

## **SPECIFICATION FOR RIPRAP REVETMENT**

### **1.0 GENERAL REQUIREMENTS**

- 1.1 This specification is to be read in conjunction with the conditions of contract, and all other specifications and drawings.
- 1.2 Where works are directed to be performed by the Contractor but are not specified in the specification, the Contractor shall carry them out with full diligence and expedience as are expected for works of this nature under the obligations of the Contractor.

### **2.0 SCOPE OF WORKS**

- 2.1 The work comprises the provision of all labour, materials, tools, transportation, instrumentation, etc. necessary to construct the riprap revetment in accordance to the Drawings and to the quality standards set in the specifications, inclusive of material and performance tests where these are specified. Mechanical equipment, a sorting site, and labour needed to assist in the checking of gradation shall be provided by the Contractor at no additional cost.
- 2.2 The Contractor shall maintain the riprap revetment until all works on the contract has been completed and accepted. Maintenance shall consist of the repair areas for damage by any possible causes.

### **3.0 LOCAL REGULATIONS**

- 3.1 The Contractor shall be responsible for executing the riprap revetment strictly in accordance with the relevant local regulations and by-laws that are current at the date of the tender together with all amendments and addenda which are imposed as statutory requirements in the course of the Works.

### **4.0 PROTECTION OF PUBLIC AND PRIVATE STRUCTURES & SERVICES**

- 4.1 The Contractor shall be responsible for detecting, protecting, upholding, upkeeping and maintaining all existing structures and services such as bridges, walls, culverts, roadside drains, mains, ducts, water supply pipes, sewers, gas conduits, electrical and telephone cables and the like over and adjacent to the Site during the tenure of the contract, regardless whether or not these services are known to exist at the time of tender. He shall take extra precautions to prevent undermining of foundations to structures and service lines, thereby resulting in damage and interruption of supply, and make good any damage due to any cause within his control at his own expense and time, and pay all consequential costs and charges in connection therewith.
- 4.2 In the event that damage has been done to structures and services due to the Contractor's work or any cause within his control, and should these repairs be carried out by the local Authority, the Contractor shall make a direct reimbursement to the local Authority for the cost and charges for carrying out the repairs, failing which the Employer reserves the right to pay the local Authority direct and deduct the same from any monies due or becoming due to the Contractor.
- 4.3 Any information made available to the Contractor at the time of the tender is indicative and is intended only as an approximate guide for the Contractor's own verification on Site. Immediately after taking possession of the Site and BEFORE commencing work, the Contractor shall

establish test holes to confirm the locations and levels of all existing underground utilities within and surrounding the Site that are affected by his excavation works. If the Engineer is of the opinion that the site verification survey of underground services is incomplete or inadequate in any way, he shall order additional confirmatory test holes to be carried out at the Contractor's expense. The Contractor shall immediately notify the Engineer and the local Authority if he should encounter services not known to have existed at the time of tender.

- 4.4 If it becomes essential in the opinion of the Engineer and the local Authority to temporarily or permanently divert any cable, pipe or other service, the Contractor shall give the necessary notices to the local Authority and arrange for the diversion work to be carried out, regardless whether or not the service to be diverted is known to exist at the time of tender. The cost of the diversion will be paid for by the Employer but it shall be the Contractor's responsibility to coordinate all service diversion works that are carried out during the tenure of the contract period and ensure that such works do not adversely affect the on-time completion of the Works, failing which the Contractor shall bear all consequences for any delay in completion of the Works due to any cause within his control.

## **5.0 SITE CONDITIONS AND CONSTRAINTS**

- 5.1 Prior to the submission of the tender, the Contractor is required and deemed to have visited the Site to fully acquaint himself as to the nature, extent and practicality of the excavation, earthworks or associated temporary works (if any). The Contractor shall satisfy himself that the existing ground and formation levels as shown on the drawings are correct.
- 5.2 The award of the Contract shall be based on the understanding that the Contractor is familiar with the geology of the Site. He shall include in his tender for all costs arising from the nature of the ground (ground levels, water table level, rock formations, subsoil conditions etc), climatic conditions, the availability or lack of access, working space, storage, accommodation, the proximity of adjoining structures and roads, local Regulations regarding the obstruction of public highways and any other limitations imposed by the Site and its surroundings, for the satisfactory completion of the riprap revetment. He shall make due allowance for the effect of these constraints on his construction operations to ensure on-time completion of the Works. No claim by the Contractor on the grounds of lack of foresight or knowledge of the site conditions or for under-provision in connection with the Works will be considered.
- 5.3 The Contractor shall ensure that his method of excavation is suitable and safe for use at the Site. The Contractor shall indemnify the Employer against any expense, liability, loss, claim or proceedings which the Employer may incur or sustain by reason of damage to any property, real or personal other than works, injury or accident to workmen or public, caused by collapse, subsidence, vibration, weakening or removal of support or lowering of ground water, arising out of or in the course of or by reason of the execution of the Works.

## **6.0 SITE ACCESS**

- 6.1 The Contractor shall be responsible for obtaining all necessary statutory approvals on temporary access into the Site for the tenure of the contract period. He shall comply strictly and diligently with all conditions attached to these approvals. The access as well as the portion of public road and walkway connected with it shall be kept clean and safe at all times. Continuous and adequate security arrangements at access points into the site shall be provided for the full duration of the contract.

## **7.0 PREPARATION OF SITE**

- 7.1 All topsoil shall be stripped and, where required for further use, stockpiled in an area provided

by the Contractor and agreed by the Engineer.

- 7.2 All trees, fallen timber, vegetation, loose stone, abandoned structures, fencing and similar debris above the ground level shall be cleared completely ahead of any subsequent construction works.
- 7.3 If directed by the Engineer, soft and organic spots in the riprap revetment foundation shall be removed and replaced with compacted material, which is compacted to the same specification as adopted for subsequent compaction works.

## **8.0 QUALITY**

- 8.1 All materials used in the works shall be of good quality and shall be obtained from sources and supplies approved by the Engineer and shall comply strictly with the tests prescribed hereinafter or, where test are not laid down in this Specifications, with the requirements of the latest issue of the relevant Malaysian Standard or other Standard approved by the Engineer.

## **9.0 INSPECTION AND TESTING**

- 9.1 All materials used in the works shall be subjected to inspection and tests as provided in the Conditions of Contract and elsewhere in the Specifications. Unless otherwise stated the cost of all tests required by this Specifications or the relevant Malaysian or other approved Standard shall be deemed to be included in the rates and prices named in the priced Bill of Quantities.
- 9.2 Control of gradation will be by visual inspection and any other means directed or approved by the Engineer. The Contractor shall provide two samples of rock of at least 5 tons each, meeting the gradation specified. The sample at the construction site may be a part of the finished riprap covering. The other sample shall be provided at the quarry. These samples shall be used as a frequent reference for judging the gradation of the riprap supplied. Any difference of opinion between the Engineer and the Contractor shall be resolved by dumping and checking the gradation of two random truck loads of stone. Mechanical equipment, a sorting site, and labour needed to assist in checking of gradation shall be provided by the Contractor at all times and at no additional costs.
- 9.3 The frequency of laboratory testing on the rock and stone samples shall be as directed by the Engineer to ensure compliance of the materials with this Specifications.
- 9.4 The actual number of tests will depend on the uniformity of the rock strata in the quarries selected by the Contractor and the method of operating the quarry. Every different rock strata or source or change of colour shall be subjected to tests.

## **10.0 APPROVAL**

- 10.1 No materials shall be used in the works unless they have first been approved in writing by the Engineer.
- 10.2 The sources from which the stone will be obtained shall be selected well in advance of the time the stone will be required in the work. The acceptability of the stone will be determined by service records and / or by suitable tests. If tests are required, suitable samples of stone shall be taken in the presence of the Engineer at least 21 days in advance of the time when the placing of riprap is expected to commence at the site.
- 10.3 The Engineer shall have the right at any reasonable time to make inspections of any proposed source nominated by the Contractor at the start of the Contract or any new source proposed by the Contractor during the period of the contract. The Contractor shall provide

suitable access and necessary transport to each site for the Engineer. The Contractor shall submit details to the Engineer of the sources from where he proposes to obtain rock at least four weeks before the start of any operation.

- 10.4 Only rocks from a source approved in writing by the Engineer shall be used in the Works of this Contract. The approval of the rock fragments from a particular quarry site shall not be construed as constituting the approval of all rock fragments taken from that quarry or relieving the Contractor of his obligations to supply material in the finished works in conformity with the requirements of this Contract Specifications. Such approval shall only be considered as conditional approval for any source or portion of a source and such approval may be withdrawn if the stone from the quarry or part of the quarry does not conform to the requirement of this Specifications. The Contractor shall carry out all such testing, etc. as is necessary to ensure compliance therewith.
- 10.5 Works done using materials not satisfying the specifications and requirements shall be rejected and the Contractor shall carry out the necessary remedial works to the satisfaction of the Engineer or replace with correction materials.
- 10.6 Final approval of any particular quarry or part thereof will depend upon the results obtained from Trial Blasts carried out by the Contractor.

## **11.0 SAMPLES**

- 11.1 Samples of all materials approved to be used in the works may be called for at any time by the Engineer.
- 11.2 The Contractor shall submit samples of all materials proposed to be used for the construction of revetment and the approval of the Engineer shall be obtained before any material is placed or stone quarried. The Contractor shall be solely responsible for finding and obtaining the required quantities of materials for the construction of the works. The Engineer shall have the right to visit and inspect the sources of supply as and when deemed necessary and the Contractor shall arrange for the necessary transport for the said purpose.
- 11.3 The Contractor shall make his own assessment of whether the potential sources of rock and relevant materials he proposes to use will meet the requirements of the Specification and of the adequacy of the supply.
- 11.4 A geological report on the proposed source/sources establishing the type and suitability of the rocks shall be submitted by the Contractor to the Engineer for evaluation and approval.
- 11.5 Should the placed material be rejected by the Engineer, the Contractor shall find the materials from another source and, if necessary, remove and dispose of any rejected materials, all at the Contractor's own expense.

## **12.0 SEQUENCE OF WORK**

- 12.1 The Contractor shall at his own cost protect the underlayers of the revetment already in place with suitably sized armour units if construction work is temporarily suspended.
- 12.2 If damage to any portion of the revetment occurs due to natural / severe weather conditions, the Contractor shall repair at his own expenses the damaged portion to the satisfaction of the Engineer.

## **13.0 MOCK-UP SAMPLE**

- 13.1 For each type of revetment in each river with different section configurations, the Contractor is

required to put up a mock-up sample of at least 10m length for the approval of the Engineer. No revetment work shall be carried out until the mock-up sample has been approved. The mock-up sample shall be constructed on the actual working surface and once approved, will form part of the permanent works.

#### **14.0 SURVEYS AND JOINT MEASUREMENTS**

- 14.1 The Contractor shall take levels and echo soundings of the riverbed along the alignment of the proposed revetment at a suitable distance to be agreed on site ahead of the construction and shall be witnessed by the Engineer. The Contractor shall prepare record drawings showing cross-sections of the riverbed profile along the revetment at 10m intervals or at closer intervals if directed by the Engineer. The record drawing after checking by the Engineer shall be signed by the Contractor and the Engineer and shall form the basis for the measurements of the Works.
- 14.2 In the event of the Contractor having to execute any work which he intends to make a claim, he shall at once, with the Engineer take measurements for the said work for record purposes.
- 14.3 If the measurements are not taken jointly and agreed at the time the work is being executed, the Contractor's measurements will not afterward be recognised by the Engineer and shall not be paid. The fact that a joint measurement is made will in no way commit the Engineer to recognition of the claim. The Engineer shall at all times have full access to the Contractor's time book and any other record books to check the quantities and the times when the works under claim are executed.

#### **15.0 EXAMINATION OF WORKS**

- 15.1 No material shall be placed on the berms, the slopes or in the core of the revetment until the Engineer has measured, checked and approved the sizes, lines, levels and slope of the previous layer. The Contractor shall provide all assistance, labour and measuring devices as required by the Engineer for checking the lines and levels of the works carried out. The lines and levels of the revetment cross-sections will be checked and measured in 10m intervals by echo sounding or by hand sounding using a steel chain and a steel ball of suitable size and weight. If subsequent layers are placed without first obtaining the approval of the Engineer, the Contractor shall, if instructed by the Engineer, remove part or all of the subsequent layer or layers to check that the underlying layer is in compliance with the Specification at the Contractor's own cost and time.

#### **16.0 PERSONNEL**

- 16.1 The Contractor shall provide qualified site staff who are experienced in similar works to be present full time to supervise the work and to perform all necessary tests to the approval of the Engineer. The site staff shall be approved by the Engineer. The Contractor shall also provide experienced divers during the period when underwater works are being carried out.

#### **17.0 QUALITY OF ROCKS**

- 17.1 Stone used for the construction of the coastal / riverbank protection works such as riprap revetment shall be hard, durable, angular in shape; resistant to weathering and to water action; free from soft, weathered or decomposed parts, overburden, spoil, and organic material; and shall meet the gradation requirements specified. Stones that are considered not suitable include, but is not limited to, are shale and rocks that are laminated, fractured, porous or otherwise physically weak. Neither breadth nor thickness of a single stone shall be less than one-third its length. Rounded stone or boulders will not be accepted unless authorised by special provisions.

- 17.2 The soundness of the rocks shall be such that when subjected to sodium sulphate test for 5 cycles in accordance with AASHTO method T-104, the maximum loss in the height does not exceed 5%. The density of the rock shall not be lower than 2,650kg/m<sup>3</sup> unless otherwise approved by the Engineer.
- 17.3 The quality of the stone at a quarry shall be uniform to such an extent that the necessary rate of delivery will not be adversely affected by testing and/or production delays.
- 17.4 Since the riprap must withstand abrasive action from material transported by the river, the abrasion test in the Los Angeles machine (AASHTO Test T 96) shall be carried out; the stone shall have a percentage loss of not more than 40 after 500 revolutions.
- 17.5 Each load of riprap shall be reasonably well-graded from the smallest to the maximum size specified. Stones smaller than the specified 10 percent size and spalls will not be permitted in an amount exceeding 10 percent by weight of each load.

## 18.0 SPECIFICATIONS

- 18.1 Each individual stone shall comply with the following Specifications –

Aggregate Crushing Value	-	25% maximum
Los Angeles Abrasion	-	15% maximum
Specific Gravity (saturated surface dry)	-	2.6 minimum
Water Absorption	-	2% maximum gain by weight
Sodium Sulphate Soundness	-	5% maximum loss over 5 cycles

## 19.0 ACCEPTANCE OF ROCK AT THE SITE OF WORKS

- 19.1 A further inspection of the rock shall be carried out at the site of the works in order to ensure that rock has not been adversely affected as a result of handling, transporting and placing at the site. Any material which, in the opinion of the Engineer does not conform with the requirements of this specifications in regards to its proposed use, will be rejected and it shall be removed from the site and the cost of removal and loss of time shall be borne by the Contractor.

## 20.0 STOCKPILING OF STONES

- 20.1 Not more than 2% of the total weight of any grade of stone stockpiled at site shall be less than the weight specified for that grade and in any case not less than 25% of the respective specified weight. For the armour layer near the crest of the revetment and at round corners, the Contractor shall select the heaviest stones of the specified grade from the stockpile for placement.
- 20.2 There shall be separate stockpiles for granite, sandstone, siltstone, shale and unsuitable material. No mixing of these materials is permitted, unless with written approval from the Engineer.

## 21.0 GEOTEXTILES

- 21.1 The geotextile shall comprise continuous filament polypropylene, needle punched fibres to form a homogeneous sheet. Fibers used in the manufacture of geotextiles and the threads

used in joining geotextiles by sewing, shall consist of long chain synthetic polymers, composed of at least 95% by weight polyolefins or polyesters. They shall be formed into a stable network such that the filaments or yarns retain their dimensional stability relative to each other, including selvages.

- 21.2 Geotextile manufactured from staple (short) fibres or comprising of reject or mixed fibres not derived from a single source polymer will be rejected.
- 21.3 The geotextile shall meet the requirements of the Table below. All numeric values in the following table, except AOS, represent minimum average roll values (MARV) in the weakest principal direction (i.e., average test results of any roll in a lot sampled for conformance or quality assurance testing shall meet or exceed the minimum values). Values for AOS represent maximum average roll values.

Permanent Erosion Control Geotextile Requirements (MARV)

Property	ASTM Test Method	Units	Geotextile		
			Woven Monofilament	All other geotextiles	
				Elongation < 50%	Elongation >50%
Grab Strength	D 4632	N	1100	1400	900
Sewn Seam Strengths	D 4632	N	990	1200	810
Tear Strength	D 4533	N	250	500	350
Puncture Strength	D 4833	N	400	500	350
Burst Strength	D 3786	kPa	2700	3500	1700
			Percent In Situ Passing 0.075 mm Sieves		
			< 15	15 to 50	> 50
Permittivity	D 4491	sec <sup>-1</sup>	0.7	0.2	0.1
Ultraviolet Stability	D 4355	%	70% after 500 hours of exposure		

## 22.0 SHIPMENT AND STORAGE OF GEOTEXTILES

- 22.1 Geotextile labelling, shipment, and storage shall follow ASTM D 4873. Product labels shall clearly show the manufacturer or supplier name, product type, and roll number. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate. Failing such, the materials shall not be accepted.
- 22.2 Each geotextile roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sunlight, and contaminants. The protective wrapping shall be maintained during periods of shipment and storage.
- 22.3 During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 71°C (160°F), and any other environmental condition that may damage the physical property values of the geotextile.

### **23.0 PLACING OF GEOTEXTILES**

- 23.1 The geotextile shall be placed loosely on the ground surface with no wrinkles or folds, and with no void spaces between the geotextile and the ground surface. Care shall be taken during installation so as to avoid damage occurring to the geotextile as a result of the installation process. Atmospheric exposure of geotextiles to the elements following lay down shall not exceed 7 days.
- 23.2 Should the geotextile be damaged during installation, a geotextile patch shall be placed over the damaged area extending 1 m beyond the perimeter of the damage. Successive sheets of geotextiles shall be overlapped a minimum of 350 mm (unless stated otherwise in the drawings), with the upstream sheet overlapping the downstream sheet.

### **24.0 LAPPING OR SEWING OF SEAMS FOR GEOTEXTILES**

- 24.1 Geotextile overlaps shall be at least 1.0m when installed underwater and 0.35m for installation in dry conditions (depending on the subsoil conditions) unless otherwise stated in the drawings. Alternatively, geotextile overlaps are to be heat welded or sewn using thread and portable hand sewing equipment. The seam strengths should equal the required strength of the geotextile, in the direction perpendicular to the seam length.
- 24.2 If a sewn seam is to be used for the seaming of the geotextile, the seaming material (thread, extrudate, or fastener) used shall consist of high strength polypropylene, or polyester that has the same or greater durability as the geotextile being seamed. Nylon thread shall not be used. The thread shall be resistant to ultraviolet radiation and shall be of contrasting colour to that of the geotextile itself. The seam assembly description shall be submitted by the Contractor along with the sample of the seam. The description shall include the seam type, stitch type, sewing thread, and stitch density.
- 24.3 For seams which are sewn in the field, the Contractor shall provide at least a 2 m length of sewn seam for sampling by the Engineer before the geotextile is installed. The seams sewn for sampling shall be sewn using the same equipment and procedures as will be used for the production of seams. If seams are to be sewn in both the machine and cross machine directions, samples of seams from both directions shall be provided.
- 24.4 For seams which are sewn in the factory, the Engineer shall obtain samples of the factory seams at random from any roll of geotextile which is to be used on the project.

### **25.0 TRENCH FOR GEOTEXTILES**

- 25.1 Trench excavation shall be done in accordance with details of the project plans. In all instances excavation shall be done in such a way so as to prevent large voids from occurring in the sides and bottom of the trench. The graded surface shall be smooth and free from debris prior to placement of the geotextile.
- 25.2 In trenches equal to or greater than 300 mm in width, after placing the backfill material, the geotextile shall be folded over the top of the backfill material in a manner to produce a minimum overlap of 300 mm. In trenches less than 300 mm but greater than 100 mm wide, the overlap shall be equal to the width of the trench. Where the trench is less than 100 mm the geotextile overlap shall be sewn or otherwise bonded. All seams shall be subject to the approval of the Engineer.

### **26.0 SAMPLING, TESTING AND ACCEPTANCE OF GEOTEXTILES**



- 26.1 The Contractor shall provide to the Engineer a certificate stating the name of the manufacturer, product name, chemical composition of the filaments or yarns and other pertinent information to fully describe the geotextile for approval. The Engineer reserves the right to reject the proposed manufacturer and the Contractor shall propose alternative manufacturers.
- 26.2 The Manufacturer's certificate shall state that the furnished geotextile meets Minimum Average Roll Values (MARV) requirements of the specification as evaluated under the Manufacturer's quality control program. The certificate shall be attested to be a person having legal authority to bind the Manufacturer. The Manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. Documentation describing the quality control program shall be made available upon request.
- 26.3 Mislabelling or misrepresentation of materials shall be reason to reject the geotextile products including materials that has been placed. The Contractor shall be solely responsible for all the remedial works.
- 26.4 Geotextiles shall be subject to sampling and testing to verify conformance with this specification. Sampling for testing shall be in accordance with ASTM D 4354. Acceptance shall be based on testing of either conformance samples obtained using Procedure A of ASTM D 4354, or based on manufacturer's certifications and testing of quality assurance samples obtained using Procedure B of ASTM D 4354. A lot size for conformance or quality assurance sampling shall be considered to be the shipment quantity of the given product or a truckload of the given product, whichever is smaller. The tests shall be carried out at a recognized independent testing institute approved by the Engineer or as directed by the Engineer at a later stage.
- 26.5 Testing shall be performed in accordance with the methods referenced in this specification for the indicated application. The number of specimens to test per sample is specified by each test method. Geotextile product acceptance shall be based on ASTM D 4759. Product acceptance is determined by comparing the average test results of all specimens within a given sample to the specification MARV.
- 27.0 PLACING OF ARMOUR UNITS AND SECONDARY ROCKS**
- 27.1 The Contractor shall demonstrate through trial sections that the proposed riprap placement technique will not damage the geotextile. Field monitoring shall be performed to verify that the armor system placement does not damage the geotextile.
- 27.2 The armour system placement shall begin at the toe and proceed up the slope. Placement shall take place so as to avoid stretching resulting in tearing of the geotextile. Riprap and heavy stone filling shall not be dropped from a height of more than 300 mm. Stones weighing more than 450 N shall not be allowed to roll down the slope. Placement of armour stones shall be vertically downwards.
- 27.3 Slope protection and smaller sizes of stone filling shall not be dropped from a height exceeding 1 m. In under water applications, the geotextile and backfill material shall be placed the same day. All void spaces in the armour stone shall be backfilled with small stone to ensure full coverage.
- 27.4 Riprap shall be placed on the prepared slope or area in a manner which will produce a reasonably well graded mass of stone with the minimum practicable percentage of voids. The entire mass of stone shall be placed so as to be in conformance with the lines, grades and thicknesses shown on the plans. Riprap shall be placed to its full course thickness at one operation and in such a manner as to avoid displacing the underlying material. Placing of riprap in layers or by dumping into chutes, or in similar methods likely to cause segregation, will not be permitted.
- 27.5 Riprap shall be tipped or otherwise placed in such a manner as to achieve the full thickness of the

material, all large voids being filled with smaller rock fragments. It may be finished finally by hand to the designed slope and thickness using crowbars. The tender rates for riprap shall include the cost of supplying, handling, placing and any necessary adjustment after dumping to achieve the necessary uniformity of distribution.

- 27.6 Following placement of the armor stone, trimming or grading of the slope shall not be permitted if it results in movement of the stone directly above the geotextile.
- 27.7 Any geotextile damaged during the riprap placement shall be replaced immediately.

## **28.0 TOLERANCES**

- 28.1 The allowable tolerance in the thickness of the various layers forming the revetment shall not be less than 5% or more than 20% of the specified layer thickness. The average finished cross section profile of the revetment shall not fall below of that specified.

## **29.0 MEASUREMENT OF PAYMENT**

- 29.1 The quantity of riprap to be paid for, of specified thickness and extent, in place and accepted shall be measured by the number of cubic metres as computed from surface measurements parallel to the riprap surface and thickness measured normal to the riprap surface as shown in the drawings. The Contractor shall not be paid for extra thickness of the revetment. Riprap placed outside the specified limits will not be measured or paid for, and the Contractor may be required to remove and dispose of the excess riprap at his own cost.
- 29.2 Pre-commencement survey as stated in "Surveys and Joint Measurements" in this Specifications shall form the basis for measurement purposes.
- 29.3 The geotextile shall be measured by the number of square meters computed from the payment lines shown on the plans or from payment lines established in writing by the Engineer. This excludes seam overlaps and any other types of overlapping areas, but shall include geotextiles used in crest and toe of slope treatments.

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