

1 Make this Section a part of the Standard Specifications:  
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3 **“SECTION 510 – SCOUR PROTECTION AND REVETMENT**  
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6 **510a – CLASS VIII RIPRAP ROCK ARMOR STONE,**  
7 **510b – ROCK FILLER MATERIAL (KYOWA BAGS),**  
8 **510c – ROCK FILLER MATERIAL (TRITON MARINE MATTRESS),**  
9 **510d – KYOWA BAGS,**  
10 **510e – TRITON MARINE MATTRESS**  
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12 **510.01 Description.** This section describes the scour protection and revetment  
13 design that will be used along the bike path adjacent to Wailua Beach. A combination  
14 of foundation material and Class VIII riprap armor stones will be installed. Kyowa  
15 Bags (or approved equal) and Triton Marine Mattress (or approved equal) will be  
16 installed as the foundation material. The scour protection shall be installed at the  
17 Wailua Beach shoreline along the bike path to protect against oceanographic storm  
18 events and wave induced scour.  
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20 **510.02 Materials.** All rock material for Class VIII Riprap and Rock Filler Material  
21 shall conform to the following requirements.  
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23 Individual rocks must be clean, sound, and free from organic material. Rock must be  
24 free from cracks, seams, and other defects conducive to accelerated weathering. The  
25 least dimensions of an individual rock fragment shall not be less than one-third the  
26 greatest dimension of the fragment.  
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28 All rocks shall have a minimum bulk specific gravity of 2.50 and absorption less than  
29 6% when tested in accordance with ASTM D6473 or ASTM C127 as applicable and  
30 shall be angular to subrounded in shape.  
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32 Rock soundness shall be tested in accordance with ASTM C88. Weight loss shall be  
33 less than 10% after 5 cycles of testing with sodium sulfate. Soundness testing shall  
34 be waived if material from the same source has been shown to have a satisfactory  
35 service record of at least 5 years.  
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37 The contractor shall designate in writing the source from which rock material will be  
38 obtained and provide information satisfactory to the engineer that the material meets  
39 contract requirements. Rock from approved sources shall be excavated, selected,  
40 and processed to meet the specified quality and grading requirements at the time the  
41 rock is installed.  
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43 **510.02a** The Class VIII Riprap Rock Armor Stones shall have the  
44 following minimum and maximum allowable particle sizes in inches  
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<i>Nominal Riprap Class by Median Particle Diameter</i>		<i>d<sub>15</sub></i>		<i>d<sub>50</sub></i>		<i>d<sub>85</sub></i>		<i>d<sub>100</sub></i>
<i>Class</i>	<i>Diameter</i>	<i>Min.</i>	<i>Max.</i>	<i>Min.</i>	<i>Max.</i>	<i>Min.</i>	<i>Max.</i>	<i>Max.</i>
<i>VIII</i>	<i>30 in.</i>	<i>18.5</i>	<i>26.0</i>	<i>28.5</i>	<i>34.5</i>	<i>39.0</i>	<i>46.0</i>	<i>60.0</i>

<i>Nominal Riprap Class by Median Particle Weight</i>		<i>W<sub>15</sub></i>		<i>W<sub>50</sub></i>		<i>W<sub>85</sub></i>		<i>W<sub>100</sub></i>
<i>Class</i>	<i>Weight</i>	<i>Min.</i>	<i>Max.</i>	<i>Min.</i>	<i>Max.</i>	<i>Min.</i>	<i>Max.</i>	<i>Max.</i>
<i>VIII</i>	<i>1 ton</i>	<i>500</i>	<i>1450</i>	<i>1900</i>	<i>3300</i>	<i>4800</i>	<i>8000</i>	<i>17600</i>

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**510.02b** The Kyowa Bag Rock Filler Material shall be well graded with a maximum dimension of 6 inches and a minimum dimension of 3 inches. If using a different product, follow manufacturers recommendations for rock sizes.

**510.02c** The Triton Marine Mattress Rock Filler Material shall be well graded with a maximum dimension of 6 inches and a minimum dimension of 2 inches. The average stone size shall not be greater than 4 inches. If using a different product, follow manufacturers recommendations for rock sizes.

**510.02d** The Kyowa Bag (or approved equal) Material shall have the final fill dimensions of 6.3 feet diameter by 1.3 feet high. The netting material shall be capable of permanently encasing the filler rock, able to be lifted in place, suitable for use in a marine and riverine environment, and capable of withstanding water velocities of 10 ft/s.

**510.02e** The Triton Marine Mattress (or approved equal) Material shall be made of High Density Polyethylene (HDPE) fabric material stitched into rectangle shapes as shown on the plans with individual compartments that will be filled with the filler stone. A geotextile fabric shall be incorporated along the bottom surface with an overlapping flap that can be placed under the adjacent mattress for continuity. The mattresses shall be made according to the dimensions shown, then filled with the filler stones and closed, then lifted using a spreader bar and laid in place. The mattress shall be capable of permanently encasing the filler rock, able to be lifted in place, used in a marine and riverine environment, and suitable as a foundation layer for the Class VIII riprap armor stones.

**510.03 Construction.** The work shall consist of the construction of a stone revetment scour protection and shoreline protection, including Class VIII riprap armor

77 stones, and geotextile fabric. The Kyowa Bags (or approved equal) and the Triton  
78 Marine Mattress shall be used as the foundation material that the Class VIII riprap will  
79 be placed on.

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82 **510.03a** The Class VIII riprap shall be placed by equipment to the depth  
83 and height specified. It shall be installed to the full course thickness in one  
84 operation and in such a manner as to avoid serious displacement of the  
85 underlying material. The Class VIII riprap shall be delivered and placed in a  
86 manner that ensures the riprap in place is reasonably homogeneous with the  
87 larger rocks uniformly distributed along the exterior surfaces and firmly in  
88 contact one to another with the smaller rocks laid in the interior of the  
89 revetment. Spalls shall be used to fill the voids between the larger rocks.  
90 Some hand placing may be required to provide a neat and uniform surface.  
91 The Class VIII riprap shall be placed in a manner to prevent damage to  
92 structures. Hand placing is required as necessary to prevent damage to any  
93 new and existing structures.

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95 **510.03d** The Kyowa Bags (or approved equal) shall be filled by the means  
96 and methods specified by the manufacturer. It shall also be filled to  
97 recommended weight using the specified rock material. Once filled, the bags  
98 shall be lifted and installed as shown on the plans for lift 1 and lift 2.

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100 **510.03e** The Triton Marine Mattress (or approved equal) shall be filled by  
101 the means and methods specified by the manufacturer. It shall also be filled to  
102 recommended weight using the specified rock material. Once filled, the  
103 mattresses shall be lifted and installed as shown on the plans.

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105 The Triton Marine Mattress (or Approved equal) shall have a minimum 8' toe  
106 from the toe of the stone revetment. In areas where the mattress needs to be  
107 moved out to meet the 8' minimum, the upper portion of the stone revetment  
108 may be partially off of the mattress. A geotextile fabric shall be placed under  
109 the Class VIII riprap in those locations.

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111 See the plans for specific locations.

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113 **Submittals.**

114 **(A)** Submit (6) sets of material gradation for the Class VIII Riprap Armor  
115 Stone, the Filler Rock for the Kyowa Bags and the Triton Marine  
116 Mattresses.

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118 **(B)** Submit (6) sets of manufacturers cut sheets and product specifications  
119 for the Kyowa Bags.

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121 **(C)** Submit (6) sets of manufacturers cut sheets, product specifications,  
122 and shop drawing for the Triton Marine Mattress.

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**510.04 Measurement.**

**510.04a** The Class VIII rock material quantities will be computed to the nearest 0.1 ton by actual weight. For each load of rock material placed as specified, the contractor shall furnish to the engineer a statement-of-delivery ticket showing the weight to the nearest 0.1 ton. The geotextile fabric shall be incidental to this work.

**510.04d&e** The Kyowa Bags and Triton Marine Mattress shall be measured as each and as fully installed and accepted by engineer.

**510.05 Payment.** Payment is made at the contract unit price for each type of rock material, or each as specified above. Such payment is considered full compensation for completion of the work.

The Engineer will pay for the following pay item when included in the proposal schedule:

<b>Pay Item</b>	<b>Pay Unit</b>
Class VIII Riprap Rock Armor Stone	Ton
Kyowa Bags	Each
Triton Marine Mattress	Each”

**END OF SECTION 510**