SECTION 414

RIPRAP

I. GENERAL

1.1 DESCRIPTION OF WORK

The Contractor shall furnish all labor, supervision, material (except as herein provided), tools, equipment, supplies, and services; and, shall perform all Work necessary for providing and placing the specified type of riprap in accordance with the requirements of these specifications and in reasonably close conformity to the dimensions, lines, and grades shown on the Drawings or as established by the Owner.

1.2 MATERIALS

A. Riprap shall conform to the requirements of Section 200.

B. Sand shall conform to the requirements of Section 200. Grading A, B, or C sand may be used in mortared or grouted riprap.

C. Mortar and grout shall conform to the requirements of Section 200.

D. Geotextile bedding shall conform to the requirements of Section 200.

E. Welded wire fabric shall conform to the requirements of Section 200.

F. The classes of dry riprap shall be as follows:

1. Class I: Stones shall weigh between 50 and 150 pounds each. At least 60 percent shall weigh more than 100 pounds, and approximately 10 percent may weigh 50 pounds or less.

2. Class II: Stones shall weigh between 150 pounds to 500 pounds each. At least 50 percent shall weigh more than 300 pounds, and approximately 10 percent may weigh 150 pounds or less.

3. Class III: Stones shall weigh from 500 pounds to 1,500 pounds each. At least 50 percent shall weigh more than 900 pounds, and approximately 10 percent may weigh less than 500 pounds.

4. Class IV: Stones shall weigh between 25 and 75 pounds each, except that approximately 10 percent may weigh 25 pounds or less and 10 percent may weigh 75 to 100 pounds.

1.3 SUBMITTALS

When required by the Owner, the Contractor shall submit certifications in the form of affidavits from the material suppliers, together with supporting data, attesting that the riprap meets specification

requirements.

II. EXECUTION

2.1 DRY RIPRAP

A. Grading

1. The subgrade for the riprap or filter shall be prepared to the required lines and grades shown on the Drawings. Any fill required in the subgrade shall be compacted to a density approximately that of the surrounding undisturbed material. Brush, trees, stumps and other objectionable material shall be removed.

2. Immediately prior to placement of riprap bedding, the prepared base will be inspected. Riprap or bedding shall not be placed until the prepared base has been approved.

B. Bedding

1. Riprap bedding shall be placed on the embankment to form a backing for riprap. Riprap bedding shall be spread uniformly on the prepared base. Compaction of the bedding material will not be required, but material shall be finished to a reasonably even surface, free from mounds or depressions.

2. Placement of the filter fabric should be done immediately after slope preparation.

3. Granular Bedding

The stone shall be spread in a uniform layer to a depth of 6-inches unless otherwise indicated on the Drawings. Where more than one layer of filter material is used, the next layer shall be spread so that there is minimal mixing of the layers.

4. Geotextile Fabric Bedding

a. Geotextile bedding material shall not be used on slopes greater than 1:1.

b. Fabric shall be placed directly on the prepared slope. Geotextile material shall be placed loosely so that positioning riprap will not stretch or tear it.

c. The entire perimeter of the material shall be turned down and buried at least 12 inches for anchorage.

d. Care shall be taken not to damage the cloth when placing the riprap. If damage occurs, that sheet shall be removed and replaced.

e. Displaced material shall be repositioned, including, if necessary, removing and replacing riprap stone, at the Contractor's expense.

f. For large stone (Class II or greater), a 6-inch layer of granular filter will be required to prevent damage to the cloth.

g. The edges of the adjacent strips of material shall run only up and down the slope and shall overlap by at least 18 inches.

h. Anchor Pin Method: Anchor pins shall be a minimum of 15-inches long and shall be spaced every 3-feet along the overlap.

i. Sewed Method: If adjacent strips are sewed together, the strips shall overlap at least 4 inches and shall be double stitched with a prayer seam, Type SSa 1.

C. Placing Stones

1. Riprap shall be placed on the embankment as soon as practicable after bedding has been finished, but no later than 15 days, in a manner that will produce a reasonably well-graded mass of rock with the minimum practicable percentage of voids. Riprap shall be placed to its full course thickness in one operation (riprap shall not be placed in layers) and in a manner to avoid displacing underlying material. Riprap stone shall not be dropped onto fabric from a height greater than 1 foot. Smaller-sized material shall not be dropped onto fabric from a height greater than 3 feet. Larger stones shall be reasonably well distributed.

2. Placed riprap shall be free from pockets of small stones and clusters of larger stones. Hand placing may be required to the extent necessary to secure the results specified and form uniform slopes.

3. A tolerance of $\pm$ 1/4 of the thickness of the maximum-size stone from the lines and grades shown on the Drawings will be allowed in the finished surface. However, the extremes of such tolerance shall be not continuous over an area of more than 200 square feet. Riprap shall be keyed into the natural ground in an approved manner and to a depth equal to the bed thickness or to solid rock.

4. The desired distribution of various sizes of stones throughout the mass may be obtained by selective loading at the source, controlled dumping of successive loads during final placement, or a combination of these methods. Placing riprap by dumping into chutes or similar methods likely to cause segregation of the various sizes will not be permitted.

5. Riprap protection shall be maintained until the riprap is accepted by the Owner. Displaced material shall be replaced to the lines and grades shown on the Drawings at the Contractor's expense.

2.2 MORTARED RIPRAP FOR SLOPES

A. Stone shall be the same size as specified for dry riprap, Class II, and shall be selected to secure fairly large, flat-surfaced stones that will produce a true and even surface with a minimum of voids. Stone shall be placed on a slope not steeper than the natural angle of repose of the fill material. Fifty percent of the mass shall be broad flat stones placed with the flat surface uppermost and parallel to the slope. Stones shall be placed first and roughly arranged in close contact, with the larger stones placed near the base of the slope. Spaces between larger stones shall be filled with stones of suitable size, leaving the surface reasonably smooth and tight and

conforming to the contour required. Stones shall be placed in a manner so as to ensure for plane surfaces a maximum variation from a true plane of not more than 1-1/4 inches in 4-feet. Warped and curved surfaces shall have the same accuracy as specified for plane surfaces.

B. As each larger stone is placed, it shall be surrounded by fresh mortar, and adjacent stones shall be shoved into contact. After larger stones are in place, spaces or openings between them shall be filled with mortar, and smaller stones shall then be placed by shoving them into position, forcing excess mortar to the surface, ensuring that each stone is carefully and firmly bedded laterally.

C. After the work is complete, excess mortar forced up shall be spread uniformly to fill surface voids completely. Surface joints shall then be pointed roughly with flush or shallow smooth-raked joints.

2.3 GROUTED RIPRAP FOR SLOPES

Grout shall consist of I part hydraulic cement and 3 parts sand, thoroughly mixed with water to produce grout having a thick, creamy consistency. Stones shall be of the same sizes and placed in the same manner as specified for dry riprap, Class I. Care shall be taken during placing to keep earth or sand from filling spaces between stones. After stones are in place, spaces between them shall be filled with grout from bottom to top and the surface swept with a stiff broom. Riprap shall not be grouted in freezing weather. In hot, dry weather, the work shall be protected from sunlight and kept moist for at least 3 days after grouting by the use of saturated burlap.

2.4 EROSION CONTROL RIPRAP

A. Erosion control riprap shall conform to the requirements of Paragraph 2.1.A.1 for weight.

B. Class I dry riprap shall be placed in a manner to present an irregular or rough surface. The depth shall be not less than two feet.

C. Class II dry riprap shall be placed in a manner to present an irregular or rough surface. The depth shall be not less than three feet.

2.5 CONCRETE RIPRAP IN BAGS

A. Wet mixture

Riprap shall consist of Class C1 concrete in suitable burlap bags except in brackish or tidal waters, where concrete shall be Class A3. Bags shall weigh approximately 100 pounds when 2/3 filled with concrete. Each bag shall be securely tied and immediately placed in the work. When used for foundation protection, bags shall be placed in accordance with the provisions governing placement of stone riprap for foundation protection as specified. When used for slope protection, riprap shall be placed in conformance with the provisions governing placement of dry riprap.

B. Dry mixture

1. Riprap shall conform generally to the requirements for wet mixtures except that the mixture shall consist of the dry ingredients and the requirements for water, consistency, and air will be waived.

2. Burlap or paper bags will be permitted. Riprap shall be a rectangular solid approximately 3 inches in thickness and shall weigh approximately 80 pounds per bag. Paper bags shall be perforated throughout on approximate 1-inch centers and shall be of adequate seal, thickness, and strength to maintain the integrity of the riprap until setting of the concrete mixture. Bag compositions shall be such that bags will disintegrate without presenting environmental problems.

C. Other Installation Requirements

1. All widening, regrading, and cutting of slopes to existing ditches will be at the locations and in accordance with the cross-sections and limits shown on the plans.

2. All erosion and sediment controls must be in place prior to installing riprap.

3. All existing interior and perimeter ditches shall be cleaned and graded to provide a positive grade and prevent standing water prior to acceptance.

III. MEASUREMENT FOR PAYMENT

A. Riprap will be paid for at the contract unit price. This price shall include furnishing and placing riprap, including welded wire fabric, mortar, or grout; excavation; and riprap bedding.

1. Dry riprap will be measured and paid in square yards of surface area or tons.
2. Mortared riprap will be measured and paid in square yards of surface area for the type specified.
3. Grouted riprap will be measured and paid in square yards of surface area or tons.
4. Dumped riprap will be measured and paid in square yards of surface area or tons.
5. Concrete riprap in bags will be measured and paid in cubic yards.

B. Erosion control riprap will be measured and paid in square yards of surface area or tons as specified for the class specified. These prices shall include geotextile bedding material when not a separate pay item, including preparing the surface, furnishing and installing geotextile bedding material, overlaps, repair work, and excavating and backfilling toe-ins.

C. Items considered incidental work will not be measured for payment or paid for as such. Incidental items are identified in Section 109.1.1 and, unless otherwise indicated in the Bid form, also include the following:

1. Erosion and sediment control materials and effort necessary to perform the Work.
2. Furnishing and installing geotextile bedding material.
3. Granular bedding material for riprap
4. Mortar or grout.
5. Surface preparation including excavating, backfilling, toe-ins, overlaps and repair work.
6. Welded wire mesh.

End of Section