench Mark
- X 10 Stationing



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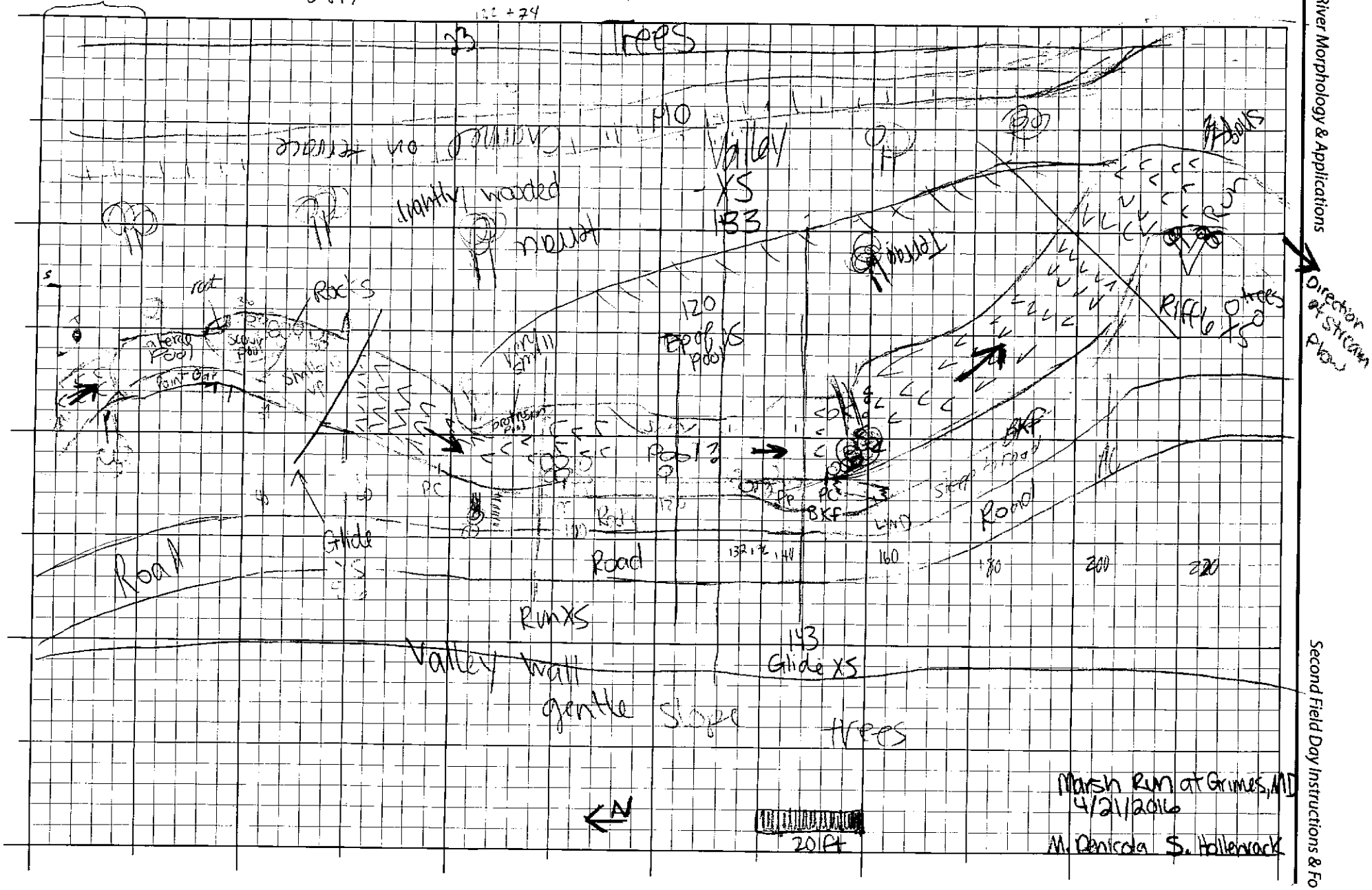
r_1 80
r_2 47ft
r_3 85ft

Valley length 157
Stream length 213.1
Belt width$_1$ = 55.3
Belt width 2 = 58.7

λ_1 = ~~81.4~~ 129.6
λ_2 = 146.2
Sinuosity = 1.17

La_1 47.5
La_2 24.8
La_3 70.4

meander Length, 132
meander Length, 84



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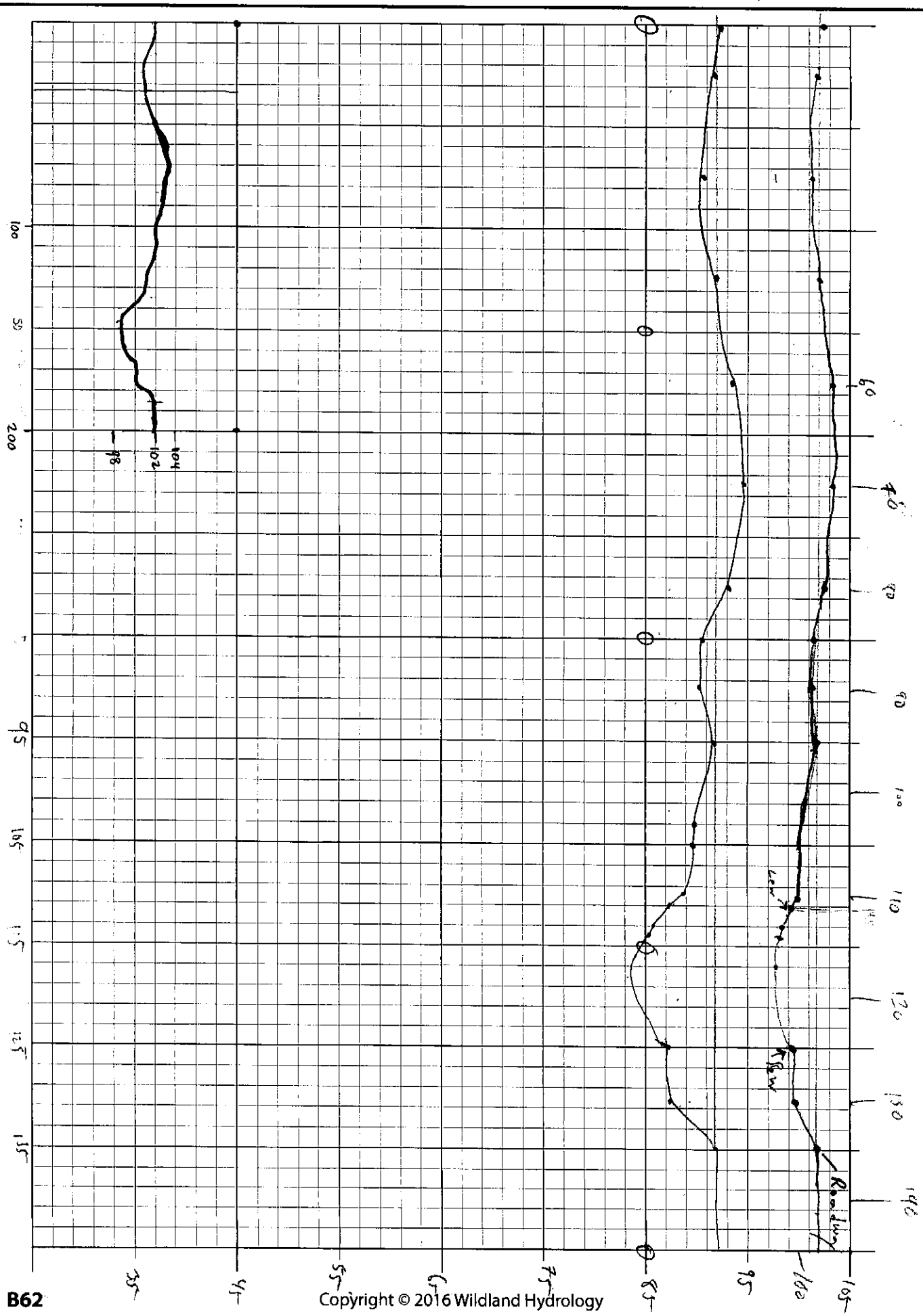

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Cross-Sections

Cross-section Overview **B29**

Cross-section Instructions **B33**

Cross-section Forms - *First Field Day* **B35**

Cross-section Forms - *Second Field Day* **B51**

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SURVEY DATA ⟹ **CROSS - SECTION 7**

Pool x - sec

SITE: Marsh Run B.M = 8.5 Sta. 0+30.2 **Date:** Thursday 5/21/2016

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES / COMMENTS / REMARKS
1	30.2	8.5	108.5			
2	0.6			5.57		
3	1			5.55		
4	1.7			5.75		
5	2.5			6.41		
6	3			6.88		
7	3.8			7.95		
8	4.4			8.36		
9	4.8			8.64		Left edge of Water
10	5.4			8.97		
11	6.5			9.21		
12	7			9.27		
13	7.3			10.16		
14	8			10.68		
15	9.2			10.99		
16	9.7			11.9		
17	10.2			11.24		
18	10.5			11.3		
19	11			11.16		
20	11.5			11.24		
21	12			11.36		
22	12.5			11.52		
23	13			11		
24	13.5			10.78		
25	14			10.60		
26	14.4			10.44		
27	15.3			10.2		
28	16			10.18		
29	16.9			9.76		
30	17.5			10.18		
31	19			9.85		

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SURVEY DATA ⟹ **CROSS - SECTION 7**

SITE: Marsh Run STA 56 Team 3 GLIDE Alan Beth Date: 4/21/16

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
1	BM	7.60	107.60		100.00	
2	0			4.18	103.42	
3	2.6			4.49	103.11	
4	4.1			6.04	101.56	
5	5.3			6.93	100.67	
6	6.1			7.51	100.09	
7	7.6			7.82 ~~7.84~~	99.78 ~~99.76~~	LEW (8.17 - 0.35 = 7.82) (8.26 - 0.42 cut = 7.84)
8	~~8.29~~			~~8.29~~	—	
9	9			8.08	99.52	
10	13.3			8.08	99.52	
11	14.4			8.28	99.32	edge of rock
12	15.8			8.35	9925	
13	17.3			8.19	99.41	edge of rock
14	18.0			8.16	99.44	on rock
15	19.1			8.24	99.36	
16	20.3			8.10	99.50	
17	21.9			8.22	99.38	
18	23.1			8.29	99.31	
19	25.0			8.31	99.29	
20	25.9			8.36	99.24	
21	27.0			8.44	99.16	Thalwag
22	27.8			8.37	99.23	edge of log
23	28.0			7.91	99.69	top of log
24	29.0			7.55	100.05	top of rock next to log
25	29.4			7.79	99.81	REW (8.42 - ~~0.64~~ 0.63 cut = 7.79)
26	30.2			7.29	100.31	
27	31.1			7.01	100.59	
28	31.6			6.66	100.94	bkf?
29	32.7			6.17	101.43	
30	33.5			5.59	102.01	
31	34.8 36.7			5.13 4.48	102.47 103.12	

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SURVEY DATA → **CROSS - SECTION 1**

SITE: Date:

Location: Sta 113.5 RUN

Observers: HUC:

Item	Distance, Point, or STATION ft	Back-Sight BS ft	Height of Instrument HI ft	Fore-Sight FS ft	Elevation ft	REMARKS / COMMENTS / NOTES
1	BM	7.81		6.75		
2	0			6.25		
3	6			6.26		
4	8			6.86		?? BKF Left
5	10			7.61		?? BKF Left 7.48 7.24
6	11.5			7.77		1.24
7	12.5			8.22		
8	13			8.90		
9	14			9.14		
10	20			9.02		
11	23			9.06		
12	25			8.84		
13	26			8.87		
14	27.8			8.48		REW
15	29			8.01		
16	31			7.79		BKF Right
17	32.5			6.61		
18	34			5.86		
19	36			5.55		
20						
21						
22						
23						
24						
25						
26						
27						
28						

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SURVEY DATA ⟹ **CROSS - SECTION** 8

Mash Run Terra 3

SITE: Sta 143 GLIDE **Date:** 4/21/16

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
1	BM	8.51			100.00	
2	0			6.12		
3	2.7			6.09		
4	6			7.20		BKF ??
5	8			7.72		
6	8.5			7.78		
7	9.5			8.18		
8	11.0			8.55		LEW
9	13.0			8.94		
10	17.0			8.94		
11	20.5			8.85		
12	25.0			8.86		
13	27.0			8.90		
14	28.5			8.50		REW
15	31.0			8.12		
16	33.5			7.56		BKF Right
17	36.0			5.88		
18	39.0			5.13		
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						

.4 d

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SURVEY DATA ⟹ **CROSS - SECTION 1**

SITE: Marsh Run **Date:** 4/21/16

Location: Team 3 - ~~STA~~ 163 RIFFLE

Observers: Beth + Allan (Team 3) **HUC:**

Item	Distance, Point, or STATION (ft)	Back-Sight BS (ft)	Height of Instrument HI (ft)	Fore-Sight FS (ft)	Elevation (ft)	REMARKS / COMMENTS / NOTES
1	BM	7.60	107.60		100.00	
2	0			4.21	103.39	Top of terrace
3	3.5			5.17	102.43	
4	8.5			6.26	101.34	
5	14.3			6.10	101.50	
6	18.0 23.7			5.73 5.90	101.87 101.70	high pt
7	26.8 28.6			6.11 6.56	101.49 101.04	
8	31.0			7.40	100.20	
9	32.8			7.82	99.78	
10	33.5			8.10	99.50	
11	34.3			8.66	98.94	LEW
12	34.9			8.66	98.94	Rock edge
13	35.6 36.8			8.12 8.46	99.48 99.14	Rock top Rock top
14	37.6			9.13	98.47	Rock edge
15	39.2			8.97	98.63	
16	41.4			9.06	98.54	
17	42.0			9.03	98.57	Rock edge
18	42.5			8.79	98.81	Rock top
19	43.6			8.81	98.79	Rock top
20	44.2 45.0			8.55 8.97	98.63	Rock top Rock edge
21	46.0			8.97	98.63	Thalweg
22	48.5			8.83	98.77	
23	50.7			8.71	98.89	REW
24	51.3 52.6			8.33 8.37	99.27 99.29	
25	53.8 55.3			8.17 7.96	99.43 99.64	
26	56.6			7.66	99.94	BKF ? 100.03 approx
27	57.0 57.9			7.42 7.00	100.18 100.60	BKF ?
28	59.0 60.3			5.94 5.02	101.66 102.58	
	62.0			4.90	102.70	Terrace top
	BM			7.60	100.00	

Floodprone width = 31
Bankfull width 19
Entrenchment = 1.6
B type

54.5

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SURVEY DATA ⟹ **CROSS - SECTION 2**

SITE: Marsh Run STA 178 RUN X-SEC Along ⊼ Both ⊕ Date: 4/21/16

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
1	BM	7.60	107.60		100.00	
2	0			6.34	101.26	
3	5			7.05	100.55	
4	9			7.51	100.09	
5	11.4 12			7.59 7.67	100.01 99.93	BKF ?
6	14.2			8.21	99.39	
7	15.3			8.73 ~~8.77~~ ~~8.83~~	98.87 ~~98.83~~ ~~98.87~~	LEW
8	15.9		9.10	~~9.10~~	~~98.50~~ 98.50	(9.10 − 0.37 cut = 8.73 WS)
9	17.9			9.18	98.42	
10	20.8			9.11	98.49	
11	23.0			9.14	98.46	
12	24.6			9.33	98.27	
13	25.3			9.34	98.26	Thalweg
14	26.7			9.27	98.33	
15	28.0			9.18	98.42	
16	29.2			9.06	98.54	
17	30.5			9.03	98.57	
18	31.1			8.71 ~~8.73~~	98.89	REW (9.04 − .33 cut = 8.71 WS) ~~98.89~~
19	32.0			8.59	99.01	
20	33.4			8.34	99.26	
21	35.1			8.04	99.56	
22	37.4			7.98	99.62	
23	39.0			7.74	99.86	BKF ✓
24	40.2			7.02	100.58	
25	41.4			6.37	101.23	
26	42.7			5.73	101.87	
27	44.2			5.14	102.46	
28						
29						
30						
31						

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SURVEY DATA → **CROSS - SECTION** 4

SITE: Marsh Run STA 206 TEAM 3 RIFFLE X SEC Alan Q Beth π Date: 4/21/16

ele bkf 99.85

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES / COMMENTS / REMARKS
1	BM	7.60	107.60		100.00	
2	0			3.72		
3	2.0			3.92		
4	9.0			5.2		
5	13.0			5.8		
6	16			5.96		
7	21			6.06		
8	26			6.22		
9	28			6.38		
10	31			6.81		
11	34			7.31		
12	35			~~7.65~~ 7.56		
13	36			7.65		
14	37			7.73	99.87	bkf? ✓
15	38			7.97	99.63	bkf? x
16	40.3			8.64	98.96	H_2O surface (8.98 - 0.34 cut) LEW
17	42			9.06		1.34 / 9.64
18	44			9.12		
19	46			9.16		
20	47.5			9.04		
21	49			9.05		
22	50			8.93		
23	50.5			9.19	98.41	thalweg
24	52			9.01		
25	54			8.92		
26	56			8.87		
27	58			8.86	98.95	8.86 - 0.21 cut = 8.65
28	59.4			8.71	~~98.99~~ 98.95	~~8.78 - 0.07 cut~~ = 1.21 / 8.65 REW H_2O surface
29	61			8.28	99.32	1.07 / 8.71
30	62			7.84	99.76	
31	63 62.5			7.54	100.06	bkf? x

63.2
65

6.96
4.43

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SURVEY DATA ⟹ **CROSS - SECTION** 3

SITE: Marsh Run STA 217 Riffle X-Sec Team 3 Alan T Beth Φ Date: 4/21/16

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
1	BM	7.60	107.60		100.00	
2	0			5.98	101.62	
3	3.0			6.89	100.71	
4	4.6			7.34	100.26	BKF (no) 99.8 approx
5	6.2			8.02	99.58	
6	8.5			8.57	99.03	
7	9.2			8.97	98.63	LEW
8	10.4			9.32	98.28	
9	12.2			9.32	98.28	
10	13.9			9.34	98.26	
11	15.7			9.36	98.24	
12	17.5			9.43	98.17	
13	19.0			9.41	98.19	
14	20.4			9.45	98.15	
15	20.8			9.48	98.12	Rock edge
16	21.4			9.04	98.56	Top of rock
17	22.0			9.56	98.04	Rock edge
18	23.3			9.91	97.69	Thalweg
19	24.4			9.58	98.02	
20	25.5			9.30	98.30	
21	26.0			~~8.93~~ 8.97	~~98.07~~ 98.63	REW (9.39 − 0.42est) 8.97 98.63 WS
22	26.4			8.78	98.82	
23	27.5			8.42	99.18	
24	28.2			8.33	99.27	
25	29.4			7.55	100.05	
26	31.0			6.31	101.29	
27	33.0			5.40	102.20	
28	BM			7.60	100.00	
29						
30						
31						

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SURVEY DATA ⟹ **CROSS - SECTION** 8

SITE: Marsh Run Pool Sta # 1+26.5 Date: 21 Apr. 2016

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
1	0	8.51	108.51			
2	0			6.65	101.86	
3	6.2			7.20	101.31	Top of Low Terrace
4	8.0			7.70	100.81	
5	9.0			8.17	100.34	
6	9.5			8.19	[redacted]	100.32
7	10			8.23	100.28	
8	11			8.19	100.32	
9	12			8.19	100.32	BKF
10	12.5			8.27	100.24	
11	13			8.45	100.06	
12	14			8.81	99.7	
13	14.5			9.13	99.38	LEW
14	16			9.66	98.85	
15	17			9.76	98.75	
16	18			9.78	98.73	
17	19			9.84	98.67	
18	20			9.85	98.66	
19	21			10.19	98.32	
20	22			10.51	98	Thalweg
21	23			10.41	98.1	
22	24			9.61	98.9	
23	26			9.49	99.02	[redacted]
24	29			9.11	99.4	REW
25	30			8.74	99.7	
26	31			8.57	99.94	
27	32			8.21	100.3	
28	33			7.43	101.08	
29	35			6.34	102.17	
30						
31						

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Longitudinal Profile

Longitudinal Profile Overview.....B69

Longitudinal Profile Instructions..... B70

Plan and Profile Diagram of Longitudinal Profile..... B71

Water Surface Facet Slopes & Dimensionless Ratios..... B74

Bankfull Maximum Depths & Dimensionless Ratios.....B76

Low Bank Height & Degree of Channel Incision.....B78

Longitudinal Profile Forms – *First Field Day*..... B80

Longitudinal Profile Forms – *Second Field Day*..... B86

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SURVEY DATA ⟹ LONGITUDINAL PROFILE 1

BM 8.51

SITE: Marsh Run **Date:** 4/21/16

Location: Washington County, Maryland

Observers: **HUC:**

	Distance, Point, or STATION (ft)	Back-Sight BS (ft)	Height of Instrument HI (ft)	Thalweg Fore-Sight FS (ft)	Thalweg Elevation Elev. (ft)	Water Surface Fore-Sight FS (ft)	Water Surface Elevation Elev. (ft)	Bankfull Fore-Sight FS (ft)	Bankfull Elevation Elev. (ft)	Low Bank HI Fore-Sight FS (ft)	Low Bank HI Elevation Elev. (ft)	NOTES e.g. Riffle Run Pool Glide	
1	BM	8.51	108.51										
2	0			9.16		8.49						Glide	
3	5.6			8.83		8.49						Riffle	
* 4	9.2			8.78		8.54						Glide	
5	8.3			9.35		8.67						Run	
6	10.7			9.36		8.67						Run	
7	11.8			9.85		8.70						Top Pool	
8	15.5			10.87		8.63						Pool	
9	26.5			11.75		8.66						Pool	
1.21 10	30			11.42		8.62		7.41				Pool	X-Sec.
11	33			11.36		8.66						Pool	
12	35			10.57		8.67						Pool	
13	36			10.10		8.66						Glide	
14	41			9.84		8.66						Glide	
15	49.6			9.43		8.72						Glide	
1.14 16	56.5			9.18		8.72		7.58				Glide	X-Sec
17	61			9.22		8.82						Riffle	
18	67			9.33		8.81						Riffle	
1.05 19	73			9.28		8.82		7.77				Riffle	
20	81			9.30		8.91						Riffle	
21	88			9.49		8.97						Riffle	
0.94 22	96			9.54		9.12		8.18?				Riffle	
23	103.5			9.84		9.14						Run	
24	111			9.90		9.14						Bottom Run/Top Pool	
0.97 25	119			10.24		9.16		8.19				Pool	
0.92 26	126.5			10.51		9.12		8.20				Pool	dmax XS
27	130			10.13		9.12						Pool	bottom

Start Glide

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SURVEY DATA → LONGITUDINAL PROFILE 2

SITE: Marsh Run **Date:** 21 Apr. 2016

Location: Team 3 Reach

Observers: Team 3 **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	143			9.72		9.18						Glide	Top XS
29	150			9.68		9.39						Riffle	
0.99 30	163			9.95		9.47		8.48				riffle	X-section
31	165			10.01		9.48						top run	
32	167			9.95		9.62						run	
* 33	175			9.26		9.62						run	
1.05 34	186			10.17		9.65		8.6				run	
1.03 * 35	178			10.29		9.63		8.6				run	X-Section
36	191.5			10.16		9.68						top riffle	
* 37	197			9.25		9.68						riffle	
38	210			10.07		9.78						riffle	
1.17 39	217			10.27		9.87		8.70				riffle	X-section
40	222			10.33		9.95						bottom riffle	
41	230			11.18		9.95						run	
42	234			11.59		9.99						run	
43	237			12.27		10.00						Pool	Imax
1.05 44	206			10.09		9.71		8.66				riffle	XS
1.21 45	113.5			9.85		9.15		7.94				run	XS
46													
47													
206 48													
49													
50													
51													
52													
53													
54													

Moderately entrench 15 little C

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10.12
11.20

Rep. @ XS 163

Site: Marsh Run @ Grimes

Location: STA 163 HUC:

Observers: Team 3

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												
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25													
	Medium	.25 - .50													
	Coarse	.50 - 1.0													
.04 - .08	Very Coarse	1.0 - 2													
.08 - .16	Very Fine	2 - 4	GRAVEL												
.16 - .22	Fine	4 - 5.7													
.22 - .31	Fine	5.7 - 8													
.31 - .44	Medium	8 - 11.3													
.44 - .63	Medium	11.3 - 16													
.63 - .89	Coarse	16 - 22.6													
.89 - 1.3	Coarse	22.6 - 32													
1.3 - 1.8	Very Coarse	32 - 45													
1.8 - 2.5	Very Coarse	45 - 64													
2.5 - 3.5	Small	64 - 90	COBBLE												
3.5 - 5.0	Small	90 - 128													
5.0 - 7.1	Large	128 - 180													
7.1 - 10.1	Large	180 - 256													
10.1 - 14.3	Small	256 - 362	BOULDER												
14.3 - 20	Small	362 - 512													
20 - 40	Medium	512 - 1024													
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		BDRK												
Stream Type:			**Landscape Type:**			TOTAL→									

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Protrusion @ Ref XS 205

Site: Marsh Run @ Grimes

Location: STA 205 HUC:

Observers: Team 3

				Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1)			POOL (2)			COMPOSITE (3)		
							Reach:			Reach:			Reach:		
							Date:			Date:			Date:		
Inches	PARTICLE	Millimeters					TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
	Silt / Clay	< .062	S/C												
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25													
	Medium	.25 - .50													
	Coarse	.50 - 1.0													
.04 - .08	Very Coarse	1.0 - 2													
.08 - .16	Very Fine	2 - 4	GRAVEL												
.16 - .22	Fine	4 - 5.7													
.22 - .31	Fine	5.7 - 8													
.31 - .44	Medium	8 - 11.3													
.44 - .63	Medium	11.3 - 16													
.63 - .89	Coarse	16 - 22.6													
.89 - 1.3	Coarse	22.6 - 32													
1.3 - 1.8	Very Coarse	32 - 45													
1.8 - 2.5	Very Coarse	45 - 64													
2.5 - 3.5	Small	64 - 90	COBBLE												
3.5 - 5.0	Small	90 - 128													
5.0 - 7.1	Large	128 - 180													
7.1 - 10.1	Large	180 - 256													
10.1 - 14.3	Small	256 - 362	BOULDER												
14.3 - 20	Small	362 - 512													
20 - 40	Medium	512 - 1024													
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		BDRK												
Stream Type:			**Landscape Type:**			TOTAL→									

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Active Bed @ Ref XS 205

Site: Marsh Run @ Grimes

Location: STA 205 HUC:

Observers: Team 3

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) Reach: Date: TOT #	ITEM %	% CUM	POOL (2) Reach: Date: TOT #	ITEM %	% CUM	COMPOSITE (3) Reach: Date: TOT #	ITEM %	% CUM
	Silt / Clay	< .062	S/C												
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25	SAND												
	Medium	.25 - .50	SAND												
	Coarse	.50 - 1.0	SAND												
.04 - .08	Very Coarse	1.0 - 2													
.08 - .16	Very Fine	2 - 4	GRAVEL												
.16 - .22	Fine	4 - 5.7	GRAVEL												
.22 - .31	Fine	5.7 - 8	GRAVEL												
.31 - .44	Medium	8 - 11.3	GRAVEL												
.44 - .63	Medium	11.3 - 16	GRAVEL												
.63 - .89	Coarse	16 - 22.6	GRAVEL												
.89 - 1.3	Coarse	22.6 - 32	GRAVEL												
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL												
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL												
2.5 - 3.5	Small	64 - 90	COBBLE												
3.5 - 5.0	Small	90 - 128	COBBLE												
5.0 - 7.1	Large	128 - 180	COBBLE												
7.1 - 10.1	Large	180 - 256	COBBLE												
10.1 - 14.3	Small	256 - 362	BOULDER												
14.3 - 20	Small	362 - 512	BOULDER												
20 - 40	Medium	512 - 1024	BOULDER												
40 - 80	Large-Vry Large	1024 - 2048	BOULDER												
	Bedrock		BDRK	55											
Stream Type:			**Landscape Type:**			TOTAL→									

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Active Bed @ Ref XS 163

Site: Marsh Run @ Grimes

Location: STA 163 HUC:

Observers: Team 3

				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:		
Inches	PARTICLE	Millimeters													
	Silt / Clay	< .062	S/C												
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25													
	Medium	.25 - .50													
	Coarse	.50 - 1.0													
.04 - .08	Very Coarse	1.0 - 2													
.08 - .16	Very Fine	2 - 4	GRAVEL												
.16 - .22	Fine	4 - 5.7													
.22 - .31	Fine	5.7 - 8													
.31 - .44	Medium	8 - 11.3													
.44 - .63	Medium	11.3 - 16													
.63 - .89	Coarse	16 - 22.6													
.89 - 1.3	Coarse	22.6 - 32													
1.3 - 1.8	Very Coarse	32 - 45													
1.8 - 2.5	Very Coarse	45 - 64													
2.5 - 3.5	Small	64 - 90	COBBLE												
3.5 - 5.0	Small	90 - 128													
5.0 - 7.1	Large	128 - 180													
7.1 - 10.1	Large	180 - 256													
10.1 - 14.3	Small	256 - 362	BOULDER												
14.3 - 20	Small	362 - 512													
20 - 40	Medium	512 - 1024													
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		BDRK	64											
Stream Type:			**Landscape Type:**			TOTAL→									

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Protrusion @ Ref XS 163

Site: Marsh Run @ Grimes

Location: STA 163 HUC:

Observers: Team 3

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) TOT #	ITEM %	% CUM	POOL (2) TOT #	ITEM %	% CUM	COMPOSITE (3) TOT #	ITEM %	% CUM
							Reach:			Reach:			Reach:		
							Date:			Date:			Date:		
	Silt / Clay	< .062	S/C												
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25													
	Medium	.25 - .50													
	Coarse	.50 - 1.0													
.04 - .08	Very Coarse	1.0 - 2													
.08 - .16	Very Fine	2 - 4	GRAVEL												
.16 - .22	Fine	4 - 5.7													
.22 - .31	Fine	5.7 - 8													
.31 - .44	Medium	8 - 11.3													
.44 - .63	Medium	11.3 - 16													
.63 - .89	Coarse	16 - 22.6													
.89 - 1.3	Coarse	22.6 - 32													
1.3 - 1.8	Very Coarse	32 - 45													
1.8 - 2.5	Very Coarse	45 - 64													
2.5 - 3.5	Small	64 - 90	COBBLE												
3.5 - 5.0	Small	90 - 128													
5.0 - 7.1	Large	128 - 180													
7.1 - 10.1	Large	180 - 256													
10.1 - 14.3	Small	256 - 362	BOULDER												
14.3 - 20	Small	362 - 512													
20 - 40	Medium	512 - 1024													
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		BDRK												
Stream Type:			**Landscape Type:**			TOTAL→									

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Worksheet B-4. Dimensionless ratios of the ten pool types (*First Field Day*).

Stream: Marsh Run Location: Grimes, MD

Observers: Team 3 Stream Type: B/c Landscape Type: C-AL-FD Date: 4/21/16

Pool Type		Dimensional Values: Pool Length (L_p)	Pool Max Depth (d_{maxp})	Pool Slope (S_p)		Dimensionless Ratios: Pool Length to Riffle Width (L_p / W_{bkf})	Pool Max Depth to Riffle Mean Depth (d_{maxp} / d_{bkf})	Pool Slope to Average Slope (S_p / S)
1. Lateral Scour Pool (LSP)	Mean	26.03	4.39	0.001	Mean	0.979	2.814	0.067
	Min.	26.03	4.39	0.001	Min.	0.979	2.814	0.067
	Max.	26.03	4.39	0.001	Max.	0.979	2.814	0.067
2. Contraction Scour Pool (CSP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
3. Step/Pool (SP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
4. Backwater Pool (BWP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
5. Plunge Pool (PP)	Mean	16.76	2.32	0.007	Mean	0.63	1.49	0.467
	Min.	16.76	2.32	0.007	Min.	0.63	1.49	0.467
	Max.	16.76	2.32	0.007	Max.	0.63	1.49	0.467
6. Pocket Water Pool (PWP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
7. Lateral Protrusion Pool (LPP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
8. Straight Dissipator Pool (SDP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
9. Converging Confluence Pool (CCP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
10. Compound Pool (CP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			

1.56

0.016

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Worksheet B-5. 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).
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: $\bar{u}/u^*$.
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: **Gaging Station Number:**

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	95	21.12	1.75	35.18	2.71	0.00675	165.75	0.54	B1c	0.0424	3.33	0.49	5.53

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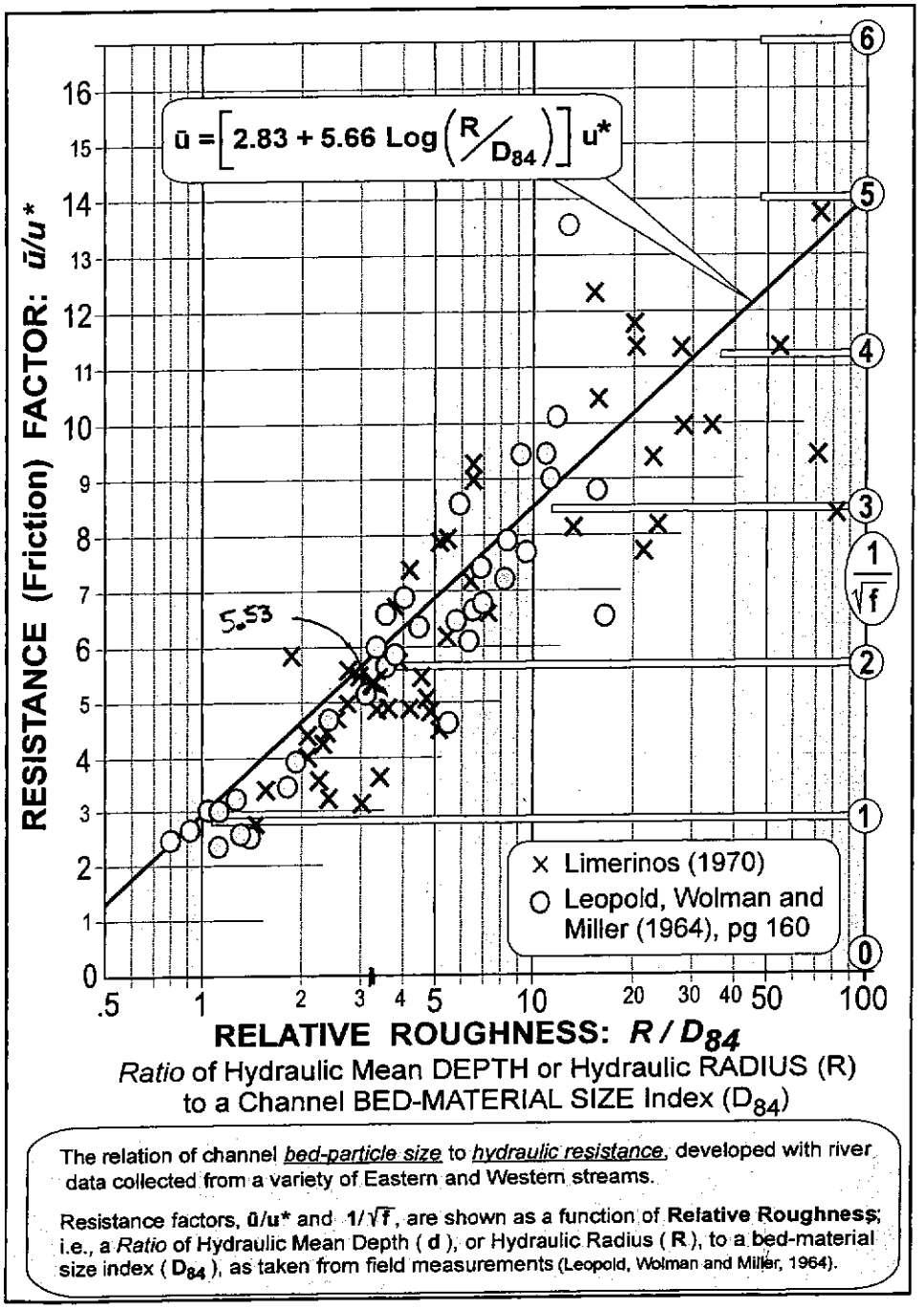

The relation of channel *bed-particle size* to *hydraulic resistance*, developed with river data collected from a variety of Eastern and Western streams.

Resistance factors, $\bar{u}/u^*$ and $1/\sqrt{f}$, are shown as a function of **Relative Roughness**; i.e., a *Ratio* of Hydraulic Mean Depth (**d**), or Hydraulic Radius (**R**), to a bed-material size index (D_{84}), as taken from field measurements (Leopold, Wolman and Miller, 1964).

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

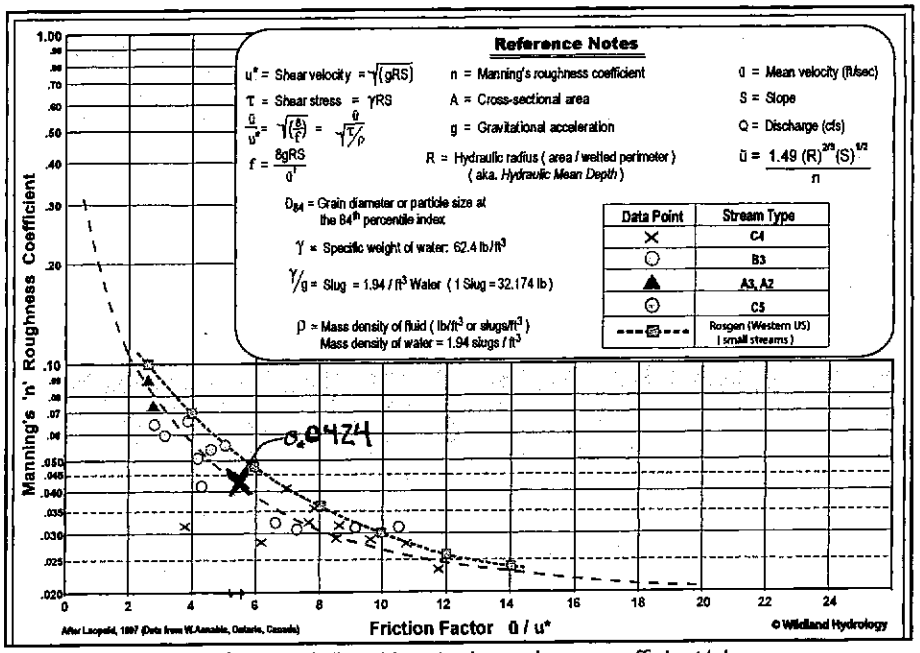

Figure B-35. Friction factor ($\bar{u}/u^*$) *vs.* Manning's roughness coefficient 'n'.

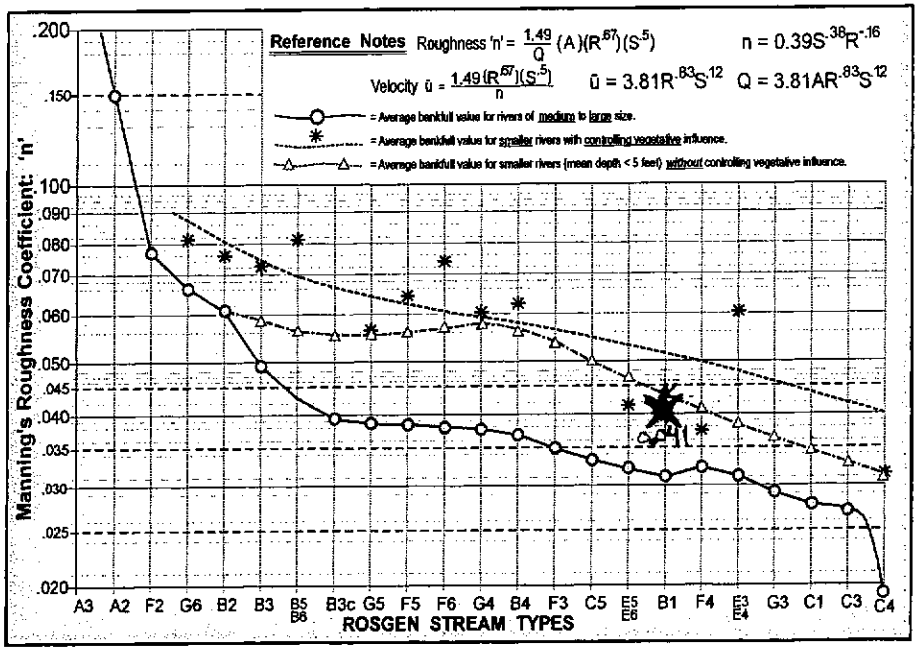

Figure B-36. Manning's 'n' roughness coefficient by stream type.

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Worksheet 4-7. 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(s) (**Figure 2-3**).
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: $n = (1.49R^{2/3}S^{1/2})/u$ (use the bankfull mean velocity from Step 3).
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: u/u^*.
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 2-18**) (Example in **Figure 4-10**).
14. Plot Manning's "n" by friction factor (**Figure 2-19**) (Example in **Figure 4-11**).
15. Plot Manning's "n" by stream type (**Figure 2-20**) (Example in **Figure 4-12**).

Gaging Station Name: **Gaging Station Number:**

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 u_{bkf} (ft/s)	Ave. Water Surface Slope S (ft/ft)	D_{84} (mm)	D_{84} (ft)	Stream Type	Manning's "n"	Relative Rough-ness R/D_{84} (ft/ft)	Shear Velocity u* (ft/s)	Friction Factor u/u*
18.9	95	29							B1c	.042	3.33	0.49	5.3
									B1/5c				

River Morph = BankFull - Depth - Vel