RIPRAP, CHANNEL ARMORING

**From Woodstock ER 0241(40)

xx. DESCRIPTION. This work shall consist of furnishing and placing riprap material for channel raising and/or armoring at the locations and to the configuration detailed in the Plans and as directed by the Engineer. This work shall also consist of placing natural river boulders throughout the finished stream channel.

The work under this Section shall be performed in accordance with these provisions, the Plans, and Section 613 of the Standard Specifications.

xx. MATERIALS.

(a) Streambed Armoring. Riprap, Channel Armoring shall consist of approved, rough, unhewn quarry stone. The stones shall be hard, sound, and resistant to the action of water and weathering. They shall be of a rock type other than serpentine rock containing the fibrous variety chrysotile (asbestos).

The least dimension of individual stones shall be at least 1/3 the longest dimension.

Stone shall have a minimum specific gravity of 2.48 (155 lb/ft^3).

Riprap, Channel Armoring shall meet the gradation of a corresponding FHWA Riprap Class as shown in the Table below.

Minimum and Maximum Allowable Particle Size in Inches								
FHWA Nominal Riprap Class by Median Particle Diameter		d15		d50		d85		d100
FHWA Class	Size	Min	Max	Min	Max	Min	Max	Max
VIII	30 in	18.5	26.0	28.5	34.5	39.0	46.0	60.0

Note: Particle size d corresponds to the intermediate (“B”) axis of the particle.

(b) Natural River Boulders. Boulders shall be natural river material. The middle dimension of any boulder shall not be less than 24 inches nor greater than 48 inches. The middle dimension of at least half of the boulders placed shall be at least 36 inches. Suitable boulders excavated during placement of Riprap, Channel Armoring may be used.

(c) Sand Borrow. Sand borrow shall meet the requirements of Subsection 703.03.

xx. PLACING.

(a) Streambed Armoring. The Engineer shall be notified and a Fluvial Geomorphologist shall be onsite during critical points of construction, including initial placement of Riprap, Channel Armoring.

Riprap, Channel Armoring shall be placed in single lifts no bigger than the d100 of the stone. Fill voids in the stone with natural streambed material, including gravels and cobbles excavated from the site or imported. Use excavator bucket to push and vibrate the natural streambed material into voids. Voids shall be so filled prior to placing each additional lift.

Once all stone has been placed and voids filled, slowly wet the stream to minimize the effects of the initial sediment pulse.

If voids develop upon initial wetting resulting in no surface flow, further fill voids with natural streambed material. Add sand borrow as needed to seal the surface to prevent subsurface flow.

Finished streambed surface shall consist of a mix of stone and natural river material with water flowing on the surface. Grade the finished surface to provide an initial flow path that concentrates low flows in approximately one-half the channel rather than shallower flow dispersed across the entire channel bottom width.

(b) Natural River Boulders. Boulders are to be placed under the direction of a Fluvial Geomorphologist designated by VTrans. The Contractor is responsible for notifying the Engineer a minimum of seven (7) days prior to placement of the boulders in order that participation of the Fluvial Geomorphologist may be scheduled.

Boulders shall be placed at an average rate of 20 per 100 linear feet of channel. Boulders shall be distributed in a generally random fashion throughout the channel, except in locations to be identified by the Engineer and/or Fluvial Geomorphologist at the time of construction, where boulders shall be either clustered or excluded.

Relatively large boulders shall be used at the toe of the stone fill slope, with no filler stone on the front face in order that gaps remain between stones on the front face to provide for improved aquatic habitat.

xx. METHOD OF MEASUREMENT. The quantity of Special Provision (Riprap, Channel Armoring) to be measured for payment will be the number of cubic meters (cubic yards) of the material specified, including natural river boulders, placed in the complete and accepted work, measured within the limits shown on the Plans or as directed by the Engineer.

xx. BASIS OF PAYMENT. The accepted quantity of Special Provision (Riprap, Channel Armoring) will be paid for at the Contract unit price per cubic meter (cubic yard). Payment will be full compensation for furnishing, transporting, and placing the material specified, including natural river boulders, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

Excavation required for the placement of Special Provision (Riprap, Channel Armoring) will be paid for separately under Contract item 203.27.

Infilling of stone with natural river material and/or sand borrow will not be paid separately, but will be considered incidental to Special Provision (Riprap, Channel Armoring).

Payment will be made under:

Pay Item	Pay Unit
900.608 Special Provision (Riprap, Channel Armoring)	Cubic Yard