Exercise 7. Bed and Banks: Bed Material Volumes

Determine the volume of bed material by size class along with the number and size of bank rocks to complete the bed design. Total bed volume can be determined by multiplying length by width by average depth of the proposed bed. An alternative would be to determine the average area of bed material from a typical cross-section and multiply it by the length. The minimum thickness of bed material was determined in exercise 4. Keep in mind that bank rocks will take up some volume and the bed material and bank rock must extend up and downstream to create a natural transition in and out of the structure. The plan view, photos and site sketch can be helpful when determining these transitions. It is probably easiest to account for bank rock volume when determining the width and average bed material thickness. If a plunge pool exists, determine if it should be filled and, if so, estimate that volume. If the average bed thickness would be sufficient to accomplish this objective, the bed length can be extended to account for the plunge pool.

Bed length (ft): 130 Bed width (ft): 20 Ave bed depth (ft): 3.5

Total bed volume: 9,100 (cu ft) 337 (cu yd) (1 cu yd = 27 cu ft)

Next determine the volume of bed material (cubic yards) needed in each size class and enter it in the table below. Use the percentages from exercise 5 and the total bed volume from above.

Size class and approximate description	Volume (%)	Volume (cubic yards)
Sand/Fine Gravel (<2-19 mm, ¾ in minus)	28	94 (~95)
Gravel (19-51 mm or ¾ -2 in)	22	74 (~75)
Small Cobble (51-102 mm or 2-4 in)	20	67 (~70)
Large Cobble (102-203 or 4-8 in)	17	57 (~60)
L Cobble/Boulder (203-508 mm or 8-20 in)	13	44 (~55)
		total = 345

Finally, determine the size and number (or volume) of rocks needed to construct banks, rock bands and other key pieces. The rock size should be at least as large as the D_{100} but can be larger since these pieces need to be stable over time. Key pieces are the best indicator of stable sizes. Banks can be constructed from these larger rocks while bed material can be used to fill voids. It is useful to have a range of rock sizes to create some irregularity or diversity in the banks and allow some interlocking of the rocks. Once an average rock size is selected, determine the total length of banks on each side and the number and length of rock bands. Then divide this total length of both by the average rock size to get the total number of rocks needed. The number of rock bands can be estimated from the longitudinal profile and pool-riffle frequency.

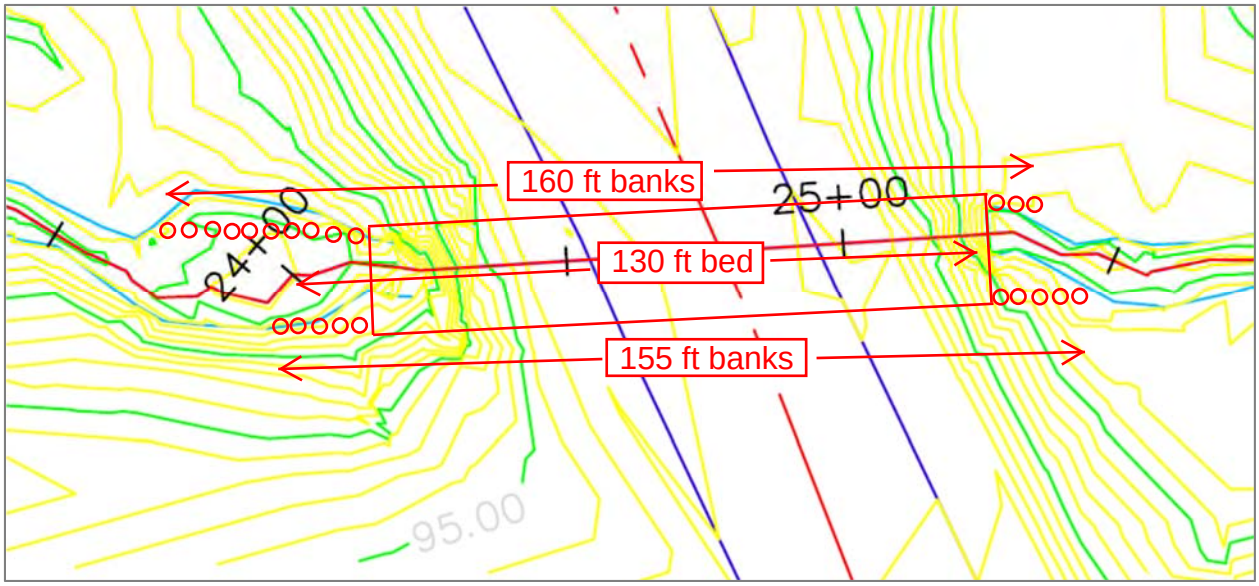
D_{100}: 22 (in, from exercise 5) Ave bank rock size (in): 21 Bank rock range (in): 18-24

Bank length (ft): right 160 left 155 total 315

Length of each rock band (ft): ____ # of rock bands: ____ Total length, rock bands (ft): ____

Total length for rocks (ft): 315 Ave bank rock size (ft): 1.75 Total # of rocks: 180 (or 20 cu yds)

sphere vol = (4/3) (pi) (r^3)
= 2.8 cu ft/rock


160 ft banks
25+00
24+00
130 ft bed
155 ft banks
95.00

Exercise 7. Bed and Banks: Bed Material Volumes

Unnamed Tributary to Rountree at W Main St, Platteville, WI

	Key Pieces				
	Axis (mm)			Mean Cubic	
Location	long	med	short	(mm)	(inches)
Upstream	260	105	75	126	5.0
	115	110	80	100	3.9
	240	130	80	135	5.3
	180	150	65	120	4.7
	170	95	90	113	4.4
	395	290	65	194	7.6
	300	205	30	122	4.8
	150	125	60	104	4.1
	115	95	70	91	3.6
Downstream		400		400	15.7
		470		470	18.5
		550		550	21.7
		350		350	13.8
		290		290	11.4
		530		530	20.9
		260		260	10.2
		320		320	12.6
		290		290	11.4

	Downstream Intermediate Axis	
	mm	in
D100 =	550	21.7
D95 =	542	21.3
D84 =	513	20.2
D50 =	350	13.8
D16 =	290	11.4