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6 ENVIRONMENT PROTECTION MEASURES

6.1 GENERAL

- i) The contractor's activities towards environment protection measures shall include construction of gabions/wire crates filled with stones, retaining walls (with RR masonry or concrete), rip rap protection, turfing, dust suppression with waters sprinkling etc., in order to prevent entrance or accidental spillage of solid matter containment, debris and other objectionable pollutions and wastage into the river, drainage channels, road other private/government properties etc. Construction drawings for the different items under this sub head shall be prepared by the contractor and got approved from Project Manager before execution. In addition to the above measures, the contractor shall also provide for appropriate additional measures if required to satisfy the provisions of Air Act, Water Act, Hazardous Waste Act, Environment Protection Act, conditions imposed on the project in the clearance and other relevant regulations. However, in case, additional measures, if any are imposed by state/central government during execution of Contract, payment for the same shall be made at the rates in Bill of Quantities and if not available in Bill of Quantities, at the rate determined as per contract provisions. Pollutants and wastes shall be disposed off in a manner and at sites approved by the Project Manager. In addition to compliance with other provisions of various notifications, the contractor shall also obtain annual renewal of the "Consent to Establish" from State Pollution Control Board required as per Govt. notification, during the entire period of his construction activities at his own cost.
- ii) The cost for implementing measures, if any, required to protect the environment in accordance with provisions of contract shall be included in the rates quoted for the various items and no separate payment will be admissible for items other than the items specifically mentioned in BOQ. Measures, if any required in accordance with provisions of contract will be complied with by the contractor, within reasonable time after issue of the notice. If the above is not complied with, the necessary work shall be carried

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out by the Project Manager at the risk and cost of the contractor. Contractor shall make necessary arrangement to prevent pollution of the water in any stream, spring, nallah and river. The contractor shall be solely responsible and liable for all damages caused by any pollution that may take place during the execution of works. In the event of any failure or inadequacy on account of the activities of the contractor resulting in to issue of notices/compensation demand by Employer/Statutory Authority of State/Central Govt., the contractor shall be liable for all such defaults. The contractor shall rectify /compensate the demands of all such notices to the full satisfaction of the concerned Authorities, without any financial liability to Employer.

6.1.1 ENVIRONMENTAL OBLIGATIONS


- i) The contractor shall, during the whole period of the works comply fully with all Indian laws and regulations relating to environmental protection, mitigating measures for reducing environmental impacts and remedial works on completion of the Works. This obligation shall extend to the construction sites themselves, all the contractor's site installations, and all quarries, borrow areas and spoil tips.
- ii) Notwithstanding any specific obligations as these may be specified in prevailing Indian laws and regulations, the contractor shall at all times comply with the following particular requirements for the protection of the environment, the local population and the workers at the construction site:
 - a) Collect, treat, remove from site and dispose of in accordance with the regulations and to the satisfaction of the Project Manager all domestic and industrial waste and excess construction materials (both solid and liquid), fuel, chemicals and other matter.
 - b) Make every effort to minimise the harmful effects of transport to and from the site, in particular vehicle emissions and noise and the control of dust on roads.

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- c) Provide its work force with fuel for cooking and heating and ensure that workers on the site do not cut wood or other vegetation as firewood. Take measures and construct works, on the instructions of the Project Manager, to prevent soil erosion from slopes in the construction area.
 - d) Not clear any areas of forest or woodland without the authority of the Project Manager and statutory authorities.
 - iii) In order to reduce adverse effect on public health resulting from the influx into the project area on construction workers, the contractor will be obliged to undertake during the whole construction period the following preventive measures:
 - a) Ensure that all construction staff and workers, prior to being accepted to work on site, submit certificates of good health and, during the construction period, ensure that all employees are given a periodic physical examination (at least once a year and following any serious illness) by a qualified registered medical practitioner.
 - b) Ensure that workers suffering from noticeable contagious illnesses are removed from the site for treatment and are not permitted to return to the site without an updated medical certificate.
 - c) Carry out regular spraying of all parts of the site and site installations to control mosquito vector diseases, using approved insecticides.
 - d) Implement a control programme to ensure the maintenance of satisfactory sanitary conditions on the site and in the living areas, and report to the Project Manager all cases of serious enteric and/or water-borne illness.
 - iv) The contractor will send representatives to constituted project environmental monitoring committees, as instructed with the Project Manager, and will at all times comply with the requests of said committees with regard to the need for environmental or health protection measures. He will also maintain close contact with local representatives and government institutions in

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addressing issues arising from the construction activities. Such issues requiring particular attention are the following:

- a) Pollution caused by construction work.
- b) Disputes related to the leasing of land for construction activities and/or site installations etc.
- c) Disputes arising from traffic congestion and restrictions on the use of the main project access road and roads in the project area.
- d) All matters relating to road safety and the reduction to a minimum of the risk of traffic accidents.
- v) The contractor will submit to the Project Manager monthly reports on environmental performance and control. These reports will give details of all environmental protection measures taken during the months, as well as:
 - a) Any environmental problems encountered during the month.
 - b) Details of health conditions, in particular any occurrence of contagious illness and any accidents.
 - c) Any notices received from government or state institutions relating to environmental matters, and the action taken by the contractor as a result.
- vi) The contractor will co-operate with the local authorities at all times to prevent migration to the area, of unauthorised persons not involved directly in the construction work. To this end, he will at all times strictly control the movement of persons into and out of the construction areas and camps.

6.1.2 MEASUREMENT AND PAYMENT

No separate payment shall be made for complying with any environmental obligations required by Indian national and state laws and regulations, and/or as described in this Chapter, and all such costs incurred by the contractor to this end shall be considered as being included in the contractor's Unit Prices.

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6.2 **GABIONS**

6.2.1 **SCOPE OF WORK**

The scope of work under this item covers supplying and installing rock or boulder filled Gabions in place as per approved drawings or as directed by Project Manager.

6.2.2 **STANDARDS**

- i) The work shall be carried out as per following Indian standards or, where not covered by these standards, to their equivalent international standards (latest edition)

IS:280 Mild steel wire for general Project Managerring purposes

IS:4826 Hot dipped Galvanized coating on round steel wire

IS:12753 Electro Galvaized coating on round steel wire

IS: 16014 Mechanically woven, double-twisted, hexagonal wire mesh gabions, revet mattresses and rock fall netting (Galvanized steel wire or Galvanized steel wire with pvc coating) —specification

IS:13360(Part-5) Plastics: Method of testing

IS:4454 Steel wire for Mechanical Spring- Specification


- ii) In case of conflict between the above standards and the specifications given herein, the specifications shall take precedence.


6.2.3 **MATERIAL**

6.2.3.1 **Rock**

Rocks to be placed in the gabions shall be clean, hard, dense, sound and of a quality that shall resist the action of water weathering. Rocks to be placed in gabions shall have the following characteristics:

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<div> <ul style="list-style-type: none"> ○ Water absorption < 5% ○ Los Angeles abrasion value < 40% ○ Sodium Sulphate < 12% ○ Slake Durability Index > 90% <p>Rocks to be placed in gabions shall be uniform in shape, in all three dimensions. The smallest dimension of the rocks shall be at least 1.5 times (preferably) the size of the mesh. The maximum dimension of the rocks shall be 0.5 times the thickness of the gabion.</p> <p>Stones for hand pitching in the front 150mm thick face shall be carefully selected and placed in position to achieve a well bonded, neat, visually attractive, flat surface, and free from bulges and/or depressions.</p> <p>6.2.3.2 <u>Gabions</u></p> <p>A wire mesh container of variable sizes ,uniformly partitioned into internal cells, interconnected with other similar units, and filled with stone at project site to form flexible, permeable monolithic structure for earth retaining and erosion control purpose, such as retaining walls, weirs etc.</p> <p>6.2.3.3 <u>Double Twisted Wire Mesh</u></p> <p>A non ravelling mesh made by continuous pairs of wires through three one half turns (commonly called double twisted) to form hexagonal shaped openings which are then interconnected to adjacent wires to form hexagonal openings.</p> <p>6.2.3.4 <u>Selvedge Wire</u></p> <p>A terminal wire used to edge wire mesh perpendicular to double twist by mechanically wrapping the mesh wires around it at least 2.5 times.</p> </div>		
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6.2.3.5 Edge Wire

A terminal wire of the same diameter as the selvage wire used to edge the wire mesh parallel to double twist by continuously weaving it mechanically into wire mesh.

6.2.3.6 Lacing Wire

A galvanized wire coating used to assemble and interconnect empty units, to close and secure stone filled units, and for internal stiffeners.

6.2.3.7 Diaphragm

An internal partition made up of same wire mesh panel in Gabion that is attached to bottom, the sides, after the gabion cage is packed with stone, to the lid of cage.

6.2.3.8 Classification

Double twisted wire mesh gabions are classified according to coating ` as follows:

i) Class- I

Consists of double twisted wire mesh made from wire which is zinc-coated before being double twisted into mesh. Fasteners, lacing wire and stiffeners are produced from zinc coated wire.


ii) Class-II

Consists of double twisted mesh shall be manufactured from the same type of galvanized steel wire as Class-I with an additional PVC coating extruded onto the galvanized steel wire.

6.2.3.9 Material And Manufacture

- i) The wire used in manufacture of double twisted mesh for use in Gabions shall conform to IS 280.

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- ii) The double twisted mesh size(class-I) shall be manufactured from zinccoated steel wire conforming to IS 4826, heavily coated and soft type or IS 12753(heavy coated)
- iii) Lacing wire and stiffeners shall be made up of wire having the same coating material as the double twisted wire mesh furnished on the order and conforming to IS 4826 or IS 12753(heavy coated) .
- iv) Galvanized Rings: Fasteners made from galvanized steel wire of 3mm diameter shall be used for products of Class- 1 type mesh.

6.2.3.10 Mesh And Box Characteristics

The nominal mesh opening size, diameter of the galvanized steel wire and the standard dimensions for gabions shall conform to the values as per table given below:

Mesh Type	'D' Nominal Size, mm	Tolerances
8 x10	80	+16% to -4%
Mesh Type (mm)	80 x 100	
'D', mm	80	
Wire Type	Zinc Coated	
Mesh Wire dia, mm	3.0	
Edge Selvedge Wire dia, mm	3.90	
Lacing Wire dia.	2.2	
Tolerances in size of Gabion Boxes	Length and Width ...±5%, Height>0.3m... ±5%, and Height ≤0.3m..... ...±10%	

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6.2.3.11 Mechanical Properties

- i) Tensile Strength: The tensile strength of wire used for double twisted mesh, lacing wire and stiffener when tested shall be in accordance with the requirements of IS 280 for soft wire 450 MPa($\pm 10\%$) at a minimum elongation of 10%, performed on a gauge length of test specimen as 200mm.
- ii) Mesh Panel Strength: The minimum strength requirements of the mesh, when tested is as shown under:

Sr. No.	Mesh Type	Mesh wire dia.(mm)	Min tensile strength Parallel to twist ,KN/m	Min tensile strength Perpendicular to twist ,KN/m
1	Zinc Coated	3.00	51	26.5

6.2.3.12 Dimensions And Tolerances


The diameter of galvanized steel wire shall conform to the values as given below:

Sr. No.	Nominal Dia. Of Galvanized wire (mm)	Mass of Zinc coating (g/m ²)	Permitted tolerance on wire diameters(mm)
1	2.20	240	+0.06
2	3.00	270	+0.08
3	3.90	280	+0.10

6.2.3.13 Measurements And Payment

The rate quoted shall be applicable per m³ of rock fill placed inside the Gabions, including the cost of Gabions. The dimensions to compute volume

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shall be measured as the dimensions of final Gabions in place. The payment shall be made as per the rates quoted by the contractor in the BOQ.

6.3 RANDOM RUBBLE MASONRY

6.3.1 SCOPE OF WORK

The scope of work under this item covers supplying and construction of RRM in cement mortar as per approved drawings or as directed by Project Manager.

6.3.2 MATERIAL

6.3.2.1 Stones

Stones used shall conform to the specifications laid down in IS: 1597 (part-1) obtained from quarries approved by Project Manager. The stone shall be of hard, tough, sound and durable quality free from voids, flaws, cracks, earth cover, zeolite etc.

The stone shall be free from defects like cavities, cracks, flaws, sand holes veins, patches of soft or loose materials, etc. Generally, the stone should not contain cryptocrystalline silica or chert, mica or any other deleterious material like iron oxide, organic impurities, etc.


The stone shall be such as not to absorb more than a quarter percent of water by weight after being kept under water for twenty four hours.

Other material such as cement, sand and water shall conform to the relevant specifications for concrete, provided elsewhere in the tender documents.

6.3.2.2 Mortar

The mortar shall consist of one part of cement and six parts of sand. Dry mortar shall be prepared by using sand corresponding to one bag of cement measured by batching boxes, and then spreading one bag of cement over it. The mixture shall then be thoroughly mixed and then specified quantity of

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water added to obtain the final mortar for use. Mortar, once mixed, shall be consumed preferably within 30 minutes in any case. Old mortar remaining back in taslas shall be thrown away and taslas thoroughly cleaned before filling the same with fresh mortar. In no case fresh mortar shall be mixed with old mortar.

6.3.2.3 Plastic Pipes

These pipes shall be low density polyethylene pipe for drainage purpose as per IS-3076(latest edition). The diameter used shall be 75mm for proper drainage in retaining wall.

6.3.3 DRESSING

Stones as received from the quarry shall have their weak corners and edges knocked off and hammer dressed on the face, the sides and the beds to enable them to come into proximity with neighbouring stones.


6.3.4 LAYING

The stones shall be wetted before laying. Every stone shall be carefully fitted to the adjacent stones so as to form close joints as far as possible,. The clips and spalls of stone shall be used wherever necessary to avoid thick mortar beds and joints. The clips shall not be used below the hearting stones and their use shall be restricted to the filling of inter stick between the adjacent stones in the hearting and these shall not exceed 20% of the quantity of stone masonry.

The masonry shall be carried up regularly and no step shall be allowed more than 60 cm. When the masonry of one part has to be delayed, the work shall be raked back at an angle not exceeding 45°.

Bond stones running through the thickness of wall shall be provided in walls upto 60 cm thick. If these walls are more than 60 cm thick, two or more bond stones, overlapping each other by at least 2 cm, shall be provided on a line from face to back. At least one bond stone or a set of bond stones shall be

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provided for every 0.5m² of wall surface. The walls shall be carried out truly in plumb. The thickness of the joint shall not exceed 2.5cm.

6.3.5 PROTECTION AND CURING

The masonry during construction shall be protected from sun rain by suitable covering and the masonry shall be kept moist for at least ten days after completion. When the work is to be done under frost condition, special precautions shall be taken as directed by Project Manager such as mixing of calcium chloride at the rate of 1.5% in cement, use of warm water in mixing and curing, covering of masonry with gunny bags, etc. Watering shall be carefully done so as not to wash any mortar out of the joints. The curing shall be done for 21 days.

6.3.6 PLUM CONCRETE

The wall shall be filled with plum cement concrete 1:3:6 with 75% graded material of minimum size of 40mm and 25% plums of 150mm size.

6.3.7 MEASUREMENT AND PAYMENTS

The in place volume of Random Rubble Masonry (RRM) and plum concrete shall be computed from the approved drawings. The price quoted per m³ shall include the cost of rock material, cement mortar, labour, all leads and lifts and compensation towards all other materials, constraints and works required to carryout the work as per approved drawings, specifications as directed by Project Manager. The payment shall be made as per the rates quoted by the contractor in the Bill of Quantity.

End of Report.

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