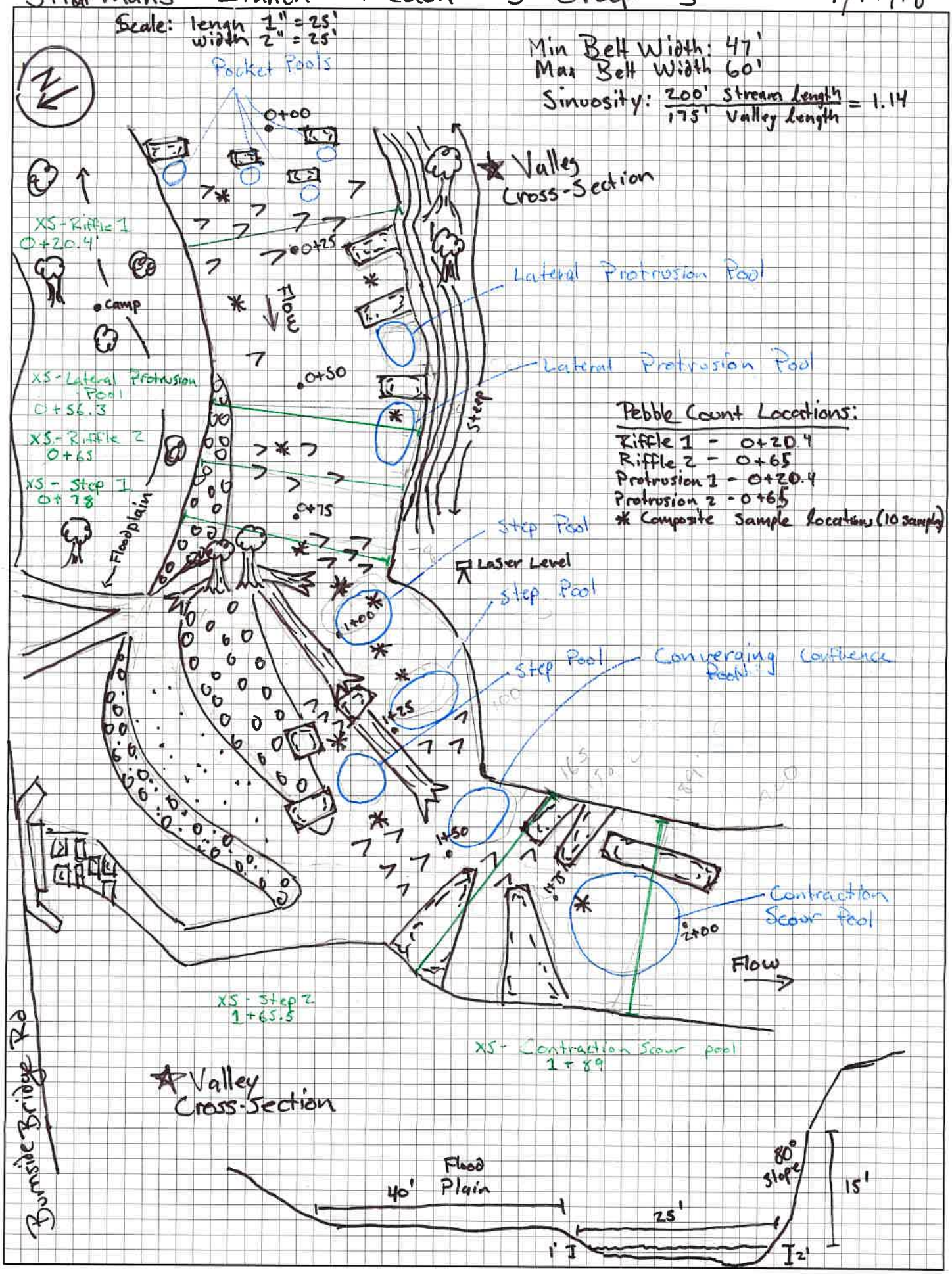
Team 3:00

Shermans Branch - Reach #3 - Group #3 4/17/18

Scale: length 1" = 25'
width 2" = 25'

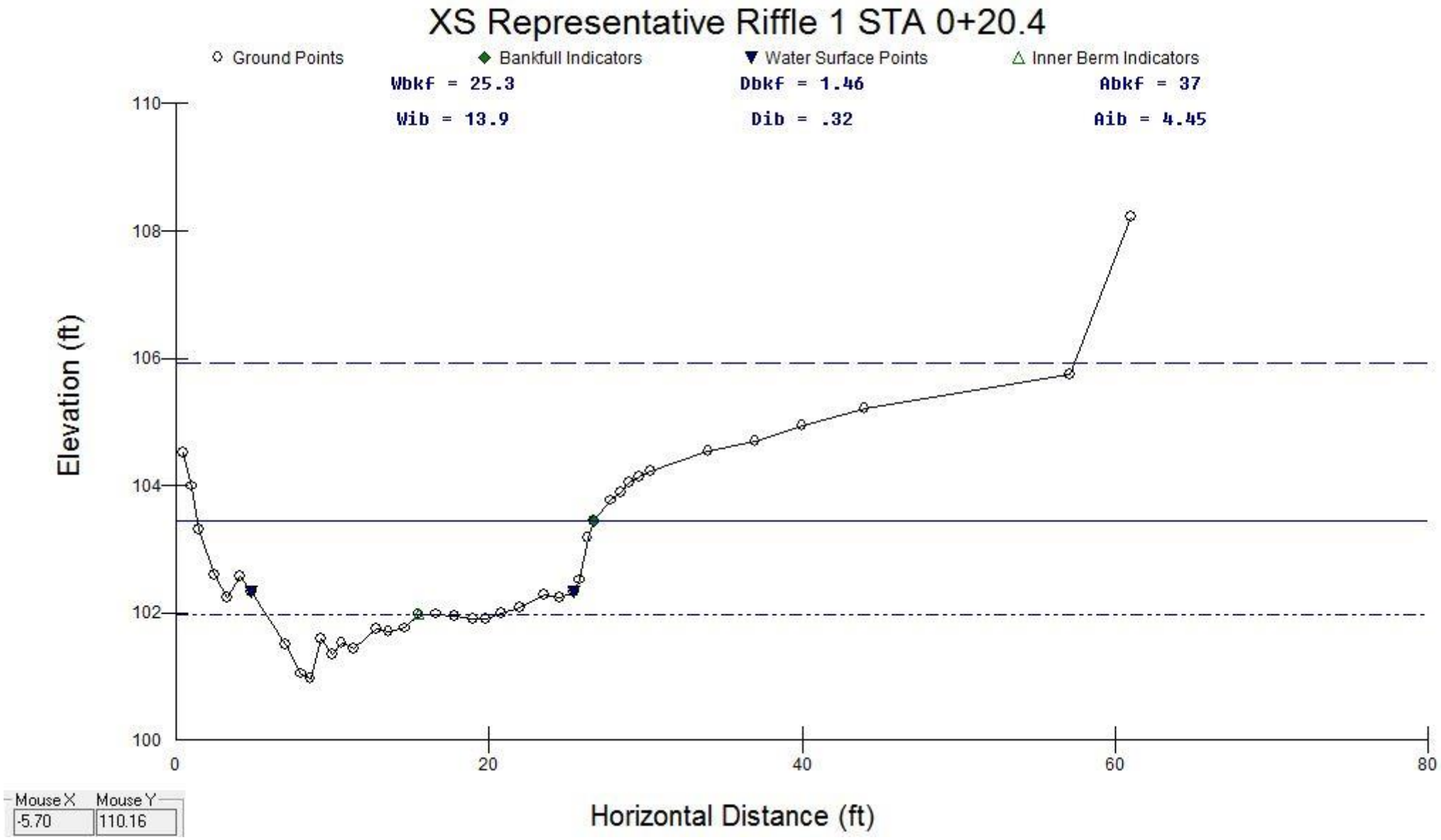
Min Belt Width: 47'
Max Belt Width 60'
Sinuosity: $\frac{200' \text{ Stream length}}{175' \text{ Valley length}} = 1.14$

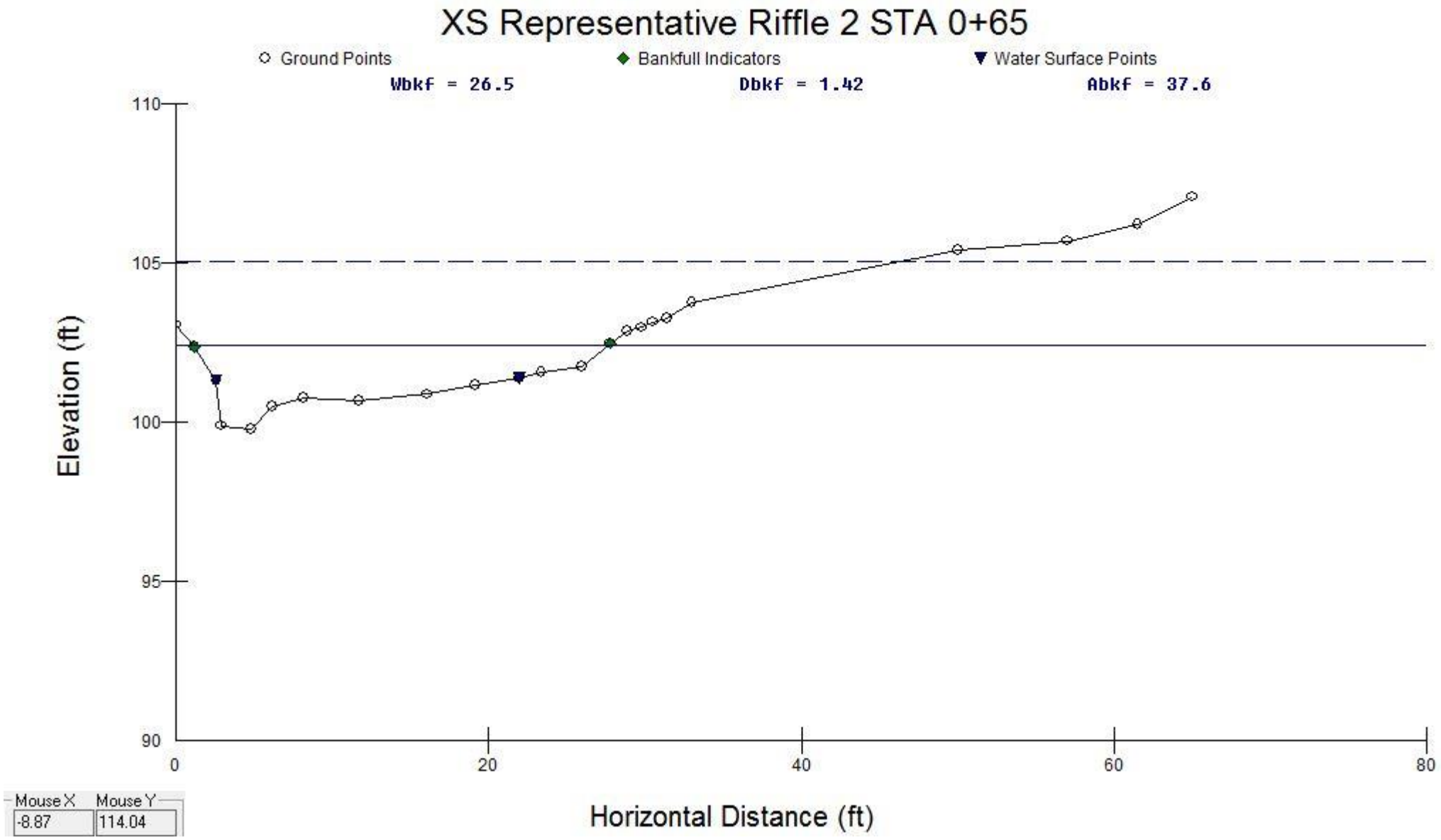


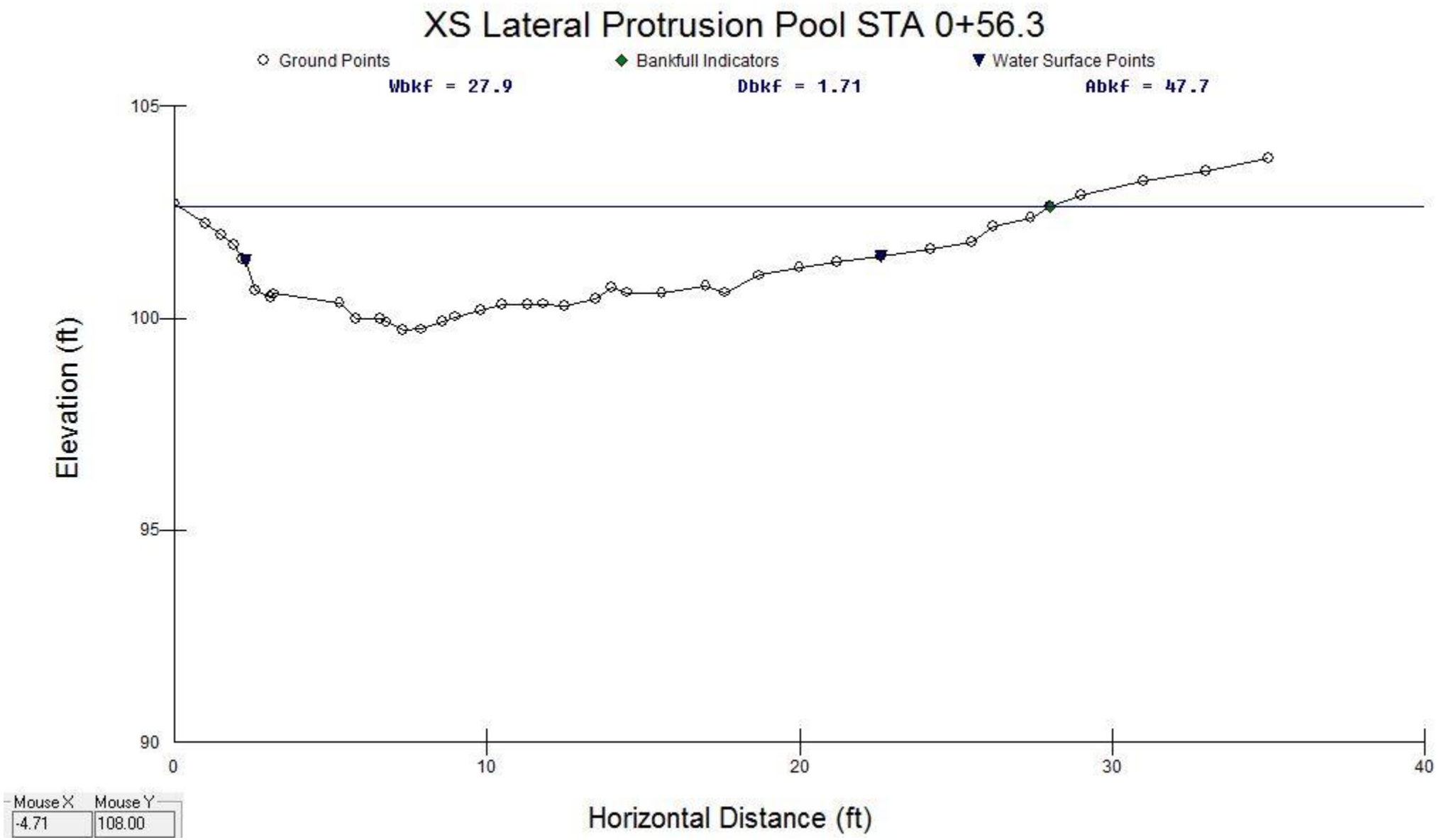
Pebble Count Locations:

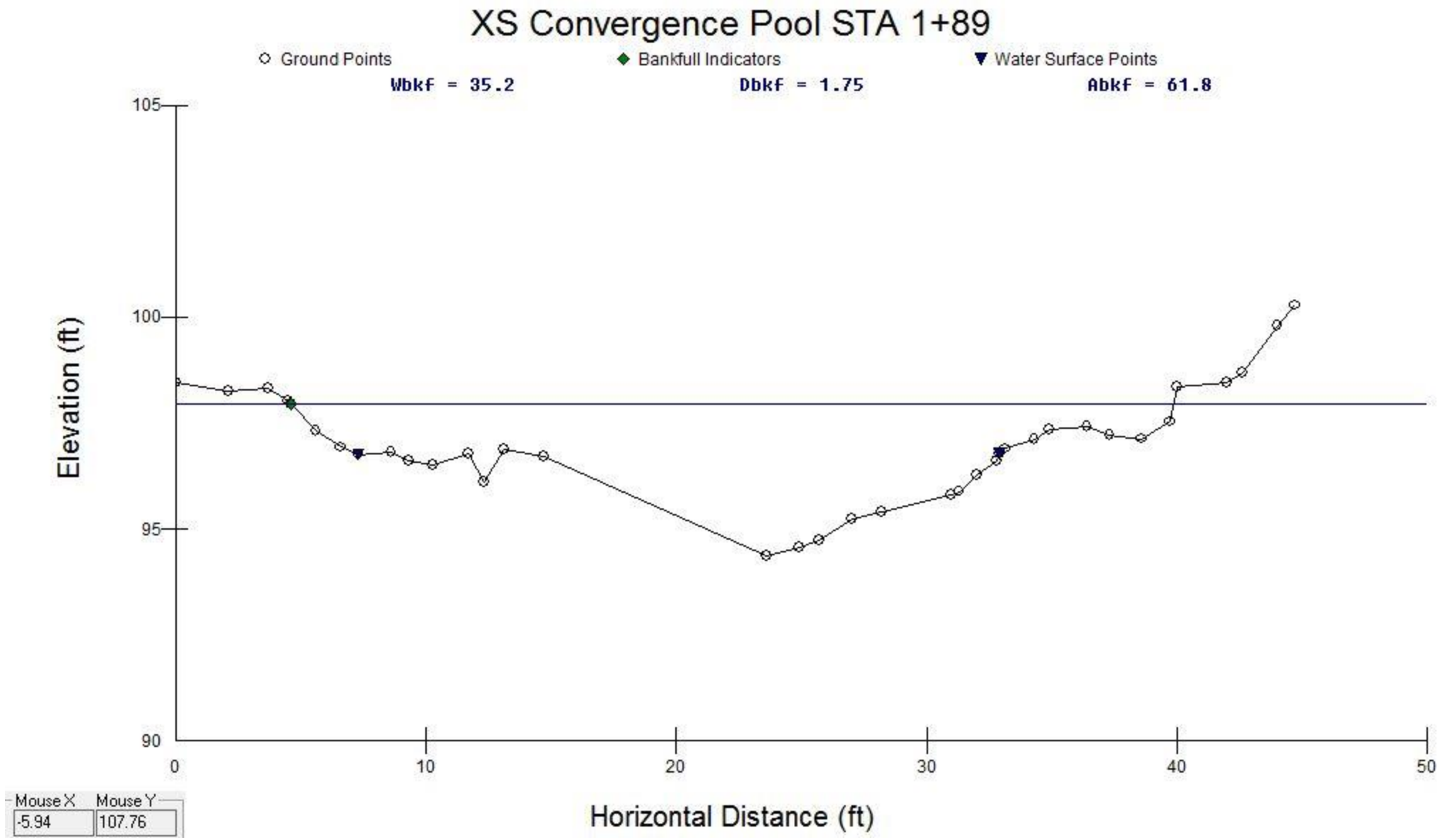
Riffle 1 - 0+20.4
Riffle 2 - 0+65
Protrusion 1 - 0+20.4
Protrusion 2 - 0+65
* Composite Sample locations (10 samples)

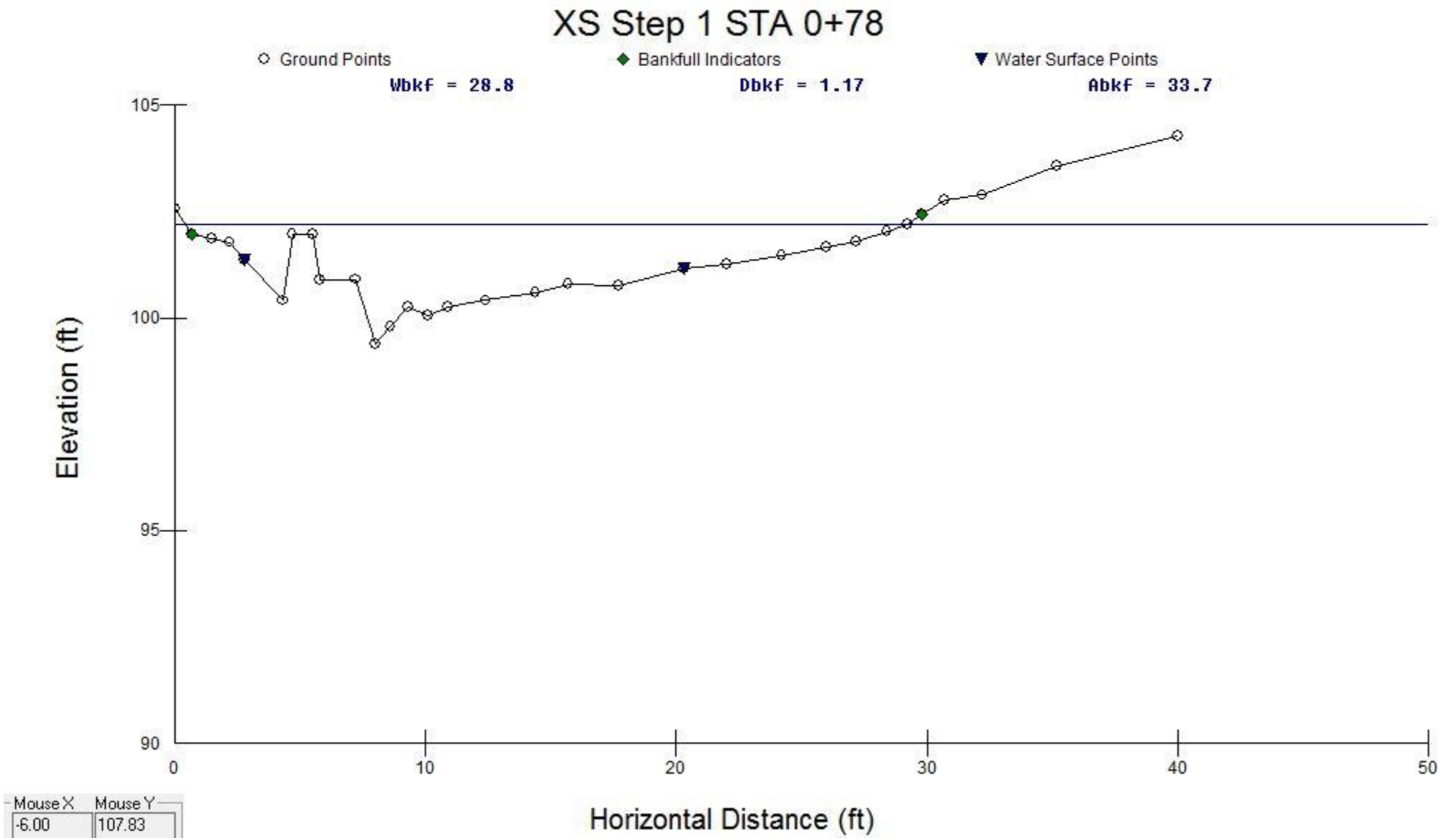
Cross-Section Graphs

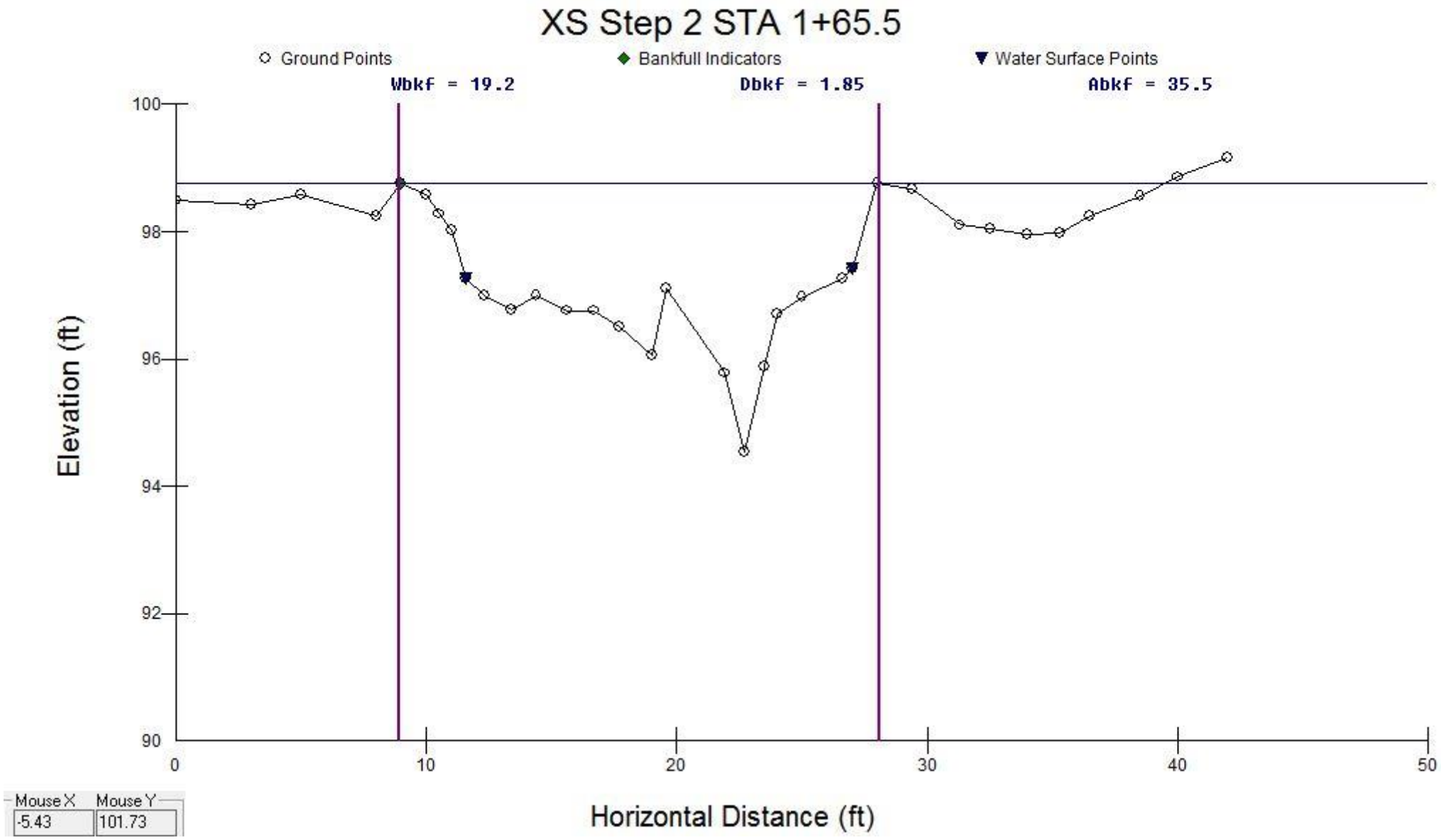

XS Representative Riffle 1 STA 0+20.4
Ground Points
Bankfull Indicators
Water Surface Points
Inner Berm Indicators
Wbkf = 25.3
Wib = 13.9
Dbkf = 1.46
Dib = .32
Abkf = 37
Aib = 4.45
Elevation (ft)
110
108
106
104
102
100
0
20
40
60
80
Horizontal Distance (ft)
Mouse X
Mouse Y
-5.70
110.16


XS Representative Riffle 2 STA 0+65
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 26.5
Dbkf = 1.42
Abkf = 37.6
Elevation (ft)
110
105
100
95
90
0
20
40
60
80
Horizontal Distance (ft)
Mouse X
Mouse Y
-8.87
114.04


XS Lateral Protrusion Pool STA 0+56.3
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 27.9
Dbkf = 1.71
Abkf = 47.7
105
100
95
90
Elevation (ft)
0
10
20
30
40
Horizontal Distance (ft)
Mouse X
Mouse Y
-4.71
108.00

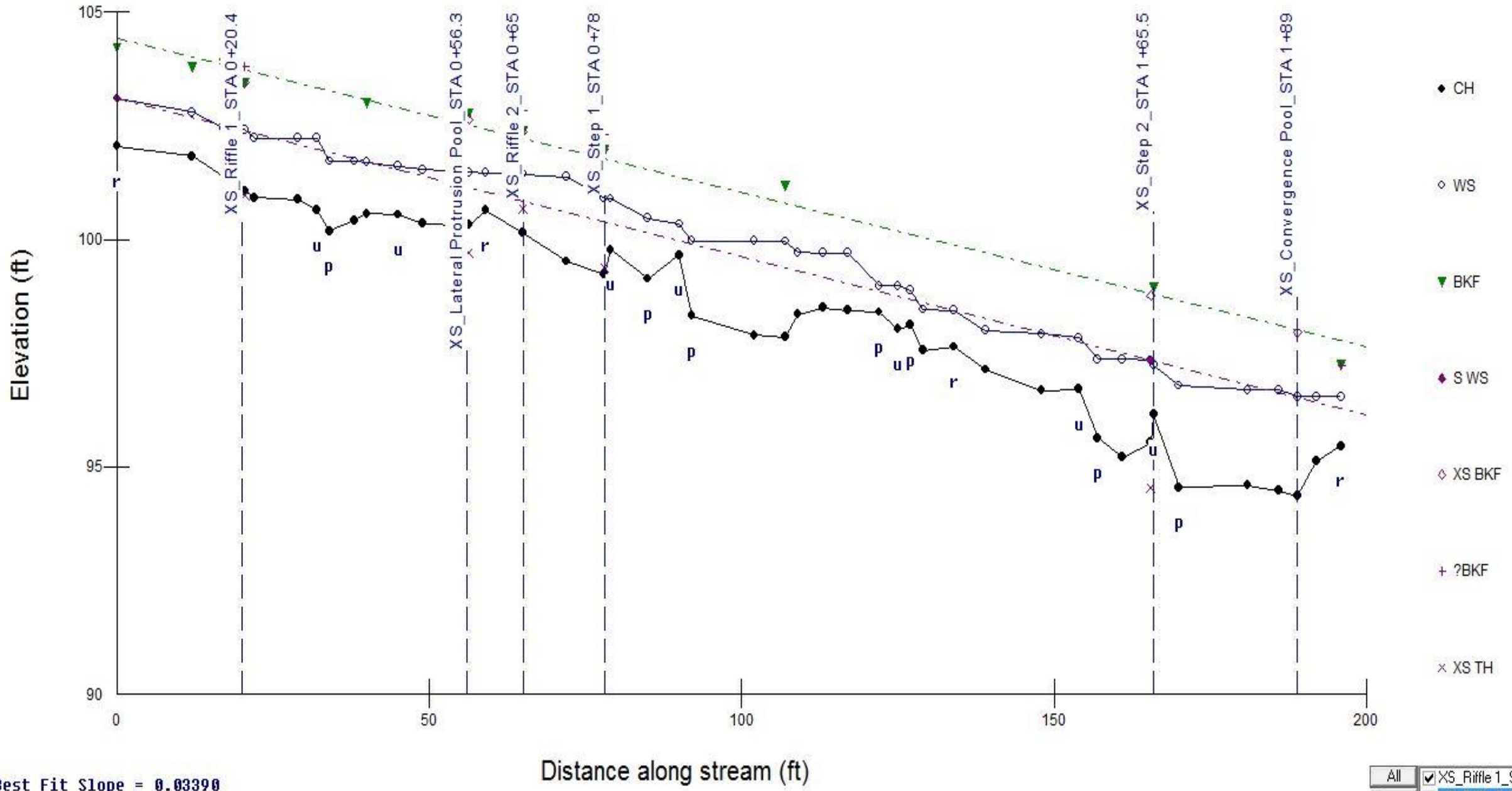

XS Convergence Pool STA 1+89
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 35.2
Dbkf = 1.75
Abkf = 61.8
Elevation (ft)
105
100
95
90
0
10
20
30
40
50
Horizontal Distance (ft)
Mouse X
Mouse Y
-5.94
107.76


XS Step 1 STA 0+78
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 28.8
Dbkf = 1.17
Abkf = 33.7
105
100
95
90
Elevation (ft)
0
10
20
30
40
50
Horizontal Distance (ft)
Mouse X
Mouse Y
-6.00
107.83


XS Step 2 STA 1+65.5
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 19.2
Dbkf = 1.85
Abkf = 35.5
Elevation (ft)
100
98
96
94
92
90
0
10
20
30
40
50
Horizontal Distance (ft)
Mouse X
Mouse Y
-5.43
101.73

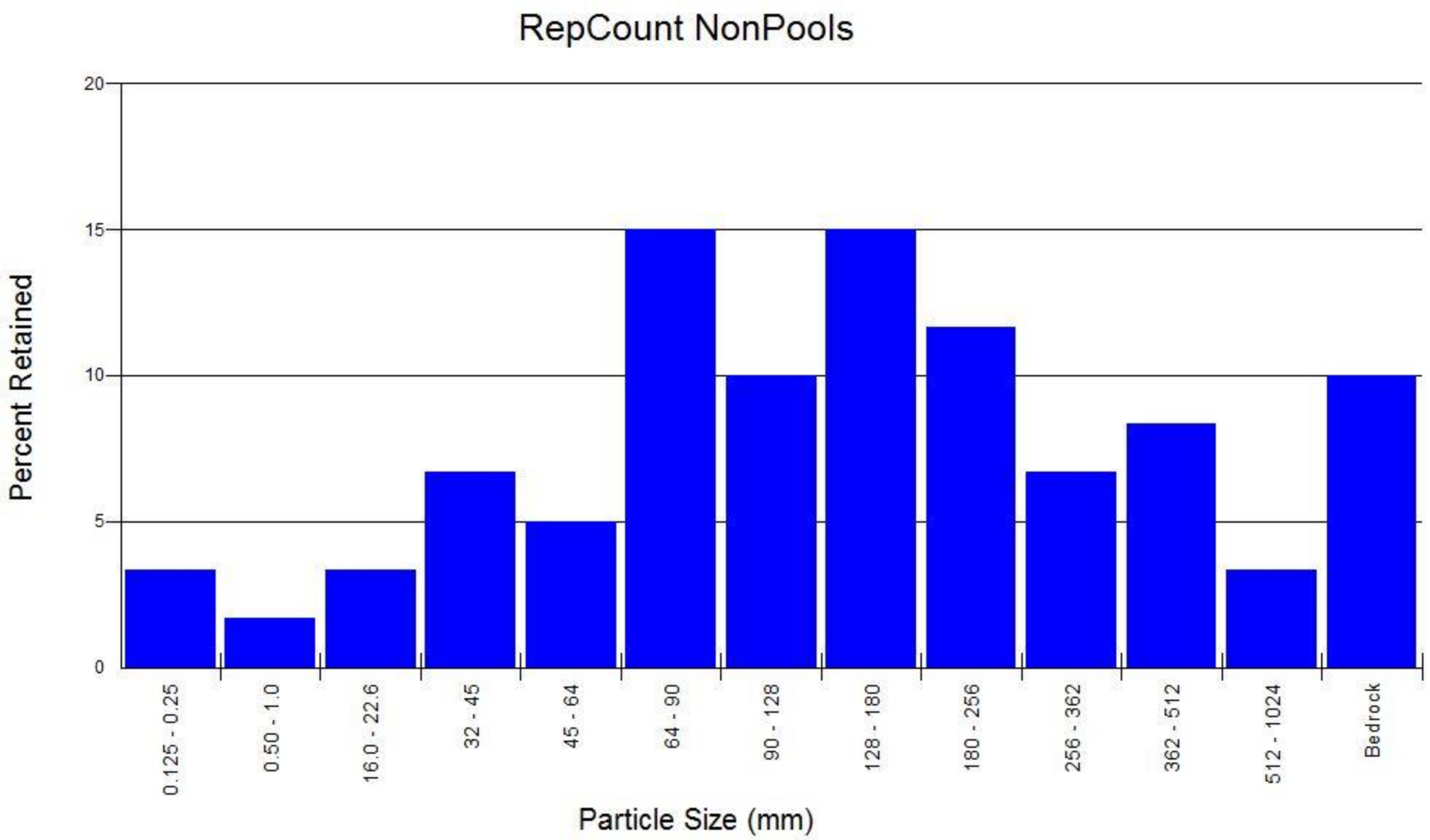
Longitudinal Profile

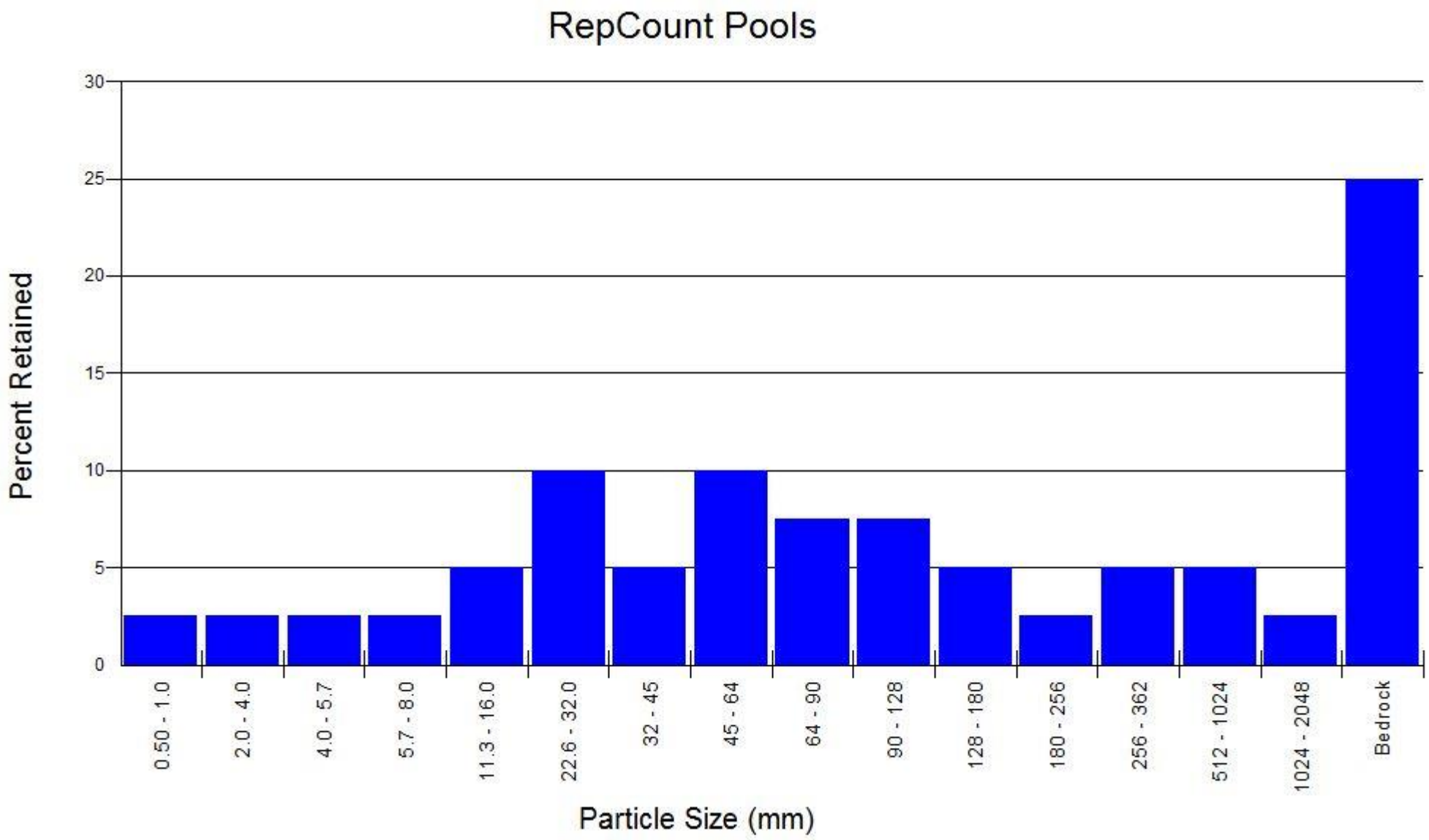
Longitudinal Profile Reach 3

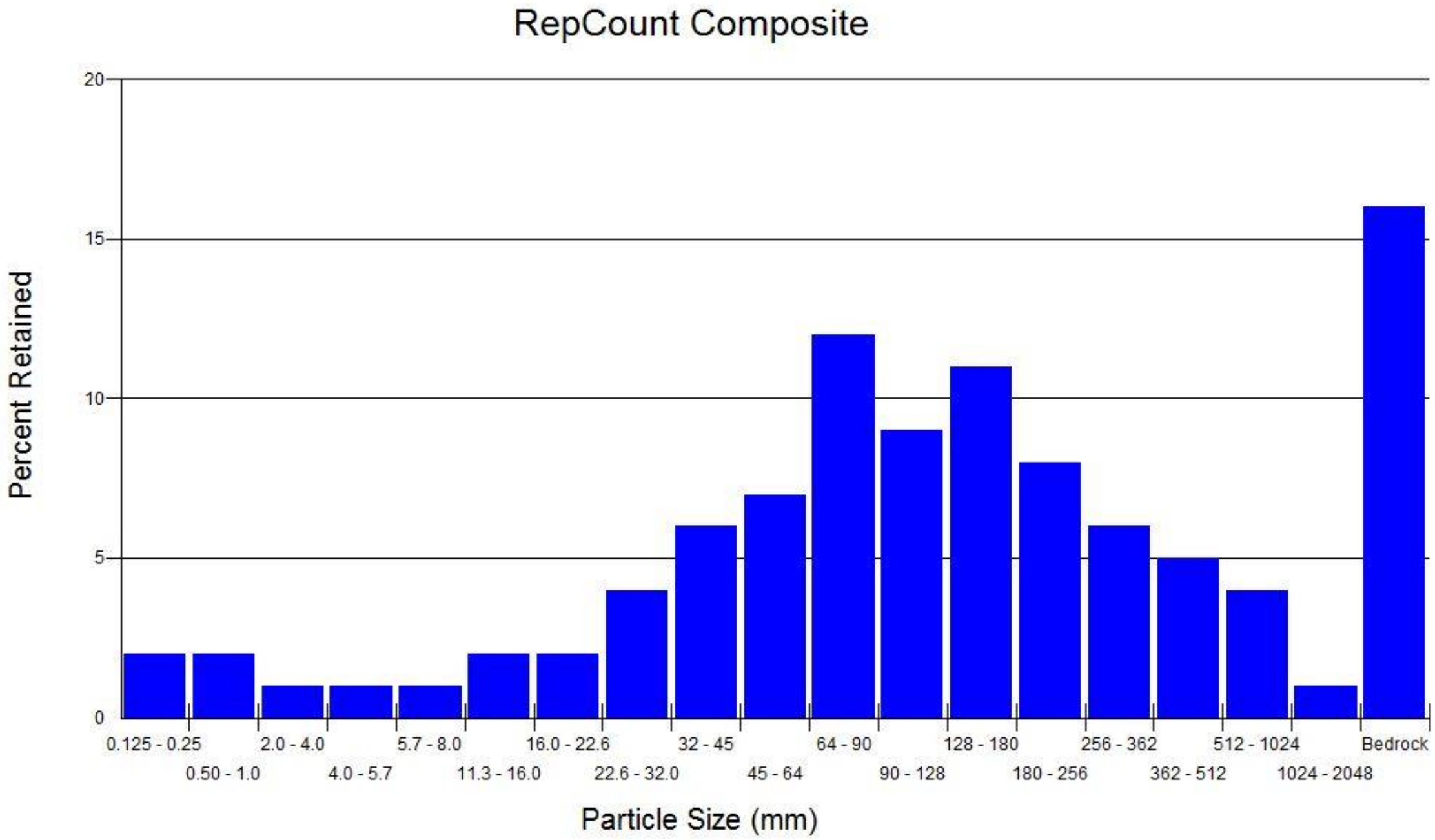


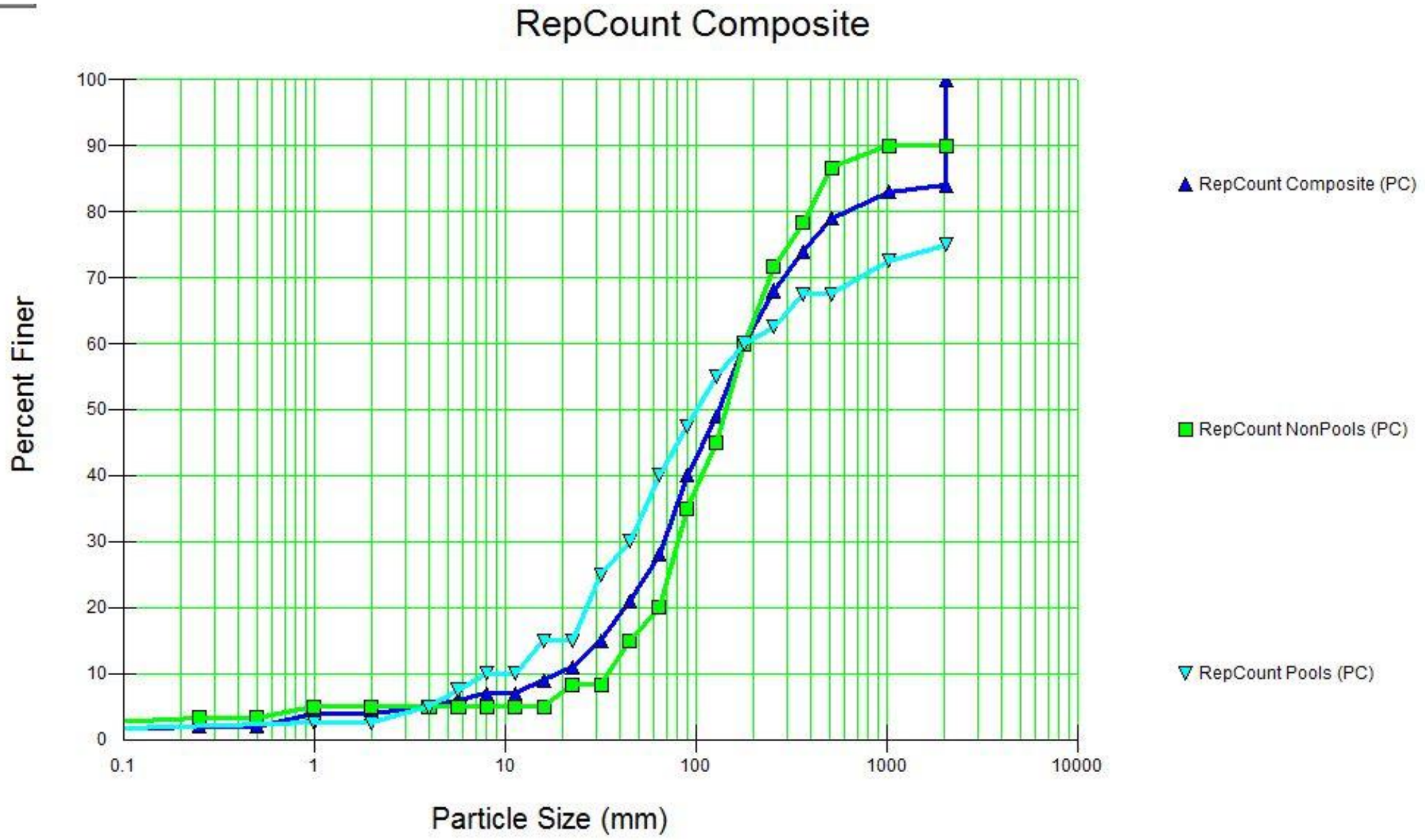
BKF Best Fit Slope = 0.03390
S WS Best Fit Slope = 0.03474

Representative Pebble Count


RepCount NonPools
Percent Retained
20
15
10
5
0
0.125 - 0.25
0.50 - 1.0
16.0 - 22.6
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
512 - 1024
Bedrock
Particle Size (mm)


RepCount Pools
Percent Retained
30
25
20
15
10
5
0
0.50 - 1.0
2.0 - 4.0
4.0 - 5.7
5.7 - 8.0
11.3 - 16.0
22.6 - 32.0
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
512 - 1024
1024 - 2048
Bedrock
Particle Size (mm)

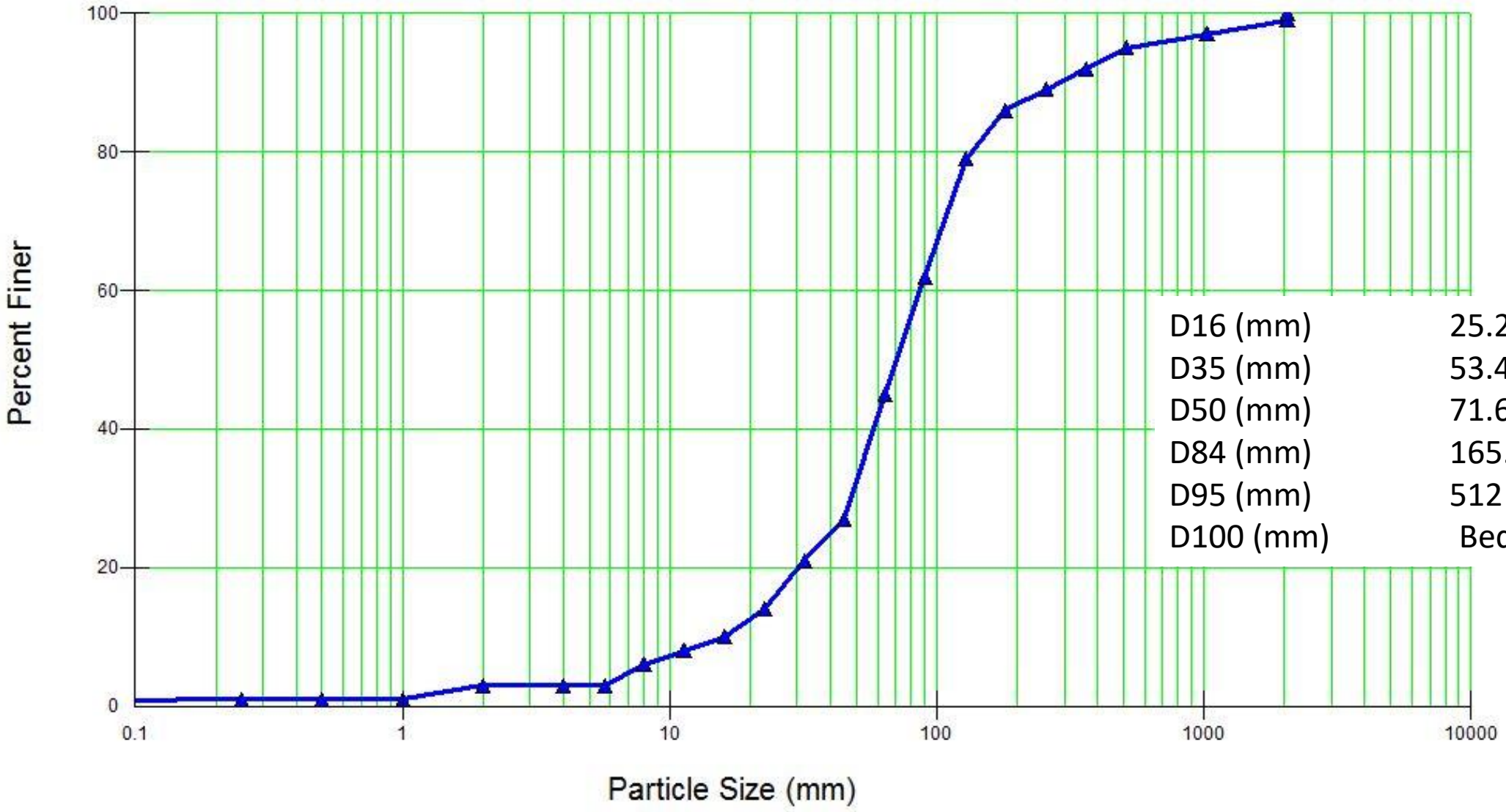

RepCount Composite
Percent Retained
20
15
10
5
0
0.125 - 0.25
0.50 - 1.0
2.0 - 4.0
4.0 - 5.7
5.7 - 8.0
11.3 - 16.0
16.0 - 22.6
22.6 - 32.0
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
512 - 1024
1024 - 2048
Bedrock
Particle Size (mm)


RepCount Composite
Percent Finer
100
90
80
70
60
50
40
30
20
10
0
0.1
1
10
100
1000
10000
Particle Size (mm)
RepCount Composite (PC)
RepCount NonPools (PC)
RepCount Pools (PC)

Active Bed Riffle Pebble Count

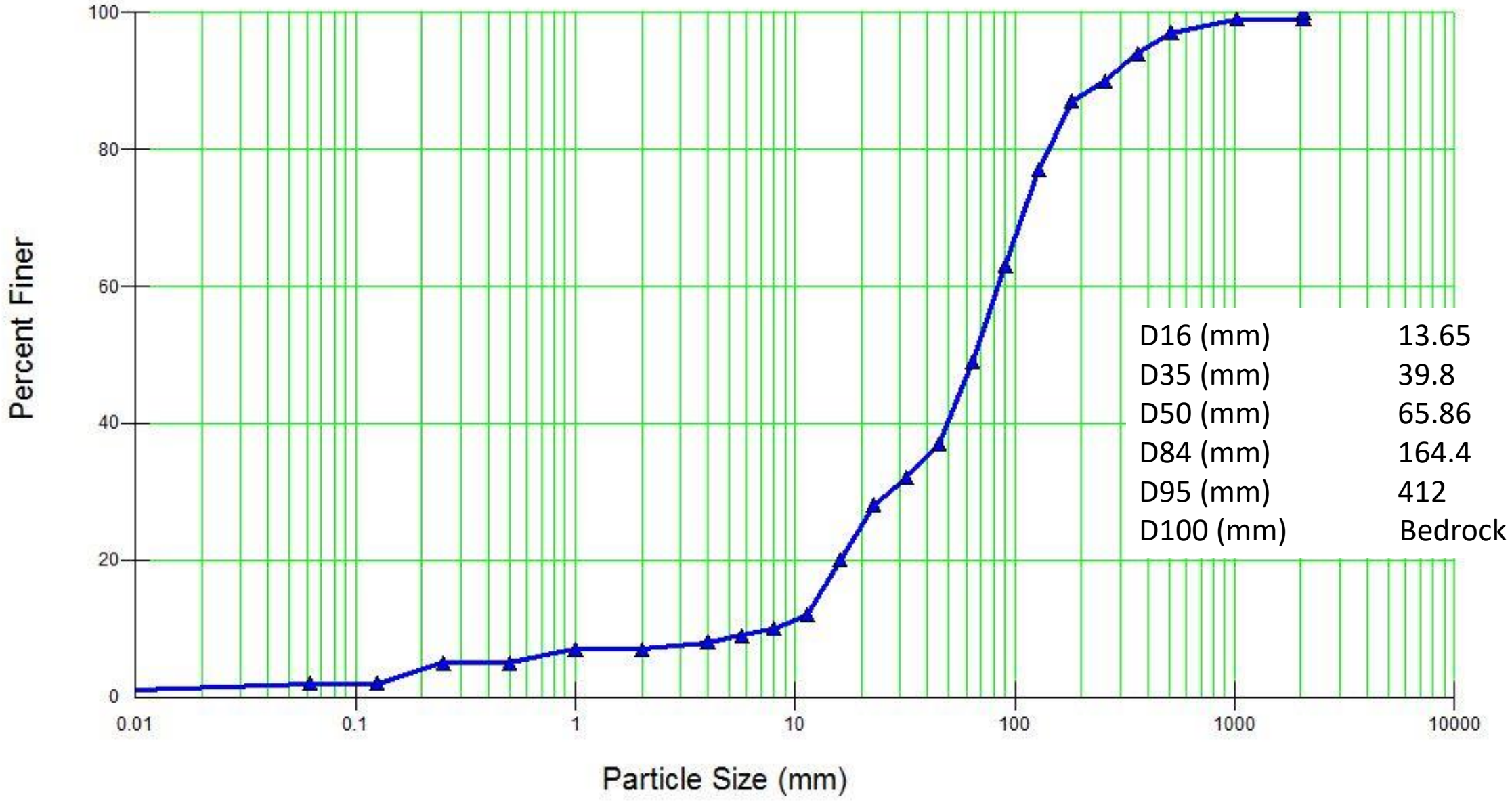
Overlays

Active Riffle 00+20.4



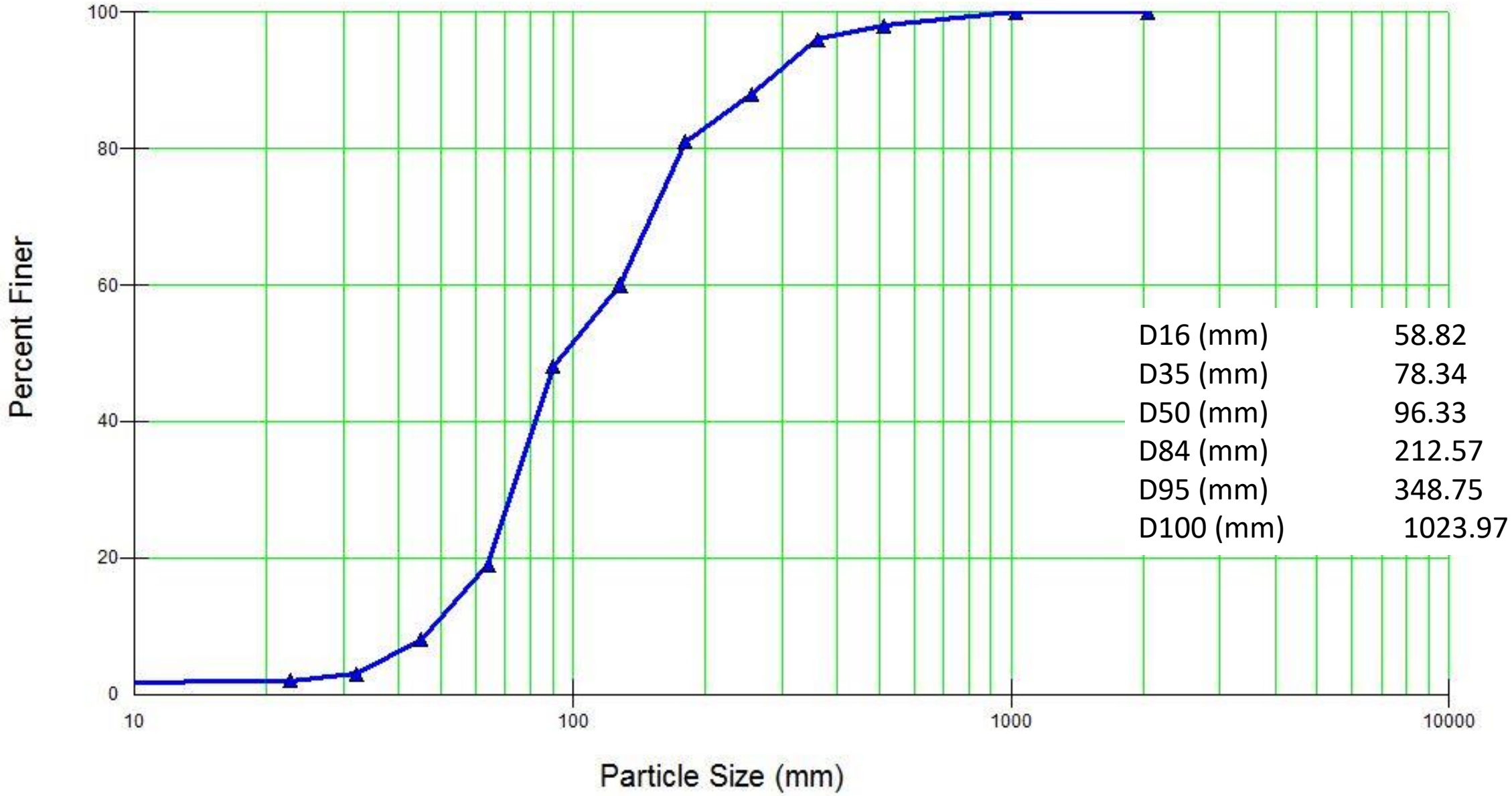
D16 (mm)	25.29
D35 (mm)	53.44
D50 (mm)	71.65
D84 (mm)	165.14
D95 (mm)	512
D100 (mm)	Bedrock

Active Riffle 00+65



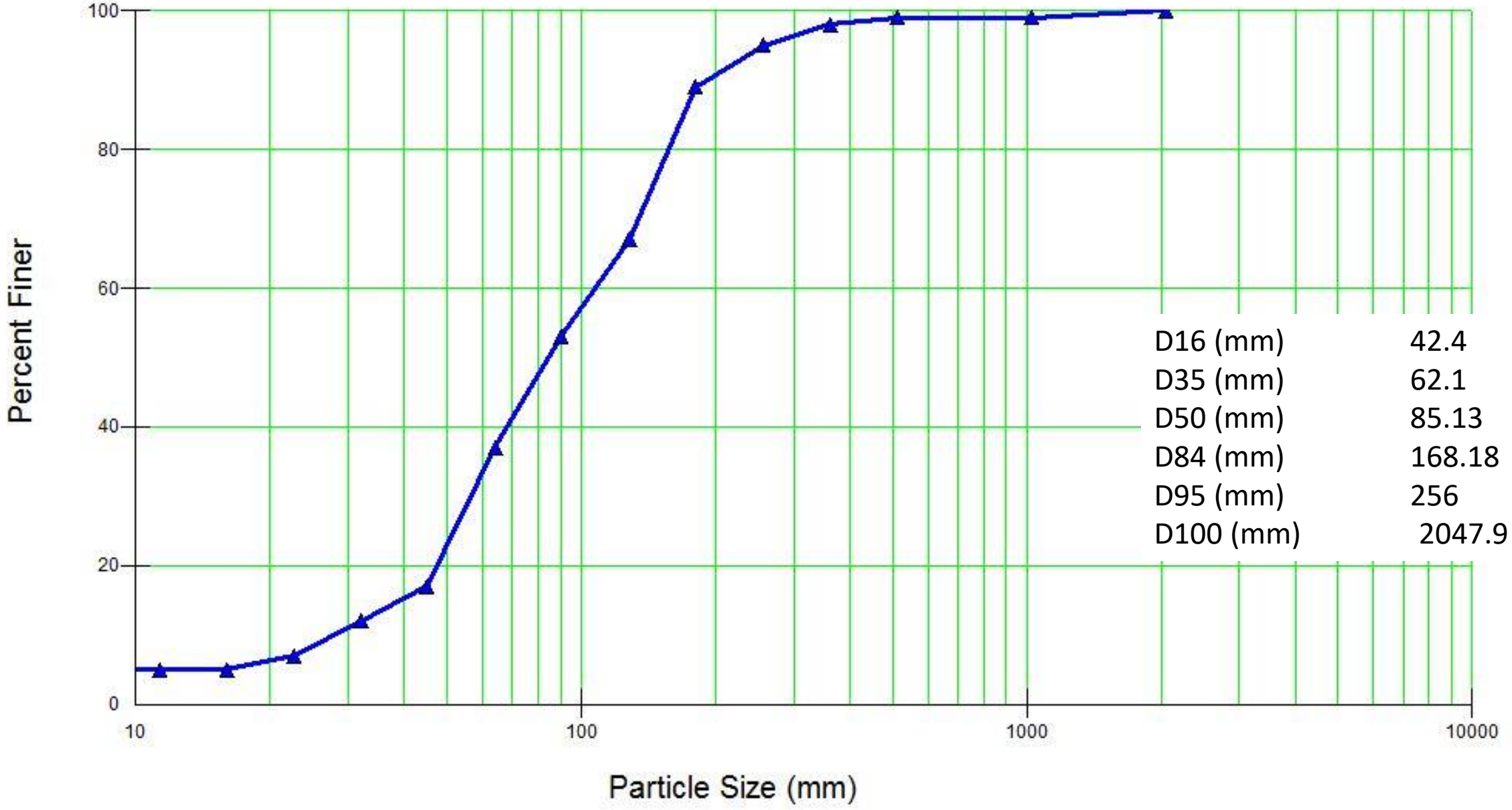
D16 (mm)	13.65
D35 (mm)	39.8
D50 (mm)	65.86
D84 (mm)	164.4
D95 (mm)	412
D100 (mm)	Bedrock

Protrusion 00+20.4



D16 (mm)	58.82
D35 (mm)	78.34
D50 (mm)	96.33
D84 (mm)	212.57
D95 (mm)	348.75
D100 (mm)	1023.97

Protrusion 00+65



D16 (mm)	42.4
D35 (mm)	62.1
D50 (mm)	85.13
D84 (mm)	168.18
D95 (mm)	256
D100 (mm)	2047.9

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

Stream: Shannons Branch Location: Reach 3

Observers: Team 3 Stream Type: B3/2/1 Landscape Type: C - CO - US Date: 4/17/18

Pool Type		Dimensional Values: Pool Length (L_p)	Dimensional Values: Pool Max Depth (d_{maxp})	Dimensional Values: Pool Slope (S_p)		Dimensionless Ratios: Pool Length to Riffle Width (L_p / W_{bkf})	Dimensionless Ratios: Pool Max Depth to Riffle Mean Depth (d_{maxp} / d_{bkf})	Dimensionless Ratios: Pool Slope to Average Slope (S_p / S)
1. Lateral Scour Pool (LSP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
2. Contraction Scour Pool (CSP)	Mean	16.95	3.7	.0052	Mean	0.67	2.54	0.15
	Min.	8.3	3.8	.0048	Min.	0.33	2.60	0.14
	Max.	25.6	3.6	.0055	Max.	1.01	2.47	0.16
3. Step/Pool (SP)	Mean	9.55	2.675	.00355	Mean	0.38	1.83	0.10
	Min.	6.9	2.05	.0014	Min.	0.27	1.40	0.04
	Max.	12.2	3.30	.0057	Max.	0.48	2.26	0.16
4. Backwater Pool (BWP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
5. Plunge Pool (PP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
6. Pocket Water Pool (PWP)	Mean	2.5	1.925	.00975	Mean	0.10	1.35	0.27
	Min.	1.8	1.65	0.000	Min.	0.07	1.13	0.00
	Max.	4.00	2.3	.0160	Max.	0.16	1.58	0.46
7. Lateral Protrusion Pool (LPP)	Mean	11.7	2.6	.0021	Mean	0.46	1.78	0.06
	Min.	9.0	2.2	.0011	Min.	0.36	1.51	0.32
	Max.	13.2	2.8	.0038	Max.	0.52	1.92	0.11
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 2-3. Field form for Level II stream classification (Rosgen, 1996; Rosgen and Silvey, 2005).

Stream:	**Sharman's Branch, Reach - Reach 3**				
Basin:		Drainage Area:	**2304** acres	**3.6**	mi^2
Location:					
Twp.&Rge: ;		Sec.&Qtr.: ;			
Cross-Section Monuments (Lat./Long.):	**0 Lat / 0 Long**			Date:	**04/18/18**
Observers:	**Team 3**			Valley Type:	C-CO-U

Bankfull WIDTH (W_{bkf}) WIDTH of the stream channel at bankfull stage elevation, in a riffle section.	**25.3**	ft
Bankfull DEPTH (d_{bkf}) Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A / W_{bkf}$).	**1.46**	ft
Bankfull X-Section AREA (A_{bkf}) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	**37.04**	ft^2
Width/Depth Ratio (W_{bkf} / d_{bkf}) Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section.	**17.33**	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.	**2.48**	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.	**58.5**	ft
Entrenchment Ratio (ER) The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH (W_{fpa} / W_{bkf}) (riffle section).	**2.31**	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.	**132.73**	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.	**0.0339**	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).	**1.14**	

Stream Type **B 3/1** (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:	Sharman's Branch			Location:	Reach - Reach 3
Date:	4/17/2018	Stream Type:	B3	Valley Type:	C-CO-US
Observers:	Team 3			HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	37.04	A_{bkf} (ft^2)	Bankfull Riffle Mean DEPTH	1.46	d_{bkf} (ft)
Bankfull Riffle WIDTH	25.30	W_{bkf} (ft)	Wetted PERMIMETER ~ $(2 * d_{bkf}) + W_{bkf}$	26.90	W_p (ft)
D_{84} at Riffle	348.75	Dia. (mm)	D_{84} (mm) / 304.8	1.14	D_{84} (ft)
Bankfull SLOPE	0.0343	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.38	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R(ft) / D_{84} (ft)	1.21	R / D_{84}
Drainage Area	3.6	DA (mi^2)	Shear Velocity $u^* = (gRS)^{1/2}$	1.234	u^* (ft/sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $u = [2.83 + 5.66 * Log\{R / D_{84}\}] u^*$	4.05	ft / sec	149.99	cfs
2. Roughness Coefficient: a) Manning's *n* from Friction Factor / Relative Roughness (Figs. 2-18, 2-19) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.06	5.68	ft / sec	210.28	cfs
2. Roughness Coefficient: b) Manning's *n* from Stream Type (Fig. 2-20) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.074	4.60	ft / sec	170.50	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 $n =$ 0.103	3.31	ft / sec	122.71	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.) Darcy-Weisbach (Leopold, Wolman and Miller)	4.36	ft / sec	161.59	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 = 0.0 year	3.05	ft / sec	113.00	cfs
4. Continuity Equations: b) USGS Gage Data $u = Q / A$	0.00	ft / sec	0.00	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 2-4b. Morphological relations, including dimensionless ratios of river reach sites (Rosgen and Silvey, 2007; Rosgen, 2008).

Stream: **Sharman's Branch**		Location: **Reach - Reach 3**	
Observers:	Date: **04/18/18**	Valley Type: **C-CO-US**	Stream Type: **B 3/1**

River Reach Summary Data.....2

Hydraulics

Streamflow: Estimated Mean Velocity at Bankfull Stage (u_{bkf})	3.313	ft/sec	Estimation Method		
Streamflow: Estimated Discharge at Bankfull Stage (Q_{bkf})	122.714	cfs	Drainage Area	3.6	mi^2

Channel Pattern

Geometry	Mean	Min	Max		Dimensionless Geometry Ratios	Mean	Min	Max
Linear Wavelength (λ)	0	0	0	ft	Linear Wavelength to Riffle Width (λ / W_{bkf})	0.000	0.000	0.000
Stream Meander Length (L_m)	0	0	0	ft	Stream Meander Length Ratio (L_m / W_{bkf})	0.000	0.000	0.000
Radius of Curvature (R_c)	0	0	0	ft	Radius of Curvature to Riffle Width (R_c / W_{bkf})	0.000	0.000	0.000
Belt Width (W_{blt})	53.5	47	60	ft	Meander Width Ratio (W_{blt} / W_{bkf})	2.064	1.813	2.315
Arc Length (L_a)	0	0	0	ft	Arc Length to Riffle Width (L_a / W_{bkf})	0.000	0.000	0.000
Riffle Length (L_r)	24.5	18.8	34.1	ft	Riffle Length to Riffle Width (L_r / W_{bkf})	0.943	0.725	1.317
Individual Pool Length (L_p)	12.1	5.08	25.6	ft	Individual Pool Length to Riffle Width (L_p / W_{bkf})	0.466	0.196	0.989
Pool to Pool Spacing (P_s)	16.6	8.68	25.8	ft	Pool to Pool Spacing to Riffle Width (P_s / W_{bkf})	0.640	0.335	0.995

Channel Profile

Valley Slope (S_{val})	0	ft/ft	Average Water Surface Slope (S)	0.0339	ft/ft	Sinuosity (S_{val} / S)	1.14
Stream Length (SL)	200	ft	Valley Length (VL)	175	ft	Sinuosity (SL / VL)	1.14

Low Bank Height (LBH)	start	0	ft	Max Depth (d_{max})	start	0	ft	Bank-Height Ratio (BHR) (LBH / d_{max})	start
	end	0	ft		end	0	ft		end

Facet Slopes	Mean	Min	Max		Dimensionless Facet Slope Ratios	Mean	Min	Max
Riffle Slope (S_{rif})	0.036	0.034	0.039	ft/ft	Riffle Slope to Average Water Surface Slope (S_{rif} / S)	1.071	0.991	1.150
Run Slope (S_{run})	0.000	0.000	0.000	ft/ft	Run Slope to Average Water Surface Slope (S_{run} / S)	0.000	0.000	0.000
Pool Slope (S_p)	0.003	0.000	0.010	ft/ft	Pool Slope to Average Water Surface Slope (S_p / S)	0.082	0.000	0.292
Glide Slope (S_g)	0.000	0.000	0.000	ft/ft	Glide Slope to Average Water Surface Slope (S_g / S)	0.000	0.000	0.000
Step Slope (S_s)	0.194	0.136	0.245	ft/ft	Step Slope to Average Water Surface Slope (S_s / S)	5.714	4.009	7.228

Max Depths[a]	Mean	Min	Max		Dimensionless Depth Ratios	Mean	Min	Max
Max Riffle Depth (d_{maxrif})	2.4	2.13	2.58	ft	Max Riffle Depth to Mean Riffle Depth (d_{maxrif} / d_{bkf})	1.667	1.479	1.79
Max Run Depth (d_{maxrun})	0	0	0	ft	Max Run Depth to Mean Riffle Depth (d_{maxrun} / d_{bkf})	0	0	0
Max Pool Depth (d_{maxp})	3.42	2.94	3.7	ft	Max Pool Depth to Mean Riffle Depth (d_{maxp} / d_{bkf})	2.375	2.042	2.57
Max Glide Depth (d_{maxg})	0	0	0	ft	Max Glide Depth to Mean Riffle Depth (d_{maxg} / d_{bkf})	0	0	0
Max Step Depth (d_{maxs})	2.12	1.67	2.54	ft	Max Step Depth to Mean Riffle Depth (d_{maxs} / d_{bkf})	1.472	1.16	1.76

Channel Materials

	Reach[b]	Riffle[c]	Bar		Reach[b]	Riffle[c]	Bar	Protrusion Height[d]	
% Silt/Clay	0	0		D_{16}	34.17	25.29		58.82	mm
% Sand	4	3		D_{35}	79.17	53.44		78.34	mm
% Gravel	24	42		D_{50}	132.73	71.65		96.33	mm
% Cobble	40	44		D_{84}	Bedrock	165.14		212.57	mm
% Boulder	16	10		D_{95}	Bedrock	512		348.75	mm
% Bedrock	16	1		D_{100}	Bedrock	Bedrock		1023.97	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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