Pebble Count Methods

The composition of the streambed and banks is an important facet of stream character, influencing channel form and hydraulics, erosion rates, sediment supply, and other parameters. Each permanent reference site includes a basic characterization of bed and bank material. For studies of fish habitat, riparian ecosystems or stream hydraulics, the characterization of substrates and bank materials may require greater detail than can be covered here.

Observations tell us that steep mountain streams with beds of boulders and cobbles act differently from low-gradient streams with beds of sand or silt. You can document this difference by collecting representative samples of the bed materials using a procedure called a pebble count.

The most efficient basic technique is the Wolman Pebble Count. This requires an observer with a metric ruler who wades the stream and a note taker who wades or remains on the bank with the field book. Particles are tallied by using size classes or categories similar to the ones shown in table 1.

Pebble counts can be made using grids, transects, or a random step-toe procedure. A step-toe procedure is described here and a zigzag pattern is shown in the illustration.

Collection Procedure

Select a reach on or near the cross-section and indicate it on your site map. For stream characterization, sample pools, runs and riffles in the same proportions as they occur in the study reach. For other purposes, it may be appropriate to sample these separately. Measure a minimum of 100 particles to obtain a valid count. Use a data sheet to record the count.

Table 1. Pebble count size classes

Size class	Size range (mm)
Sand	< 2
Very fine gravel	2 - 4
Fine gravel	5 - 8
Medium gravel	9 - 16
Coarse gravel	17 - 32
Very coarse gravel	33 - 64
Small cobble	65 - 90
Medium cobble	91 - 128
Large cobble	129 - 256
Small boulder	257 - 512
Medium boulder	513 - 1024
Large boulder	> 1025

The above scale has been modified slightly

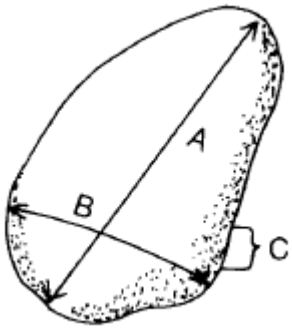
Start the transect at a randomly selected point at one of the bankfull elevations (not necessarily the present water level). Averting your gaze, pick up the first particle touched by the tip of your index finger at the toe of your wader.

Measure the intermediate axis (neither the longest nor shortest of the three mutually perpendicular sides of each particle picked up) (Figure 1). Measure embedded particles or those too large to be moved in place. For these, measure the smaller of the two exposed axes. Call out the measurement. The note taker tallies it by size class and repeats it back for confirmation.

Take one step across the channel in the direction of the opposite bank and repeat the process, continuing to pick up particles until you have the requisite number (100 or more) of measurements. The note taker keeps count. Traverse across the stream perpendicular to the flow or in a zigzag pattern (Figure 2).

Examples of data sheets are provided on pages six and seven.

Figure 1. Axes of a pebble



A. Long axis
B. Intermediate axis
C. Short axis

Continue your traverse of the cross-section until you reach an indicator of bankfull stage on the opposite bank so that all areas between the bankfull elevations are representatively sampled. You may have to duck under bank-top vegetation or reach down through brush to get an accurate count. Move upstream or downstream randomly or at a predetermined distance and make additional transects to sample a total of at least 100 particles.

References

Harrelson, Cheryl C; Rawlins, C. L.; Potyondy, John P. 1994. Stream Channel Reference Sites: An Illustrated Guide to Field Technique. Gen. Tech. Rep. RM-245. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 61 p.

Leopold, L. B., M. Wolman, and J. Miller, 1964. **Fluvial Processes in Geomorphology**. W. H. Freeman, San Francisco, CA, 522 pp.

G.S. Bevenger and R.M. King. 1995. A Pebble Count Procedure for Assessing Watershed Cumulative Effects. Res. Pap. RM-RP-319. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 17 p.

Bankfull physical features include the top (level surface) of adjacent point bars, change in slope, change in bank composition, limit of woody vegetation and in some cases debris and scour lines. A minimum of 10% of your pebble count should be collected from bankfull features.

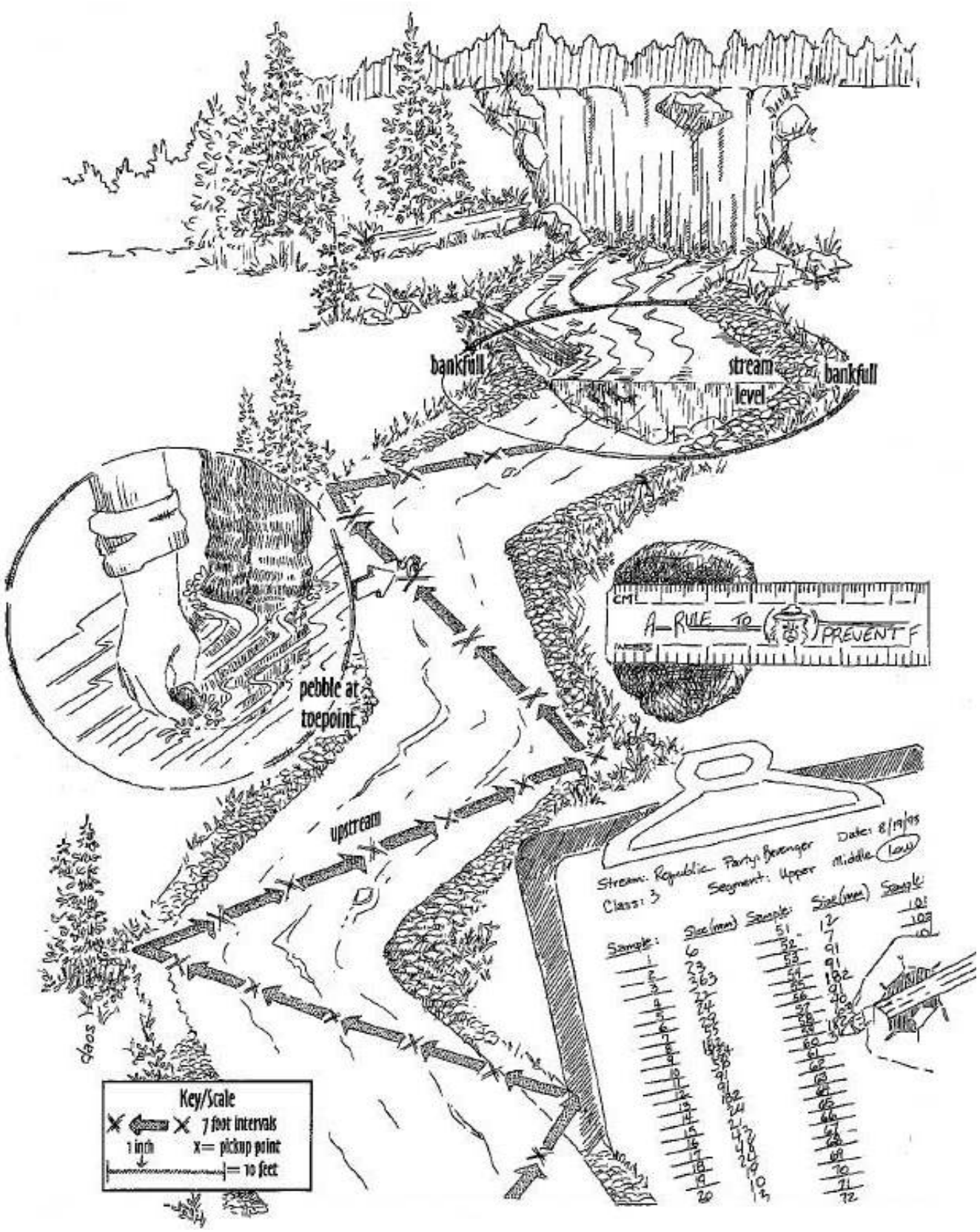
The red line drawn on this image indicates the approximate path the students chose while conducting their pebble count within a 100-meter reach of Skaggs Run.

Results

Sand (1); Fine gravel (20); Coarse gravel (27); Cobble (20); Boulder (8)

Index = 3.38
D_{50} = 23

Figure 2. Pebble count zigzag pattern



The illustration above is from A Pebble Count Procedure for Assessing Watershed Cumulative Impacts.

Pebble Count Survey

Stream _____ Date _____
County _____ Watershed _____
Latitude _____ Longitude _____ River reach _____
Monitor(s) _____
Affiliation _____
Mailing address _____
Phone/e-mail _____
Directions to site _____

Discharge		Or estimate	High	Normal	Low	None

Reach Description and Sketch

Use the space below to briefly describe the conditions of your reach and provide a bird's eye view sketch. Be sure to indicate flow direction and the location of your pebble count stations, bank pins, cross sections, stream structure and other important features.

Land Uses in the Watershed: Record all known land uses upstream and surrounding your monitoring site. Indicate whether they have a High (**3**), Moderate (**2**), Slight (**1**) potential to impact (**I**) the quality of the stream. Also, indicate the approximate location (**L**) of the land use Does it occurs beside the stream site (**S**), within ¼ mile of the stream site (**M**), or within the stream's watershed (**W**).

Land Uses	Impact	Location	**Land Uses**	Impact	Location
Single family homes			Landfill		
Suburban			Trash dump		
Urban			Abandoned mining		
Active construction			Active mining		
Paved roads			Pastureland		
Unpaved roads			Cropland		
Bridges			Animal Feedlots		
Oil and Gas wells			Other (describe below)		
Logging					
Parks, trails etc.					
Other recreation					

Land Use Comments _____

Overall comments – Indicate what you feel are the present and future threats to your stream or make any additional comments. Feel free to attach any additional information such as topographic maps, photographs or any other information that you feel is important.

Submit the survey to the address below:

Citizens Monitoring Coordinator
Division of Water and Waste Management
601 57th Street
Charleston, WV 25304

Questions? Send e-mail to tcraddock@wvdep.org or call (304) 926-0499

Pebble Count Data Sheet

Materials	Size ranges (mm)	Count			Stations
		Riffle	Run	Pool	
Silt/clay	< 0.06				1
Very fine sand	0.06 – 0.125				
Fine sand	0.126 – 0.25				2
Medium sand	0.26 – 0.5				
Coarse sand	0.5 – 1				3
Very coarse sand	1 - 2				
Very fine gravel	2 - 4				4
Fine gravel	5 - 8				
Medium gravel	9 - 16				
Coarse gravel	17 - 32				5
Very coarse gravel	33 - 64				
Small cobble	65 - 90				6
Medium cobble	91 - 128				
Large cobble	129 - 180				7
Very large cobble	181 - 255				
Small boulder	256 - 512				8
Medium boulder	513 - 1024				
Large boulder	1025 – 2048				9
Very large boulder	> 2048				
Bedrock					
Woody debris					10
	Totals				

Habitat Percentages:	Riffles	Runs	Pools

Indicate the location of your transects (stations) along your tape measure.

Pebble Count: Collect a minimum of 100-particles from your reach using a zigzag method, percent habitat method or specific transects throughout the reach (e.g. every 10-metes).

Indicate your sampling method from the choices below.		Size Classes (mm)						
		Silt/clay < 0.06	Sand 0.06 – 2	Fine gravel 2 – 24	Coarse gravel 25 – 64	Cobble 65 – 255	Boulder 256 – 1096	Bedrock > 1096
Zig-Zag								
% Habitat								
10-m Transects								
Totals								

If a pebble count is not collected, estimate the composition of a representative riffle.

Silt	Sand	Gravel	Cobble	Boulder	Bedrock

Estimate the water level

Low	Normal	High	Dry

WV Department of Environmental Protection
WV Save Our Streams Program
601 57th Street, S.E.
Charleston, WV 25304

Photo's: Number and describe the photo's taken at your station

_____ _____

_____ _____

_____ _____

Note: This data sheet is only designed for broad category pebble counts.