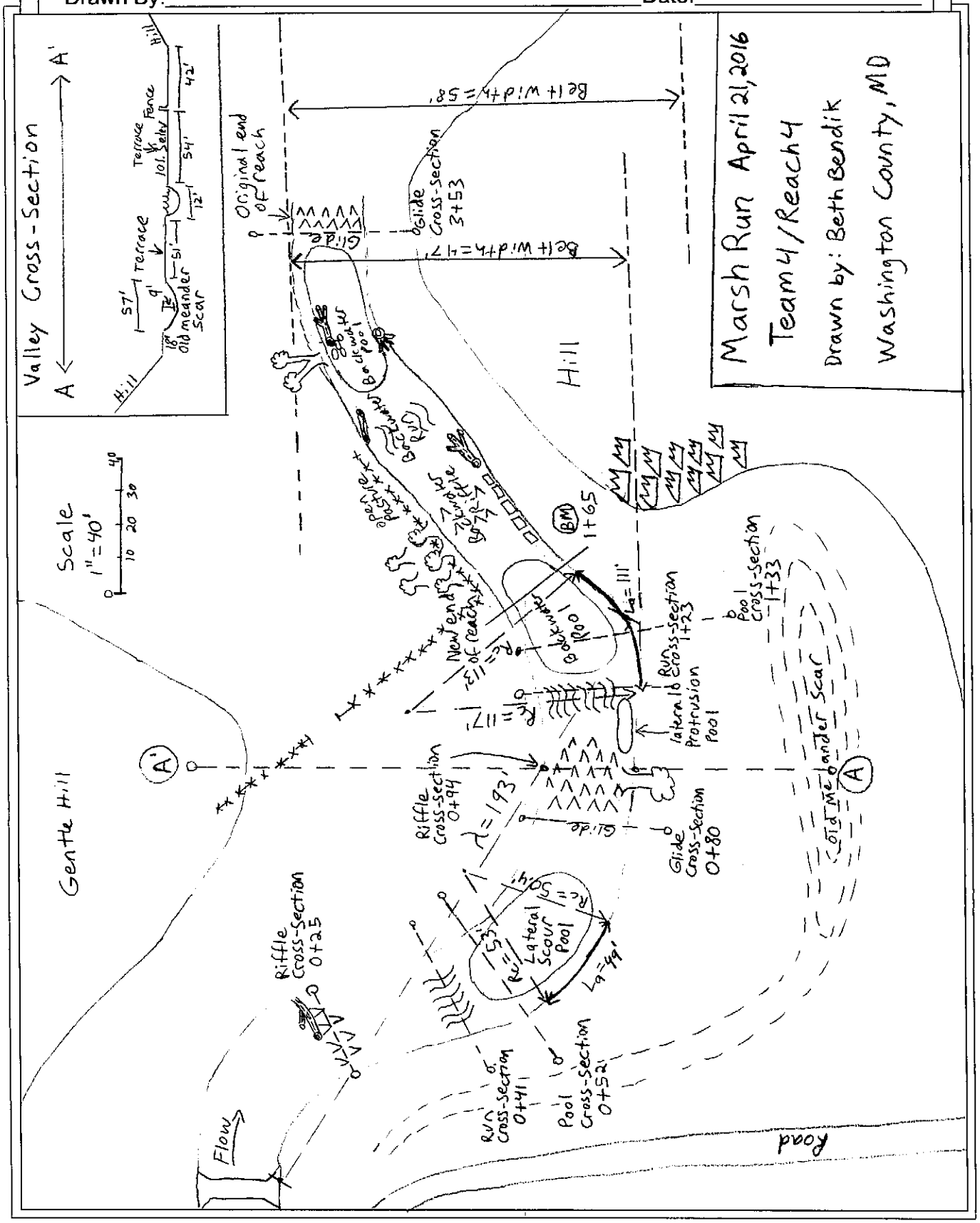
AREA-SITE LOCATION....REACH MAP

Stream/Drainage:_____ Site/Reach:_____

Drawn By:_____ Date:_____



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SURVEY DATA ⟹ **CROSS - SECTION 2**

SITE: Riffle ; 0+25 Marsh Run Reach 4 Date: 4/21/16

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS	
1	0	7.09		5.6		Ground shot	LB
2	+1			5.61		" "	
3	+7			6.05		" "	
4	+13			5.82		" "	
5	+19			6.75		" "	
6	+21.5			7.45		Bankfull d_{bkf} = 8.68 - 7.45 = 1.23	
7	+23.0			8.68		Water Surface	
8	+23.0			9.1		LEW	
9	+26.0			9.39		Channel bottom	
10	+27.0			9.45		Thalweg	
11	+29.0			9.25		" "	
12	31.0			9.45		" "	
13	34.0			9.38		" "	
14	35.0			9.39		" "	
15	37.0			8.71		REW	RB
16	41.0			7.75		Bank - Ground	
17	45.0			6.31		" "	
18	51.0			6.2		Floodplain	
19	58.0			5.79			
20		7.09					
21						d_{bkf} = 1.23	
22							
23							
24						8.68	
25						2.46	
26						6.22	
27							
28							
29							
30							
31							

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SURVEY DATA ⟹ **CROSS - SECTION 1**

SITE: POOL X-Section Date: 4-21-16

Location: 1+33 Marsh Run Reach 4

Observers: HUC: 09

Item	Distance, Point, or STATION ft	Back-Sight BS ft	Height of Instrument HI ft	Fore-Sight FS ft	7/16 Elevation ft	REMARKS / COMMENTS / NOTES
1			107.16			
2	0+00			6.55	add +0.07 on FS	LEFT PIN
3	0+08			6.95		
4	0+13			6.67		
5	0+18			6.40		
6	0+24			6.37		TOP BANK
7	0+25			6.57		
8	0+26			6.66		
9	0+27			6.95		
10	0+27.6			7.20		
11	0+28			8.31		
12	0+31.8			9.10		LEW
13	0+34			9.73		
14	0+36			9.87		
15	0+39			10.11		TWG
16	0+41			9.89		
17	0+42			9.84		
18	0+45			9.97		
19	0+47			9.97		
20	0+49.8			9.07		REW 9.07
21	0+51			7.8		BKF ? 7.80
22	0+51.8			7.33		1.27
23	0+52.1			6.61		
24	0+53			6.60		$d_{bkf} = 1.27$
25	0+58			6.73		
26	0+61			7.1		
27	0+71			7.26		
28	0+82			6.68		RIGHT PIN

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SURVEY DATA ⟹ **CROSS - SECTION** 3

SITE: Run, 0+41 Marsh Run Reach 4 Date: 4/21/16

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
1	0	7.09		5.67		Floodplain LB
2	11.0			6.0		" "
3	16.0			6.45		" "
4	22.0			6.6		Bank
5	24.5			7.6		d_{bkf} = 1.19
6	26.0			8.79		LEW - water surface
7	26.0			8.65		LEW channel bottom
8	28.0			9.07		channel bottom
9	31.0			9.0		" " " "
10	33.0			9.37		channel bottom
11	35.0			9.55		thalweg 8.79
12	38.0			9.4		channel 7.6
13	41.0			9.37		Channel 1.19
14	42.5			8.79		REW
15	45.0			6.28		Bank
16	46.0			5.82		Flood Plain / Bank
17	49.0			5.6		" "
18	58.0			5.62		" "
19		7.09				
20						
21						d_{bkf} = 1.19
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						

24.5 7.6

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SURVEY DATA → CROSS - SECTION 1

SITE: Marsh Run Date: 4/21/16

Location: 0+52 ; Pool Reach 4

Observers: HUC:

Item	Distance, Point, or STATION ft	Back-Sight BS ft	Height of Instrument HI ft	Fore-Sight FS ft	Elevation ft	NOTES / COMMENTS / REMARKS	
1	0+0	7.09		6.15		Ground shot	LB
2	0+7			6.46		" "	
3	+9.5			7.45		Bank slope - Wbkf	= 1.15
4	+11			8.17		Bank Slope	
5	+12			8.6		LEW / water surface	
6	+14			9.6		Channel Bottom	
7	+17			9.9		" "	
8	+20			10.23		Thalweg	
9	+23			10.05		channel bottom	
10	+26			9.74		" "	
11	+28			8.82		REW	
12	+29			8.38		bank slope	
13	+29.5			6.15		Ground Shot - FP	
14	+31.0			6.0		" " - FP	
15	+37.0			5.8		" " - FP	
16	+45			5.72		" " - FB	
17		7.09					
18							
19						8.60	
20						7.45	
21						1.15	
22							
23							
24						dbkf = 1.15	
25							
26							
27							
28							

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SURVEY DATA ⟹ **CROSS - SECTION** 4

SITE: Glide 3+53 Marsh Run Date: 4/22/16

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS	
1	0	7.09		7.84		Floodplain	LB
2	1.0			8.97		LEW	
3	3.0			9.56		channel bottom	
4	5.0			9.82		channel "	
5	8.0			9.89		channel bottom	
6	9.5			9.41		channel bottom	
7	11.0			9.6		Thalweg	
8	13.0			9.4		channel bottom	
9	15.0			9.2		channel bottom	
10	17.0			9.12		channel bottom	
11	20.0			9.10		REW - water surface	
12	21.0			8.3		Ground	
13	23.0			7.89		bankfull d_{bkf}	9.10
14	27.0			7.7		Ground	7.89
15	34.0			7.0			
16							1.21
17		BM✓ = 7.09					
18							
19						d_{bkf} $\Delta = 1.21$	
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

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SURVEY DATA ⟹ **CROSS - SECTION 2**

SITE: Glide 0+80.2 Marsh Run Reach 4 **Date:** 4/21/2016

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS	
1	BM	4.99	104.99		100		
2	0.	~~4.~~		4.31			
3	11			3.59			
4	13			4.08		terrace break in slope	6.70 5.24 1.46
5	14			5.58		break	
6	15.4 ~~15.7~~			5.24 ~~5.37~~		break break (BF)	6.70 5.59 1.11
7	16.1			5.59		break	
8	16.6			5.88		break	6.70 5.88 .82
9	17.2			6.70	98.29	LEW	
10	18.2			6.99		Channel	
11	18.7			7.1		Chanel	6.70 5.88 .82
12	19.5			6.73		Shallow Chanel	
13	20.3			7.09		channel	
14	21.0			7.24		Thalwag	
15	21.9			7.34		Channel	6.38
16	22.7			7.26		channel	6.70 5.37 1.33
17	23.9			7.08		channel	
18	25.2			7.38		channel	
19	25.8			6.90		channel	
20	26.5			7.42		"	
21	27.3			7.63		Channel	
22	28.3			7.73		"	
23	28.5			7.21		"6.38	5.63 4.96 .67
24	~~28.1~~ 29.0			~~7.82~~ 7 ~~6.38~~ surface shot	REW	REW boulder	
25	~~30.8~~			5.38		~~terrace~~ bankful	
26	32.8			4.96		terrace	
27	34.6			4.34		slope	
28	37.5			3.74		Top bank	
29	52.3			4.15		Flat	
30	BS	4.99				BS close	
31							

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riffle

2 of 2

SURVEY DATA ⟹ **CROSS - SECTION 7**

SITE: marsh Run at Grimes Reach 4 **Date:** 4/21/2016

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
1					100	
2	0.00	6.03		6.03		Flat
3	7.6	6.36		6.36		top of bank
4	8.5	8.21		6.89		Feature break
5	9.4			7.61		Slope
6	11.0			5.41		Shelf
7						Low
8						
9	31.1			6.04		BF (?)
10	31.8			5.59		L.Terrace
11	32.9			5.09		Flat
12	38.2			4.68		Flat
13	52.8			4.84		Flat
14	60.0			4.0		Flat end
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						

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0+94. station

Classification Riffle

SURVEY DATA ⟹ **CROSS - SECTION** 1

SITE: Marsh Run at Grimes Reach 4 Date: 4/21/2016

Location: Downstream Reach

Observers: NN, LM HUC:

Item	Distance, Point, or STATION ft	Back-Sight BS ft	Height of Instrument HI ft	Fore-Sight FS ft	Elevation ft	REMARKS / COMMENTS / NOTES
1	BM	6.03	~~100.03~~		100.00	rock in ~~road~~ dirt
2	4		106.03	4.96		
3	7.7			5.19		top of bank
4	8.5			5.41		slope break - possible terrace
5	10.2			6.42	99.61	bankful(?) 1.2
6	11.0			7.02		~~Bench~~
7	11.6			7.62	98.41	LEW
8	12.4			7.99		channel shot
9	13.8			8.11		channel shot
10	14.6			7.93		channel
11	15.9			8.15		channel
12	16.4			8.10		channel
13	17.4			8.63		channel
14	17.9			8.12		channel
15	TP	4.99	104.99			moved to other side channel
16	18.4			7.43		channel
17	19.9			7.67		channel
18	21.7			7.03		channel
19	22.85			7.70	97.27	Thalweg
20	23.5			7.59		channel
21	24.7			7.58		channel
22	25.5			7.61		channel
23	26.2			7.59		channel
24	26.8			7.69		channel
25	28.0			7.71		channel
26	29.1			7.0		Roots
27	29.3			6.89		~~REW~~ roots REW
28	29.8			6.60		

~~[illegible]~~ 7 / 4.86 / 99.5

104.03 / 6.42 / 99.61

97.27 / 4.68 / 102.95

calculate watersurface Bankful

99.61 / 97.27 / 2.34 max depth

104.99 / 7.70 / 97.29

LEW 6.6

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SURVEY DATA ⟹ **CROSS - SECTION** 5

SITE: ~~Glide~~ Run Marsh Run Sta 123 **Date:** 4/21/16

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES / COMMENTS / REMARKS
1	46.3			7.45		
2	47.6			7.24		
3	49.1			6.99		REDW
4	50.1			6.55		
5	51.1			6.1		
6	51.9			5.71		
7	52.4			5.06		
8	53			4.35		TOB
9	55.5			4.48		Top of berm
10	59.2			4.89		Low flo
11	64.4			4.62		
12	70.9			4.24		
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						

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SURVEY DATA ⟹ **CROSS - SECTION 8**

SITE: Run March Run Reach 4 Date: Sta 23 4/21/16

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
1	BM	4.99	104.99			
2	0			4.2		
3	3.5			4.4		
4	7.2			4.7		
5	13			4.44		
6	17			4.2		
7	19.3			4.08		
8	22.9			4.00		TOB
9	24.4			4.6		slope
10	25			5.21		Little flt.
11	25.6			5.54		Brk BF
12	26			6.12		Brk, Eros
13	26.6			6.38		
14	27.5			6.66		
15	28.8			6.95		EOW
16	31.5			7.6		
17	32.9			7.6		
18	33.9			7.76		
19	34.7			7.6		
20	36.0			7.58		
21	37			8.02		Thalweg
22	38			7.88		
23	38.9			7.85		
24	39.9			7.78		
25	41			7.86		
26	41.9			7.85		
27	42.7			7.76		
28	43.5			7.76		
29	44.3			7.69		
30	45.4			7.5		
31						

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SURVEY DATA ⟶ **LONGITUDINAL PROFILE 1**

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

Location: Reach 4

Observers: Team 4 | HUC:

	Distance, Point, or STATION (ft)	Back-Sight BS (ft)	Height of Instrument HI (ft)	Thalweg Fore-Sight FS (ft)	Thalweg Elevation Elev.	Water Surface Fore-Sight FS (ft)	Water Surface Elevation Elev.	Bankfull Fore-Sight FS (ft)	Bankfull Elevation Elev.	Low Bank Hi Fore-Sight FS (ft)	Low Bank Hi Elevation Elev. (ft)	NOTES e.g. Riffle Run Pool Glide	WS - BKF
1			7.092										
2	0+00			9.28		8.61		7.55				TOP RIFFLE	1.14
3	21 + 25+5+6			9.7		8.62		7.49				RIFFLE	1.17
4	35			9.62		8.61						RIFFLE	
5	46 + 41			10.13		8.69		7.41				END START Pool	1.28
6	52			10.45		8.71						Pool Deepest	
7	73			9.73		8.67						START GLIDE	
8	80			9.12		8.77	98.32					END GLIDE ST RIFF	
9	96.6			9.93		9.03		7.79				RIFFLE XSEC	1.24
10	107			9.79		9.01						END RIF START RUN	
11	119			9.98		9.0						RUN	
12	136			9.91		9.04		7.84				END RUN START POOL	1.24
13	173			10.81		9.0		7.85		Back water		Pool	1.15
14	180			10.55		9.0				Riffle			
15	193.5			10.75		9.0							
16	202			10.11		9.0							
17	210			10.16		8.98							
18	220			10.75		8.98		7.67					1.32
19	230			10.65		8.98							
20	243.5			10.3		8.98		7.73					1.25
21	274			10.06		8.97		7.76					1.23
22	297			10.14		8.97							
23	3+08			10.3		9.0							
24	3+20			10.25		9.0							
25	332			10.24		9.0							
26	3+37			11.19		9.0		7.74					
27	3+44			10.95		9.0							

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SURVEY DATA ⟶ **LONGITUDINAL PROFILE 2**

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

Location: Reach 4

Observers: Team 4 HUC:

	Distance, Point, or STATION ft	Back-Sight BS ft	Height of Instru-ment 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	3+48			10.52		9.03						START GLIDE
29	3+53			9.39		9.1		7.7				END GLIDE START RIFFLE 1.3
30												
31	0+10			9.73		8.63						MID RIFFLE
32	0+62			10.45		8.75						
33	1+48			10.06		8.96						BW RIFFLE
34	1+65			9.9		9.0						BW RIFFLE
35												
36	0+25			9.48		8.65						
37	0+41			9.57		8.67						
38	0+52			10.3		8.73						water surface tilted 8.65
39	3+53											
40												
41												
42												
43												
44												
45												
46												
47												
48												
49												
50												
51												
52												
53												
54												

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4/21/16

Site: March Run at Grimes Reach 4

Location: 0+96.6 (Riffle) HUC:

Observers: Riffle

Protocol Dot Count for ~~RIFFLE~~ 1 ~~POOL~~ 2 Pebble ~~COMP.~~ 3

Inches	PARTICLE	Millimeters		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	SAND									
	Medium	.25 - .50	SAND									
	Coarse	.50 - 1.0	SAND									
.04 - .08	Very Coarse	1.0 - 2	SAND									
.08 - .16	Very Fine	2 - 4	GRAVEL									
.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									
			TOTAL→									

Stream Type: **Landscape Type:**

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4/21/16

Site: March Run at Grimes Reach 4

Location: 25.2 (Riffle) HUC:

Observers:

Protrusion Dot Count for ~~RIFFLE~~ 1 ~~POOL~~ 2 Pebble COMP. 3

Inches	PARTICLE	Millimeters		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	SAND									
	Medium	.25 - .50	SAND									
	Coarse	.50 - 1.0	SAND									
.04 - .08	Very Coarse	1.0 - 2	SAND									
.08 - .16	Very Fine	2 - 4	GRAVEL									
.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									
				TOTAL→								

Stream Type: **Landscape Type:**

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Site: Marsh Run at Grimes 4/21/16

Location: Reach 4 HUC:

Observers:

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3
	Silt / Clay	< .062	S/C			15
	Very Fine	.062 - .125	SAND			1
	Fine	.125 - .25				4
	Medium	.25 - .50				1
	Coarse	.50 - 1.0				8
.04 - .08	Very Coarse	1.0 - 2				0
.08 - .16	Very Fine	2 - 4	GRAVEL			1
.16 - .22	Fine	4 - 5.7				1
.22 - .31	Fine	5.7 - 8				0
.31 - .44	Medium	8 - 11.3				1
.44 - .63	Medium	11.3 - 16				4
.63 - .89	Coarse	16 - 22.6				0
.89 - 1.3	Coarse	22.6 - 32				2
1.3 - 1.8	Very Coarse	32 - 45				1
1.8 - 2.5	Very Coarse	45 - 64				0
2.5 - 3.5	Small	64 - 90	COBBLE			1
3.5 - 5.0	Small	90 - 128				6
5.0 - 7.1	Large	128 - 180				3
7.1 - 10.1	Large	180 - 256				4
10.1 - 14.3	Small	256 - 362	BOULDER			1
14.3 - 20	Small	362 - 512				1
20 - 40	Medium	512 - 1024				0
40 - 80	Large-Vry Large	1024 - 2048				0
	Bedrock		BDRK			56
					TOTAL→	

RIFFLE (1)			POOL (2)			COMPOSITE (3)		
Reach:			Reach:			Reach:		
Date:			Date:			Date:		
TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM

Stream Type: **Landscape Type:**

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

COMPLETE

Stream: Marsh Run Location: Reach 4 1.71

Observers: Stream Type: Landscape Type: 22.06 Date: 4/21/16

0.002

Pool Type		Dimensional Values: Pool Length (L_p)	Pool Max Depth ($d_{max p}$)	Pool Slope (S_p)		Dimensionless Ratios: Pool Length to Riffle Width (L_p / W_{bk})	Pool Max Depth to Riffle Mean Depth ($d_{max p} / d_{bk}$)	Pool Slope to Average Slope (S_p / S)
1. Lateral Scour Pool (LSP)	Mean	27	2.94	.00215	Mean	1.22	1.71	1.075
	Min.				Min.			
	Max.				Max.			
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	22.5	2.85	0	Mean	1.01	1.66	0
	Min.	29	2.33	0	Min.	1.31	1.36	0
	Max.	16	3.38	0	Max.	.73	1.98	0
5. Plunge Pool (PP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
6. Pocket Water Pool (PWP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
7. Lateral Protrusion Pool (LPP)	Mean	18	3.38	0.001	Mean	0.816	1.98	0.5
	Min.	18	3.38	0.001	Min.	0.816	1.98	0.5
	Max.	18	3.38	0.001	Max.	0.816	1.98	0.5
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.			

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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**).

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Gaging Station Name: Marsh Run @ Grimmes **Gaging Station Number:** 01617800

Drainage Area (mi²)	Bankfull Discharge Q_{bkf} (cfs)	Bankfull Width W_{bkf}	Bankfull Mean Depth d_{bkf} (ft)	Bankfull Area A_{bkf} (ft²)	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	95.0	22.0	1.7	37	2.56	0.0021	2004	6.72	C1	0.036	1.57	0.327	3.76

Bedrock

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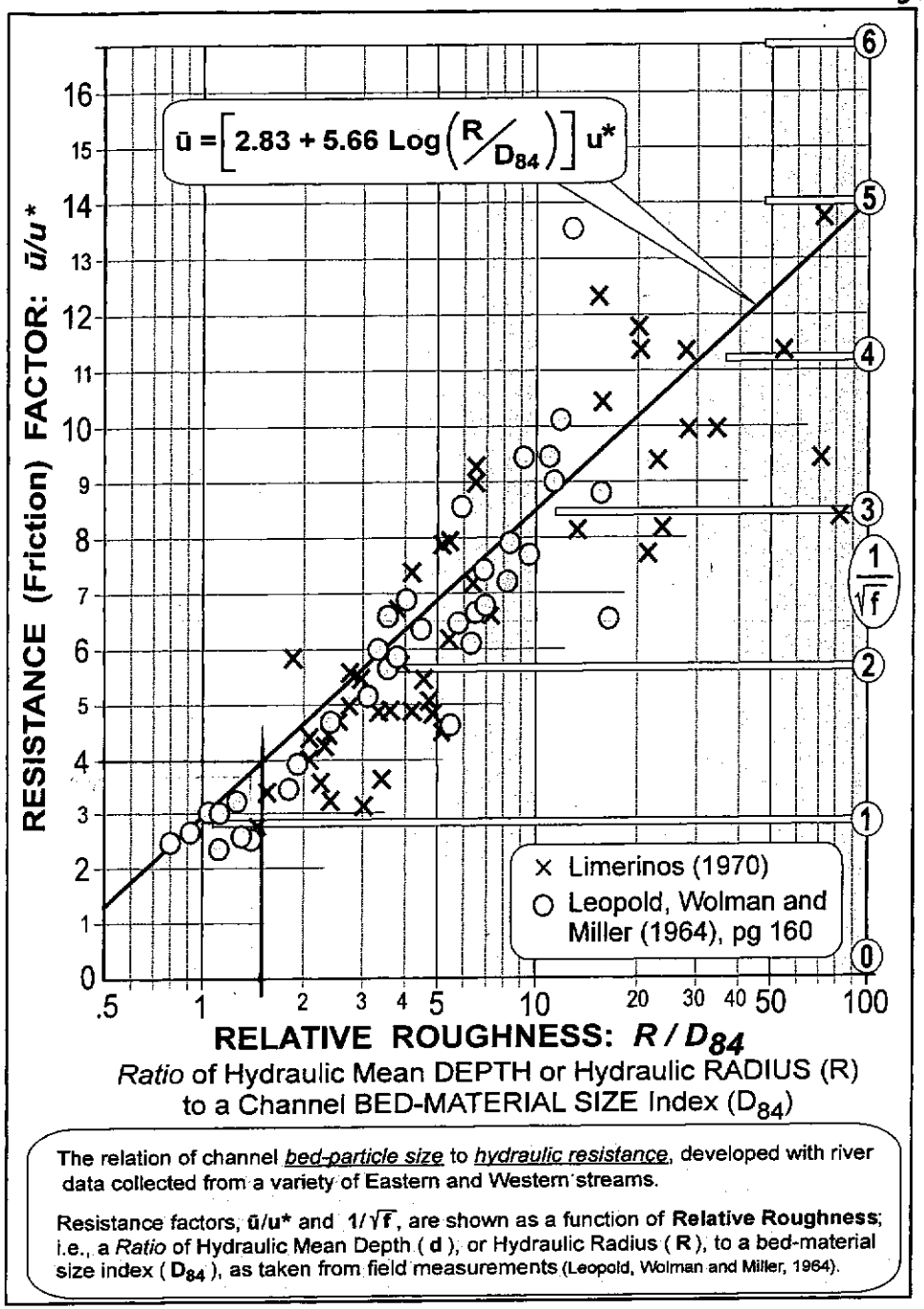
R = 1.57

Plotted on computer Reach 4 Marsh Run 4/21/16



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 ($\bar{u}/u^*$).

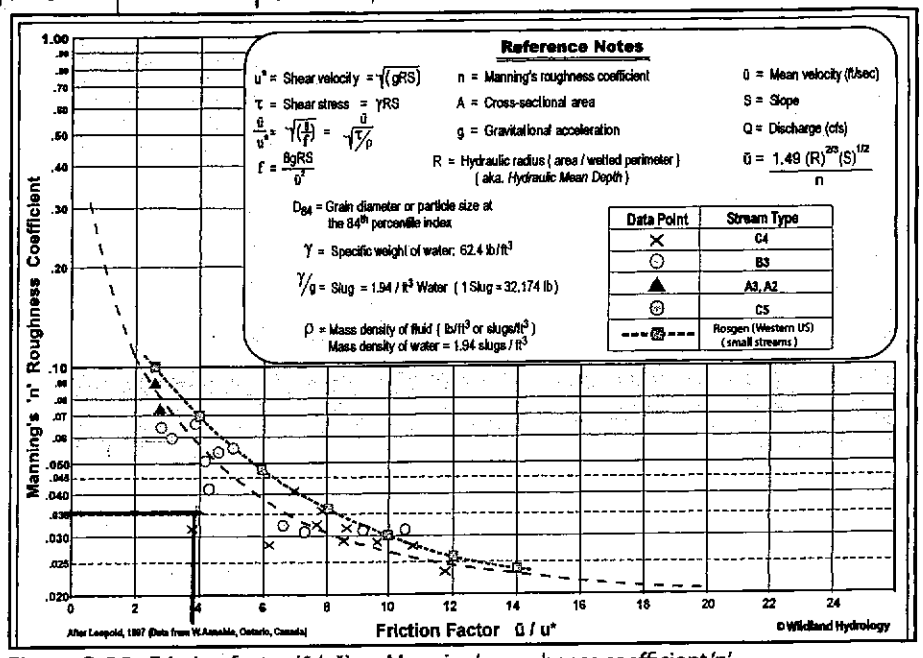


Figure B-35. Friction factor ($\bar{u}/u^*$) *vs.* Manning's roughness coefficient 'n'.

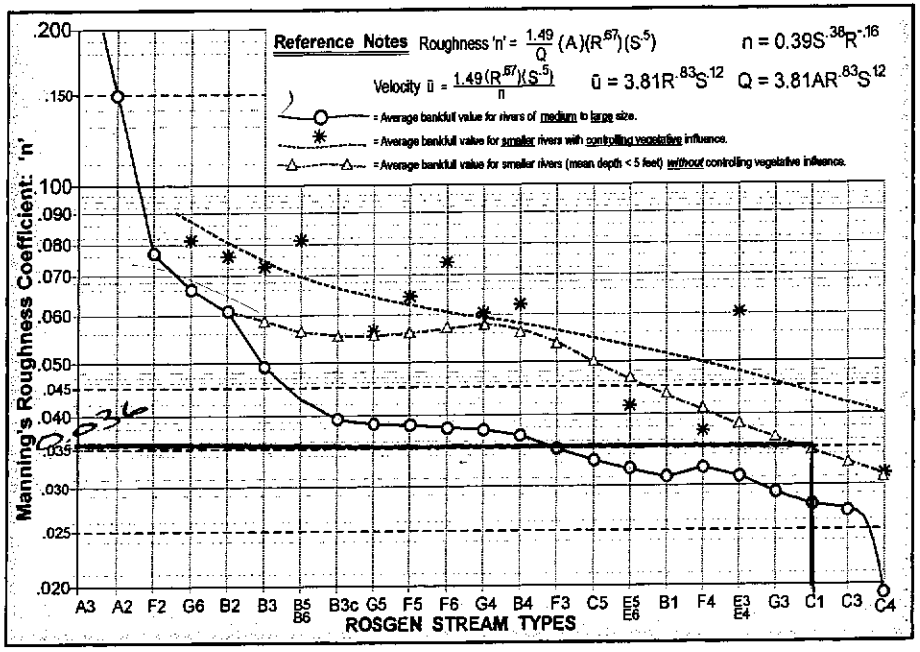


Figure B-36. Manning's 'n' roughness coefficient by stream type.

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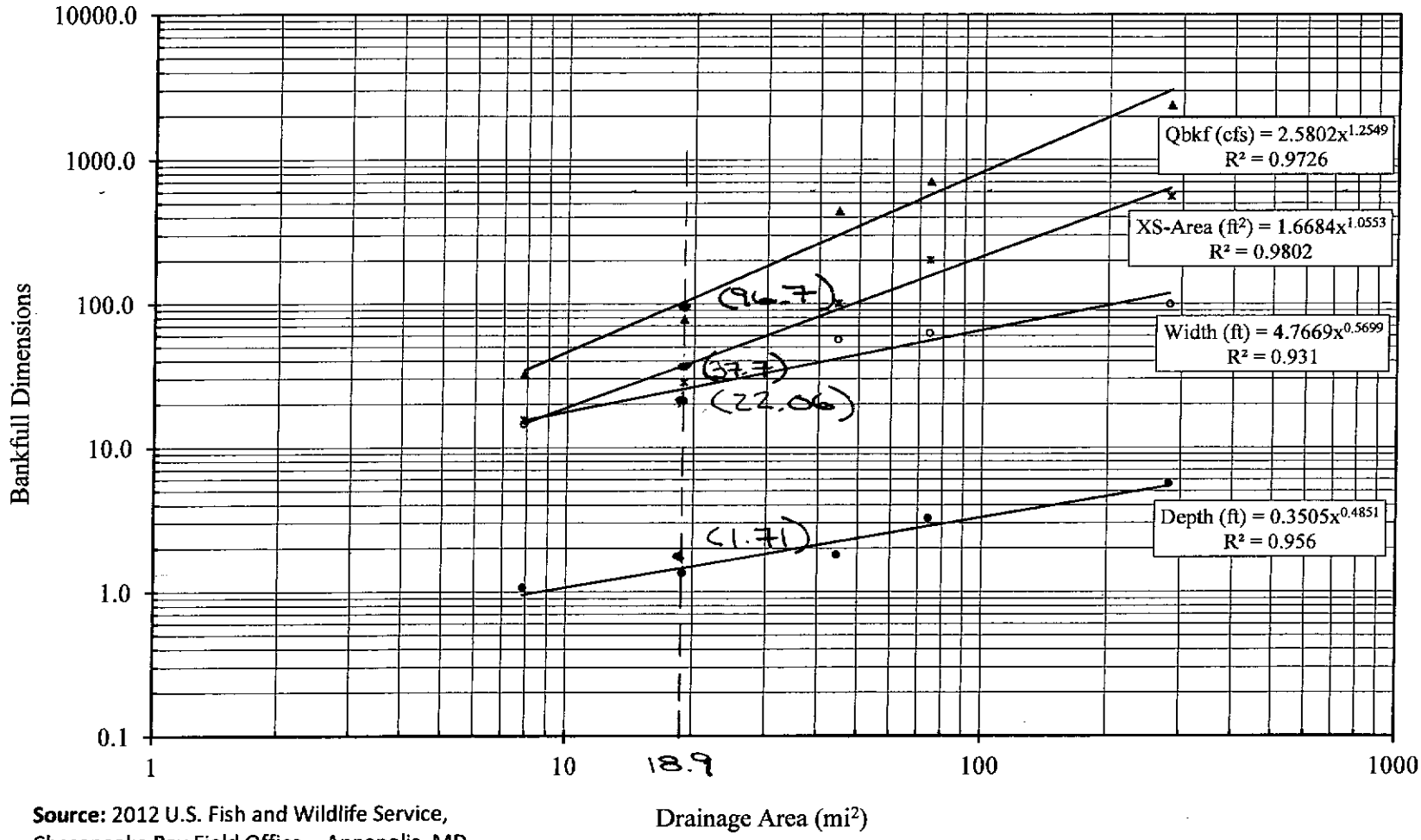
Q = 96.7 XS Area = 37.7
W = 22.1 Dbkf = 1.71

Bankfull Characteristics for Selected USGS Gages in the PA and MD Carbonate Great Valley Section of the Ridge and Valley Province



Source: 2012 U.S. Fish and Wildlife Service, Chesapeake Bay Field Office - Annapolis, MD

Marsh Run Reach 4
4/21/16