

**SUBSTRATE RESTORATION NOTES**

THE FOLLOWING SPECIFICATION IS DESIGNED TO REPLACE AND RESTORE COARSE (GRAVEL, COBBLE, BOULDER AND BEDROCK) SUBSTRATE TO THE STREAM CHANNEL IN CASES WHERE COARSE SUBSTRATES ARE ABSENT FOLLOWING CHANNEL EXCAVATION. THE PURPOSE OF THIS RESTORATION MEASURE IS TO PROVIDE NATURAL SUBSTRATE AND EROSION AND SCOUR PROTECTION IN THE CHANNEL.

1. SUBSTRATES COMPRISED PREDOMINANTLY OF GRAVEL (0.08 - 2.5 INCHES), COBBLE (2.5 - 10.1 INCHES) AND/OR BOULDER (10.1 - 80 INCHES), ALSO REFERRED TO IN THIS SPECIFICATION AS COARSE SUBSTRATE OR ALLUVIUM, THAT ARE REMOVED FROM THE STREAM DURING CHANNEL EXCAVATION WILL BE TEMPORARILY STOCKPILED IN A NON-WETLAND/AQUATIC SITE FOR POSSIBLE REPLACEMENT IN THE CHANNEL.
2. IMMEDIATELY FOLLOWING CHANNEL EXCAVATION, PERFORM AND RECORD THE RESULTS OF A PEBBLE COUNT (HARRELSON ET AL 1994) IN THE EXCAVATED CHANNEL TO DETERMINE THE PERCENT COMPOSITION OF SILT/CLAY, SAND, GRAVEL, COBBLE, BOULDER AND BEDROCK SIZE CLASSES.
3. IF THE IN-PLACE STREAM SUBSTRATE IS COMPRISED OF GREATER THAN 70% GRAVEL, COBBLE, BOULDER, AND/OR BEDROCK, THE STREAM SUBSTRATE WILL BE DEEMED ACCEPTABLE AS IS AND SUBSTRATE REPLACEMENT WILL NOT BE PERFORMED.
4. IF THE IN-PLACE STREAM SUBSTRATE IS COMPRISED OF LESS THAN 70% GRAVEL, COBBLE, BOULDER, AND/OR BEDROCK, THE CHANNEL WILL BE OVER-EXCAVATED TO A DEPTH OF 6 TO 8 INCHES AND BACKFILLED WITH COARSE SUBSTRATE TO MEET THE >70% SPECIFICATION, AS VERIFIED BY A PEBBLE COUNT.
5. COARSE ALLUVIUM EXCAVATED FROM THE CHANNEL AND TEMPORARILY STOCKPILED IS THE PREFERRED MATERIAL TO USE FOR SUBSTRATE REPLACEMENT.
6. IF THE QUANTITY OF EXCAVATED COARSE ALLUVIUM IS INSUFFICIENT OR CONTAINS TOO HIGH A PERCENTAGE OF FINES (SAND, SILT, AND CLAY), THEN THE FOLLOWING MIXTURE OF MATERIALS CAN BE USED AS SUBSTRATE:
  - a. CLEAN, NON-ACID FORMING ROUNDED NATURAL ROCK AND STONE, SUCH AS RIVER GRAVEL, LIMESTONE OR SANDSTONE;
  - b. USE AND MIX THE SPECIFIED QUANTITIES(% BY WEIGHT) OF THE FOLLOWING NATIONAL STONE ASSOCIATION SIZE CLASSES OF ROCK AND STONE

NSA#(a)	GRADE ROCK SIZE (IN.)			QUANTITY (BY WEIGHT)
	MIN.	AVG.	MAX.	
R-1	No. 8	0.75	1.5	SPECIFY (ii)
R-2	1	1.5	3	SPECIFY (ii)
R-3	2	3	6	SPECIFY (ii)
R-4	3	6	12	SPECIFY (ii)
R-5	5	9	18	SPECIFY (i)
R-6	7	12	24	SPECIFY (i)
R-7	12	15	30	SPECIFY (i)

PEBBLE COUNT REFERENCE:

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, STATION. 61 P. HTTP//216.48.37.142/PUBS/20753.

NOTES TO DESIGNER:

- i. NATIONAL STONE ASSOCIATION; SUBSTITUTE ALTERNATIVE ROCK SIZE CLASSIFICATIONS AS NEEDED
  - ii. SPECIFY SUBSTRATE THRESHOLD SIZE BASED ON CRITICAL SHEAR STRESS ( $T=GRS$ ) AND STREAM POWER ( $W=QGS/W$ )<sup>1</sup>.
7. USE THE FOLLOWING PAY ITEM FOR SUBSTRATE RESTORATION:
- 203-20.01, CHANNEL SUBSTRATE, C.Y.