



GOVERNMENT OF INDIA
भारत सरकार
MINISTRY OF RAILWAYS
रेल मंत्रालय

GUIDELINES
For Application Of
JUTE GEO-TEXTILE
In
Railway Embankments
And
Hill Slopes

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PREFACE

India is a vast country with varying climate, rainfall and soil characteristics. Network of Indian Railways passes through different type of terrain – deserts in Rajasthan, Heavy Rainfall Regions in Sub-Himalayan Belts, Deccan Plateau and Alluvial Gangetic Plain. Therefore, problem of erosion varies from one region to another. Hence, erosion protection measures have to be provided in such a way that they cater to specific site requirement. Jute Geo-textile can be used effectively in controlling erosion in railway embankment and hilly slopes along the track.

Keeping this in view, guidelines have been formulated covering relevant details regarding Geo-jute and its laying in field. These guidelines have been prepared on the basis of literature survey from BIS Codes, Documents/Reports of Indian Jute Industries Research Association (IJIRA) & Jute Manufacturers Development Council (JMDC), previous reports issued by RDSO & field experiences in use of Geo-jute on Indian Railways. These guidelines will help field engineers to adopt Geo-jute as an effective measure for erosion control in railway embankments and hilly slopes along railway track. Suggestions/comments are welcome and may be sent to Executive Director/Geo-technical Engineering, RDSO, Lucknow.

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1.0 INTRODUCTION :

- 1.1 Jute is a natural fiber out of which Jute Geotextiles (JGT) can be made by the special treatment and weaving processes. Jute geotextile being a natural fabric is biodegradable and environment-friendly. It has good hygroscopic and hydrophilic properties. It can absorb moisture upto about 5 times its dry weight and form mulch to promote a quick growth of vegetation. JGT possesses good drapability, i.e. it can shape itself well to the ground topography on which it is laid. It helps controlled extremes of temperature and thus additionally supports growth of vegetation.
- 1.2 These properties make JGT admirably suitable in areas where natural treatment of a soil surface for control of erosion is called for. Adequate growth of vegetation is possible during the lifetime of JGT provided the right type of species of vegetation is chosen and planted, considering the soil and climatic ambience.
- 1.3 Erosion of railway embankments and hill slopes is caused principally by rains and winds. Erosion of the top soil gradually destabilises the earthen embankments. Denuded hill slopes are always vulnerable to erosive forces of rains particularly during the monsoon. JGT when applied on an exposed soil surface acts as miniature check dams or micro terraces, reduces the kinetic energy of rain splashes, diminishes the intensity of surface runoff prevents detachment and migration of soil particles and ultimately helps in quick growth of vegetation on it by formation of mulch. JGT, therefore, helps in controlling erosion in railway embankments and hill slopes naturally.
- 1.4 These guidelines have been prepared based on BIS Code IS-14986 and RDSO's Reports no. GE:G-1, July 2003; no. GE-1, June 1994 and no. GE:G-4, February 2005 taking into consideration the practices prevalent in the field on Indian Railways.

2.0 SCOPE :

- 2.1 This document gives the guidelines of Jute Geotextiles (JGT), suitable for application in slopes of railway embankments and also in hill slopes along railway track including their choices and installation methods.

3.0 B.I.S. REFERENCES FOR TESTING JGT :

- 3.1 The following Standards of 'Bureau Of Indian Standards' (BIS) should be used for measuring various dimensions of JGT and for testing of JGT for strength parameters and other related items. All standards are subject to revision and parties to agreements based on these standards are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below :

I.S. No.	Title
1954 : 1990	Method of determination of length and width of fabrics (second revision)
1963 : 1981	Methods for determination of threads per unit length in woven fabrics (second revision)
1969 : 1985	Methods for determination of breaking load and elongation of woven textile fabrics (second revision)
2387 : 1969	Method for determination of weight of jute fabrics (first revision)
2405 (Part 1) 1980	Industrial sieves: Part 1 Wire cloth sieves (first revision)
2405 (Part 2) 1980	Industrial sieves: Part 2 Perforated plates (first revision)
4744 : 1991	Textiles – Packaging of jute products in rolls (first revision)
7702 : 1975	Method for determination of thickness of woven and knitted fabrics.

4.0 TERMINOLOGY :

4.1 For the purpose of these guidelines, the following definitions shall apply -

4.1.1 Average Moisture Regain

It is the percentage moisture regain by JGT at the time of preshipment (delivery) inspection calculated on the basis of ten readings per roll.

4.1.2 Contract Moisture Regain

It is the percentage regain of moisture by the JGT on the basis of which corrected net weight is calculated.

4.1.3 Corrected Net Weight

The weight obtained by adjusting the actual net weight on the basis of average Moisture Regain (4.1.1) and Contract Moisture Regain (4.1.2).

4.1.4 Contract Weight

The weight as arrived at in accordance with the relation given in Note (2) under Table-1 (Annexure-A) from the marked length per roll, nominal width and weight per square metre of JGT.

4.1.5 Cut (Full Cut)

The length of JGT continuously woven as specified in the agreement between a buyer and a seller.

4.1.6 Ends

The warp threads of a JGT, i.e. the number of threads in a JGT running along the machine direction.

4.1.7 Jute Mesh

Open structured jute geotextile made out of 100 percent jute fibers in which yarns of a specified diameter are laid in specified numbers/length in machine (warp) and cross (weft) directions.

4.1.8 Lot

The quantity of JGT of a particular type packed in rolls of a specified length ready for delivery against a dispatch note.

4.1.9 Picks

The weft or filling threads of a JGT, i.e. the number of threads along the cross direction (perpendicular to the warp threads).

4.1.10 Roll

The cylindrical rigid package containing a particular type of JGT, rolled on a suitable core and wrapped with a roll, covering with its outer layer stitched properly in conformity with IS:4744.

5.0 SPECIFIC REQUIREMENTS :

5.1 Mechanism of Surface Soil Erosion -

5.1.1 Raindrops cause detachment of the particles of the exposed soil-surface of railway embankments and hill slopes along railway track by their impact and the detached particles are carried away by the surface run-off and wind. The dislodged particles carry with them seeds and soil-nutrients. Natural growth of vegetation on the slopes is thus hindered. The exposed denuded slopes become increasingly vulnerable to erosion agents and are ultimately destabilised.

5.2 Role of Jute Geo-textile in Surface Erosion Control -

5.2.1 JGT is capable of reducing the erosive effects of rain drops and controlling migration of soil particles of the exposed surface. On biodegradation, JGT forms mulch and fosters quick vegetative growth. Choice of the right type of JGT and plant species is critical for effective results.

5.2.2 Table-1 mentions different types of JGT with their salient properties that can be applied on embankment slopes of railways and of hill along railway track to control the erosive effects of natural agents, i.e. rains and wind.

5.2.3 Species of vegetation needs to be selected carefully considering the local soil and climatic conditions. JGT incidentally, does not draw upon nitrogenous reserves with its degradation and its fibrous residue improves the soil structure. Trials indicate that JGT has a low C-factor (0.004 for 3:1 slope and 0.005 for a 1.5:1 slope on plying retention of soil to the extent of 99.6% and 99.5% respectively).

5.3 Selection of JGT -

5.3.1 The choice of JGT basically depends on the type of soil to be protected. It requires to be ensured primarily that the slope to be protected from rain water erosion is geo-technically stable.

5.3.2 The selection of JGT is also required to be done in consideration of the extreme rainfall in a limited time span at that location as the intensity of rainfall is more important than the average annual rainfall at a place for assessing Erosion Index and deciding on the choice of a particular type of JGT.

5.3.3 No systematic research has been conducted on this aspect as yet. It is recommended that the choice of JGT should be limited to Type (1) of Table-1 (Annexure-A) where the intensity of rainfall is severe irrespective of the soil-type. Field trials so far conducted have shown that following combinations have given satisfactory results-

- a) Soil mixed with rock grits and boulder pieces covered with JGT Type-1 of Table-1 (730 gsm).
- b) Soil with dominantly sand silt composition and small quantities of clay and or stone grits protected by JGT Type-2 of Table-1 (500 gsm).
- c) Soil with sand and/or clay overlain by JGT Type-3 of Table-1 (292 gsm).

5.3.4 The types of JGT mentioned in Table-1 are indicative and provide broad guidelines to the choice of the JGT type by a user.

6.0 INSTALLATION METHOD :

- 6.1 The stages of laying of JGT on slopes, for rain water erosion control are as under -
 - 6.1.1 The slope should be made free from undulations, soil slurry, mud and sharp projections and compacted with additional earth, wherever necessary.
 - 6.1.2 Anchoring trenches should be excavated at the top and toe of the slope along the length of the embankment. Recommended dimensions of the trench (usually rectangular) are 450 mm deep and 300mm wide.
 - 6.1.3 The selected JGT should be unrolled across the top trench and along the slope downward, caring to see that it touches the soil surface at all points.
 - 6.1.4 Overlaps should be minimum 150mm at sides and ends (see Figure-1). JGT at the higher level on the slope should be placed over the portion to its next at a lower level. Side overlaps of a JGT piece should be placed over its next at a lower level. Side overlaps of JGT piece should be placed on one side and under the next piece on the other.

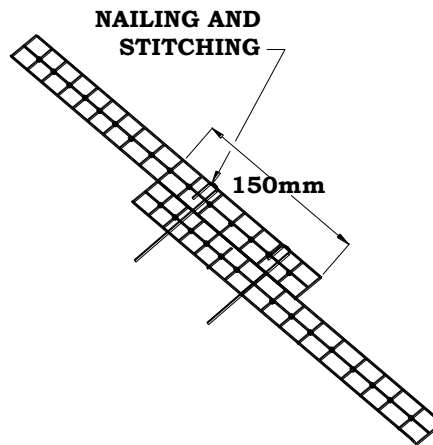


Figure-1 : Overlapping Of Jute Netting

- 6.1.5 The JGT should be fixed in position by steel staples as shown in the Figure-2 (usually of 11 gauge dia.) or by split bamboo pegs. Stapling should be done normally at an interval of 1500 mm both in longitudinal and transverse directions. Special care should be taken to staple the JGT within the anchoring trenches both at the bottom and at the sides.

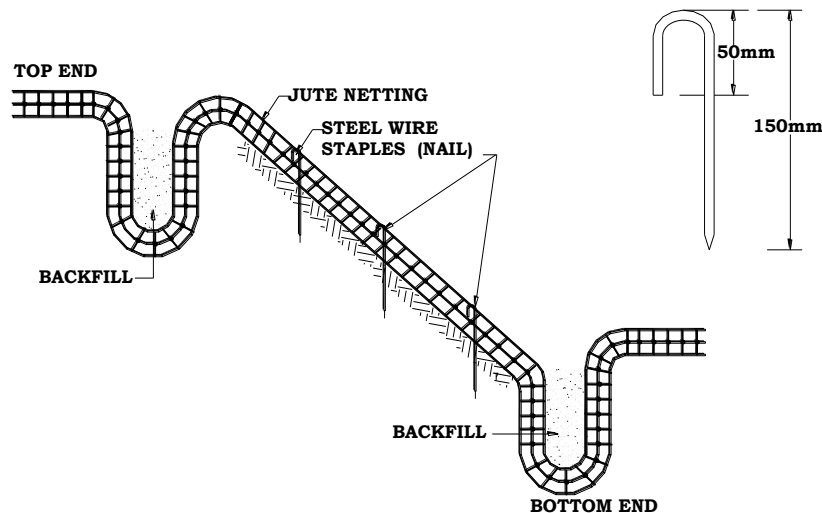


Figure-2 : Placement Of Jute Netting

- 6.1.6 The anchoring trenches should be filled-up with brick-bats/soil for preventing displacement of the JGT. Care should be taken that the overlaps are not displaced during installation.
- 6.1.7 Care should be taken to ensure that the JGT is not damaged due to puncture, tear and other operational stresses.
- 6.1.8 Seeds of vegetation (grass, legumes etc. of appropriate variety) should then be spread (refer to Annexure-B for guidance in selecting the species of vegetation). If seeds are not available, saplings of the appropriate plant species may be planted at suitable intervals through the openings of the JGT.
- 6.1.9 In special circumstances, a second dose of seeds may be spread with dibbling of locally available grass.
- 6.1.10 Installation should be completed preferably before the monsoon to take advantage of the rains for quick germination of seeds.

7.0 MONITORING :

- 7.1 Close monitoring should be done for at least one season cycle.
- 7.2 The treated area should be kept out of bounds for cattle and other grazing animals till the time of maturity of vegetation.
- 7.3 The damage and displacement of JGT should be noted for corrective actions. Torn portions of the JGT should be covered with new pieces of JGT of identical specifications duly stapled at all sides.
- 7.4 Watering and maintenance of the vegetation should be carried out as per specialist advice of agronomist or botanist.
- 7.5 Advice should be sought from specialists to find out the cause of unsatisfactory growth of vegetation. The advice should be implemented. Withered plants should be replaced.

8.0 PACKING, MARKING, TRANSPORTATION, STORAGE AND HANDLING OF JGT :

8.1 Packing -

- 8.1.1 JGT shall be packed in rolls duly covered from all sides with a polyethylene sheet inside the roll-covering with loose ends of the roll-covering sewn with jute twine.

8.2 Marking -

- 8.2.1 The roll shall be stenciled with indelible ink to show Roll Number, Length of the cloth rolled in metres and specification including quality & construction.

8.3 Transportation -

- 8.3.1 JGT can easily be handled and transported. Jute yarns are basically robust, but care needs to be taken to keep it free from moisture and fire. JGT can be shipped in rolls or bales either as a bulk or a break-bulk cargo.

8.4 **Storage –**

- 8.4.1 JGT should be provided with a water-proof cover protection against rains and moisture. Its direct contact with soil during storage should also be avoided.
- 8.4.2 Humidity, temperature variation, lack of air-circulation and abnormal moisture absorption affect the quality of JGT. Therefore, JGT should be protected against damage and exposure in adverse climate conditions during transportation and storage.
- 8.4.3 JGT should not normally be stored for a long period. Protracted storage of JGT may impair its strength to some extent.

8.5 **Site Handling –**

- 8.5.1 JGT rolls should be provided with a protective wrapping. It should be kept above the ground and should be covered with a tarpaulin or thick plastic sheet.
- 8.5.2 As JGT can absorb water upto 5 times their dry weight; their exposure to moisture/water may pose handling problems. Therefore, JGT should be protected against moisture/ water.

9.0 **SELECTION OF VEGETATION :**

- 9.1 In selection of vegetation-type care, must be taken to identify those grasses/plants which are suitable for the location, may be grown easily and have soil binding properties, such as deep and spreading root system with trailing habit. Based on the above criteria, implantation of local varieties of grass/plants should be preferred.
- 9.2 Some important grasses and legumes are listed in Annexure-B with their specific adaptability for stabilisation of moderate slopes, steep slopes, waste land & gullies and suitable for arid & semi-arid zones.

10.0 **CASE STUDY :**

10.1 NAME OF PROJECT : Use Of Geo-Jute For Turfing On The Approach Banks Of Bridge No. 50 On River Gandak For Restoration Of Chhitauni - Bagaha Rail Link Project In Varanasi Division Of North Eastern Railway.

10.2 **GENERAL DETAILS :**

- 10.2.1 Total length of the railway track from km 301/1 to km 309/13 is 8.72 km. Length of approach bank on Valmikinagar - Bagaha station side is 4.5 km from the abutment of bridge and the length of the approach bank on Chhitauni - Paniyahawa station side is 3.5 km. Maximum height of bank is 13.20 m.
- 10.2.2 The bridge is Rail cum Road Bridge which connects Uttar Pradesh and Bihar states. NH-28B passes through the bridge. The earthwork for the rail and road embankments was done with SP-SM type of sandy soil. Slope of the bank is 2.5(H):1(V).
- 10.2.3 The section was opened for traffic in the year 1998-99. The annual GMT of the section is 13. The cumulative GMT of 71.95 has passed through the bridge upto year 2006. Geo-jute was used for turfing for protection of slope of embankment against erosion.

10.3 SALIENT FEATURES OF GEO-JUTE UTILISATION IN THE PROJECT -

10.3.1 **Year Of Laying** Of Geo-Jute : 1993-1994

10.3.2 **Specifications** Of Geo-Jute Used :

- a) Heavy jute-mesh of uniform open plain weave of unbleached single jute yarn averaging 60 Kg per spindle of 14400 metres (approx).
- b) Weight of cloth of average 0.56 kg per metre width with a tolerance of $\pm 5\%$.
- c) Turf consisting of sods not less than 10 cm thick and 23 cm square (as shown in Figure-3), well beaten into the bank and laid so that their edges are in close contact and form a level and compact surface.

10.3.3 **Source Of Supply** Of Geo-Jute : M/s Continental Construction Ltd, Continental House, 28, Nehru place New Delhi.

10.3.4 **Method Of Installation** Of Geo-Jute : As per the specifications of the manufacturer.

10.3.5 **Cost Of Laying And Raw Material** (Geo-Jute) : Total quantity of Geo-jute used was 1,68,197 sqm @ Rs. 50/sqm with total cost of Rs. 84 lacs. The cost per sqm includes cost of Geo-jute and its laying.

10.3.6 **Special Arrangement**, If Any Made For Use Geo-Jute : After laying of Geo-Jute, following arrangements were made at site till grass grew up on slopes :

- a) Slope was regularly watered for growing of the vegetation.
- b) Barricading was provided to stop the trespasses of cattle.

10.3.7 **Present Status** Of Geo-Jute : No remains of geo-jute are available or observed.

10.3.8 **Observed Efficacy Of Geo-Jute Application** : Turfing is well grown up and no slips/cutting/breaches and erosion of embankment has been observed. Slope is safe and well maintained.

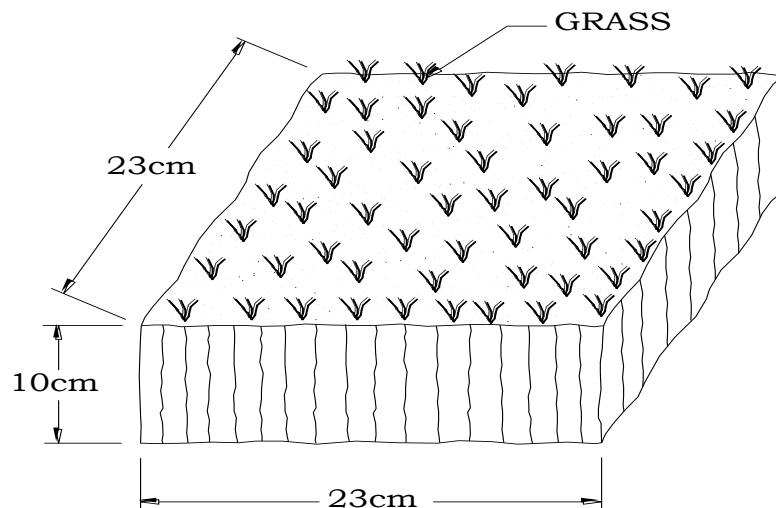


Figure-3 : Turf Sod

10.4 CONCLUSION -

10.4.1 After inspection, it was observed that turfing is well grown-up on slopes of both sides of rail and road embankment. No erosion or slip/breaches of the slope/bank was observed. The slope is well maintained. No formation problems have been reported so far in the bank. It can be concluded that in this project, the **Geo-jute has fulfilled its objectives.**

11.0 CONCLUSIONS AND RECOMMENDATIONS :

- 11.1 Erosion of exposed slopes of bank and cutting, if allowed unchecked may often threaten the integrity and stability of the railway support structures. In all new constructions, including widening etc. a system based on assessed erosion level should be designed & incorporated covering most appropriate erosion protection measures.
- 11.2 As far as possible use of local variety of grass and legumes must be made for vegetation growth.
- 11.3 Long term durability studies covering all aspects related to decay and loss of strength of jute fabrics with respect to time under varied environmental conditions are considered necessary for designing engineered biotechnical systems.

- Note :**
1. Additional technical details and cost etc. may be obtained from M/s Indian Jute Industry Research Association, 17, Taratola Road, Kolkata – 700 088 (website : www.ijira.org).
 2. List of some of the Manufacturers of Jute Geo-textiles has been given in Annexure – C.

12.0 BIBLIOGRAPHY :

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2. 'Erosion - Causes And Control Techniques For Slopes Of Banks And Cuttings' by A. Azeem, A. Ali of Geo-technical Engineering Directorate, RDSO.
3. 'Application Of Jute Geo-textile And Innovative Jute Products' - Jute Manufactures' Development Council, Ministry Of Textiles.
4. 'Manual On Use Of Jute Geo-Textile In Civil Engineering'. - Jute Manufactures' Development Council, Ministry Of Textiles.
5. 'Guidelines For Application Of Jute Geo-Textiles For Rain Water Erosion Control In Road And Railway Embankment And Hill Slopes' by RDSO.
6. 'Guidelines For Earthwork In Railway Projects', RDSO's report no. GE : G-1, July 2003.

13.0 ACKNOWLEDGEMENT :

The Guidelines have been prepared by Shri M.K. Gupta, Director/G.E. under guidance of Shri Alok Kumar, Executive Director/Geo-technical Engineering with the assistance of Shri Sanjay Kumar Awasthi, ARE/GE and Shri Shiv Kumar, SRE/GE.

ANNEXURE - A

TABLE-1
DIFFERENT TYPES OF JUTE GEO-TEXTILES

(Para 5.3)

SL	Characteristics	Type 1	Type 2	Type 3	Test Method (Ref to I.S.)
i	Material	100% Natural	Jute Fiber	-	-
ii	Construction	Plain Weave	-	-	-
iii	Weight at 20 percent MR(in gsm)	730	500	292	2387:1969
iv	Maximum length (metre)	68	68	68	1954:1990
v	Width (cm)	122	122	122	1954 : 1990
vi	Ends/dm	7	6.5	11	1963 : 1981
vii	Picks/dm	7	4.5	12	1963 :1981
viii	Thickness (mm)	7	5	3	7702 : 1975
ix	Aperture size (mm)	12x12	13x20	8x7	2405 (Pt I): 1980 2405 (Pt II) 1980
x	Minimum Breaking Load (N/10 cm)				
	a) Machine Direction (warp-way)	1200	1040	1000	1969 : 1985
	b) Cross Direction (weft-way)	1200	790	1000	1969 : 1985 (See Note-1)
xi	Maximum Elongation At Break (in percent)				
	a) Machine Direction (warp-way)	10	11	12	1969 : 1985 (See Note-1)
	b) Cross Direction (weft-way)	12	15	12	1969 : 1985 (See Note-1)

Notes :

- Determination of minimum breaking load and maximum elongation at break as per IS-1969:1985 cannot be done on Type-1 and Type-2 fabrics.

Indian Jute Industries Research Association (IJIRA) recommends that these tests on Type-1 and Type-2 fabrics be carried out on good brand Fabric Testing Machine on 20 yarns at random (with at least 20 cm grip length and having the rate of traverse of the machine set at 30 cm/min) to assess the yarn characteristics.

- Contract Weight Of Roll In Kg =
$$\frac{\text{Nominal Width (cm)} \times \text{Marked Length (m)} \times \text{Weight (gsm)}}{100} \times \frac{100}{1000}$$
- Correct Net Weight Of Roll In Kg =
$$\text{Net Weight (kg \%)} \times \frac{(100 + \text{Contract Moisture Regain (\%)})}{(100 + \text{Average Moisture Regain (\%)})}$$
- The selected JGT shall satisfy all the requirements mentioned in Table-1.

ANNEXURE – B

Grasses And Plants

For

Stabilisation Of Embankment Slope, Steep Hill Slope And Gullies

(Reference : Para 9.2)

B.1 Some important grasses and legumes are listed below with their specific adaptability **for stabilisation of moderate slopes** :

SL	Name	Characteristics
1	Gynodon Dactylon (Common Doob)	Trailing habit spreading system, suitable for lighter and sandy soils sown with the advent of monsoon.
2	Cenchrus Ciliaris (Anjan)	Adapted to tropical and sub-tropical summer rainfall areas, sown with the advent of monsoon. Suitable to wide range of soils.
3	Dicanthium Annulatum (Marvel Grass)	Adapted to tropical and sub-tropical summer rainfall areas. Suitable to wide range of soils.
4	Eragrostis Cuvula (Weeping Love Grass)	Strongly tufted deep-rooted bunches, excellent for protecting terraces and channels. Suitable for wide range of soil especially sandy loam.
5	Pennisetum Pedicellatum (Dinanath Grass)	Suitable for dry to marshy ground, sandy loam with annual rainfall of about 1000mm.

B.2 Some grasses and legumes **for stabilising steep slopes**, waste land and gullies are given below :

SL	Name	Characteristics
1	Stylosanthis Gracilis	Draught resistant, wide adaptability, suitable for light soils.
2	Stylosanthis Gusineusis	Drought resistant, suitable for light and medium well drained soils.
3	Calopegonium Orthocarpum	Deep-rooted perennial legume, vigorous growth (grows during February-March).
4	Pennisetum Purpureum	Suitable for an elevation of about 1500 m.

B.3 Tree species **suitable for arid and semi-arid zones** are listed below :

- a) Eucalyptus Tereticornis
- b) Acacia Nilotics
- c) Acacia Tortiles
- d) Chlorodendrum Enerme

Annexure – C

List Of Manufacturers Of Jute Geo-textiles

SL	Contacts Of Manufacturers	SL	Contacts Of Manufacturers
1.	Gloster Jute Mills Ltd. 21, Strand Road Kolkata – 700 001 Tel : 220-9601 (5 Lines) Fax : 221-4222	2.	Hastings Jute Mill (A Div. Of Murlidhar Ratanlal Exports Ltd.) 15B, Hemanta Basu Sarani Kolkata - 700001 Tel : 248-2091/8581, 248-9842 Fax : 248-4101
3.	The Ganges Mfg. Co. Ltd. Chatterjee International Centre 23 A, Jawahar Lal Nehru Road 6 th floor, Flat No. A-1 Kolkata - 700071 Tel : 226-0881 (7 Lines) Fax : 226-8281	4.	Naffar Chandra Jute Mills Ltd. 2, Cooper Lane Kolkata - 700001 Tel : 248-9868 Fax : 225-0221
5.	The Naihati Jute Mills Co. Ltd. 7, Hare Street, Kolkata - 700001 Tel : 248-9904/9918 Fax : 248-4062	6.	New Central Jute Mills Co. Ltd. 18A, Brabourne Road Kolkata - 700001 Tel : 225-5359 Fax : 225-2208
7.	Howrah Jute Mills 135, Foreshore Road (Upper) Howrah –711102 Tel : 6602302/2748 and 6601446/4159 Fax : 6601-447/5258	8.	ANGLO-INDIA TUTE MILLS CO. LTD. 18, Netaji Subhas Road, Kolkata –700001 Ph : (9133) 22305811, 2258190, 813735/4214 (Factory) Fax : (9133) 263754
9.	AMBICA MULTIFIBRES LTD. (Unit: Bally Mills) Kankaria Estate (7 th Floor) 6, Little Russel Street, Kolkata - 700071 Ph : (9133) 2479921/ 2479720/2472286/2402683 Fax : (9133)2403159 E-Mail : amltd@giascl01.vsnl.net.in	10.	THE CHAMPDANY INDUSTRIES LTD. (Wellington Jute Mills) G.P.O. Box 543, 25, Princep Street Kolkata - 700072
11.	KANKNARRAH CO. LTD. 29/1, Stphen House (2 nd Floor), 4, B.B.D. Bag (East), Kolkata-700001 Ph : (9133)2200477/1397/98/ 2483914, 822016/18 (Factory) Fax : (9133)2489063 TLX : 4994 KCL IN	12.	LUDLOW JUTE MILLS (Prop.: Aekta Limited) 71, Park Street, Kolkata - 700016 Ph : (9133) 2466991/6992/6993, 6613267/ 3366/67 (Factory) Fax : (9133)2466990,2499466 TLX : 4484 KCI IN
13.	TEPCON INTERNATIONAL (INDIA) PVT. LTD. (Unit: Shree Hanuman Jute Mills) 29/1, Stephen House, 2 nd Floor 4B.B.D.Bag East, Kolkata-700001	14.	ADITYA TRANSLINK PRIVATE LIMITED 9 India Exchange Place, 3 rd Floor Kolkata- 700001 Tel : (9133) 2205897 Fax : 2203185