



## Chapter 7

### MUCK DISPOSAL PLAN

#### 7.1 Introduction

The Bursar Project proposed on Marusudar river envisages construction of 265m high concrete gravity dam near village Pakal, nearly 25km downstream of the confluence of Warwan and Rin rivers. The other components of the project include one headrace tunnel of 6750m length & 8.5m diameter, 129m high surge shaft of 19m, two pressure shafts each about 1027m long (both inclined and horizontal portions), four penstocks each about 130m long and two surface powerhouses one dam toe power house and other surface power house near Lopara about 7Km downstream of the dam. Besides this, for isolating the river stretch for the execution of the dam, one diversion tunnel of 1157m length along the right bank and two coffer dams are proposed. Also four adits of about 1950m aggregate length and 845m upstream Surge Gallery (7.0m diameter, horse shoe shaped) are proposed for the project. The aforementioned constructional activities would lead to generation of muck. In addition to this, the muck would also be generated during the execution and upgradation of the internal access roads.

#### 7.2 Total quantity of muck to be generated

The total quantity/volume of material that would be generated consequent to the construction of various project components of the proposed Bursar Project is estimated to be 8,798,150 m<sup>3</sup>, the details of which are given in Table 7.1.

As mentioned above, the swell factor has not been taken into consideration while working out the total quantity of muck generation i.e. 8,798,150 m<sup>3</sup>. After considering a swell factor of 60% for rock excavation and 20% for common excavation and adding the percentage accordingly, the total quantity of muck works out to be 12,050,240m<sup>3</sup>, for details refer Table 7.2





**Table 7.1 Quantity of muck to be generated from various components of Bursar Project**

S. No.	Project Components	Nature of Excavation	Common Excavation (m <sup>3</sup> )	Rock Excavation (m <sup>3</sup> )	Total Quantity* (m <sup>3</sup> )
1	Diversion Tunnel	Surface and Underground	12000	226250	238250
2	Dam and Cofferdams	Surface	3600000	1815000	5415000
3	Stilling Basin including retaining and cellular wall	Surface	250000	110000	360000
4	Pressure Shaft	Underground	-	18200	18200
5	Dam Toe Power house	Surface	55000	305000	360000
6	Intake Structure at Lopara	Underground	8000	40000	48000
7	Headrace Tunnel	Underground	10800	672200	683000
8	Headrace Tunnel Gate Shaft	Underground	19000	59000	78000
9	Surge Shaft	Underground	5400	114200	119600
10	Pressure Shaft	Underground	10800	202300	213100
11	Powerhouse at Lopara	Surface	1040000	155000	1195000
12	Pothed Yard	Surface	56000	14000	70000
	<b>Total (1 to 12)</b>		<b>5067000</b>	<b>3731150</b>	<b>8798150</b>

\*Note: In the excavated muck figures, the swell factor has not been taken into account





**Table 7.2 Quantity of muck to be generated from Bursar Project along with muck swell factor**

S. No	Project Components	Common Excavation (m <sup>3</sup> )	Rock Excavation (m <sup>3</sup> )	Total Quantity* (m <sup>3</sup> )
1	Diversion Tunnel	14400	362000	376400
2	Dam and Coffor Dams	4320000	2904000	7224000
3	Stilling Basin including retaining and cellular wall	300000	176000	476000
4	Pressure Shaft	-	29120	29120
5	Dam Toe Power house	66000	488000	554000
6	Intake Structure at Lopara	9600	64000	73600
7	Headrace Tunnel	12960	1075520	1088480
8	Headrace Tunnel Gate Shaft	22800	94400	117200
9	Surge Shaft	6480	182720	189200
10	Pressure Shaft	12960	323680	336640
11	Powerhouse at Lopara	1248000	248000	1496000
12	Pothed Yard	67200	22400	89600
	<b>Total (1 to 12)</b>	<b>6080400</b>	<b>5969840</b>	<b>12050240</b>

Out of 87,98,150m<sup>3</sup> quantity of muck generated, the Project authority envisages utilization of 31,00,000m<sup>3</sup> of generated muck for the execution of various Project components. Thus, the balance unused quantity of muck requiring proper disposal and management works out to be 5698150m<sup>3</sup> which is around 64.76% of the total muck to be generated. After adding swell factor to the quantities of balance muck 56,98,150m<sup>3</sup> at percentages 60% for rock and 20% for common excavation, the total muck which requires disposal and management works out to the order of 78,03,502 m<sup>3</sup>, of which common excavation would be 39,37,878 m<sup>3</sup> and rock excavation would be 38,65,624 m<sup>3</sup>.





### 7.3 Management of the muck generated

The dumping of rock spoil can potentially be a cause for environmental problems and land degradation. It would cause landslides and be an aesthetical damage to the natural landscape. Out of 78,03,502 m<sup>3</sup> of material, a large quantity of muck would be utilized in various miscellaneous activities like road construction/ improvement of local roads, retaining walls, breast walls, Crate filling, CAT Plan activities, building constructions, landscaping activities, terrain levelling, establishing of compensatory agricultural terraces, sports fields, parking lots, etc. In addition some quantity would be stacked along the roads, which would either be widened or constructed afresh. The efforts will be made to relocate and rehabilitate the unused material within short distances from sites of its generation.

Some of the muck can be utilized for back filling as also for filling the wire crates for providing protection to slopes along the river banks both upstream and downstream of the proposed dam. All efforts should be made to find ways to use the materials in such a manner that negative impacts on the environment are avoided. Local people living in the proposed project area shall have to be encouraged to lift the unusable muck for their utility for land improvement and upgradation of their local and private infrastructure, etc. As such, the need to construct massive spoil tips would not arise.

Considering the good geological conditions of the HRT, DT, Dam area, etc., it is expected that much part of the muck generated would be of high quality which can also be used in the construction activities of Project. Efforts have to be made during the execution of the project to utilize the maximum quantity of the high quality muck for the aggregate production and minimize the rock quarrying activity. This would avoid the unnecessary quarry excavations proposed at long distances in upstream areas. This would also reduce the overall cost required for the measures to be taken for relocation and rehabilitation of the estimated muck generated.

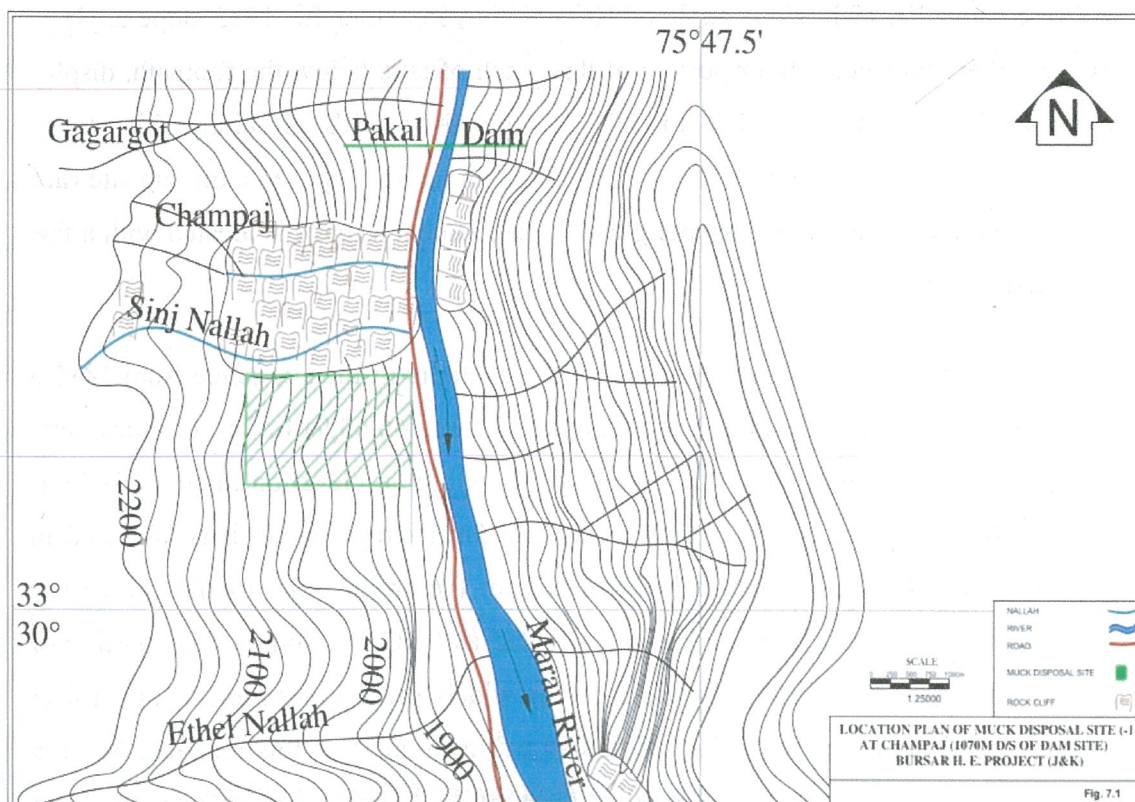


## 7.4 Muck dumping sites

In order to prevent depletion of the reservoir capacity, no dumping site has been proposed in the upstream of the dam in close vicinity of the reservoir. To avoid construction of massive spoil tip at single location, three muck dumping sites have been identified. The salient features of the proposed muck dumping sites are given in Table 7.3 and discussed in the paras that follow.

**Table 7.3 Salient features of the proposed muck dumping sites**

Site No.	Proposed muck dumping site	Approximate area available for dumping (ha)	Quantity to be dumped (m <sup>3</sup> )
Site-1	Champaj (d/s of dam)	7 ha	7,28,327
Site-2	Dumbai (between dam & Power House)	41 ha	46,65,914
Site-3	Lopara (near Power house)	17 ha	24,09,261



**Fig 7.1 Location plan of Muck Disposal Site 1 near Champaj d/s of Dam site**





**7.4.1. Site-1 (Champaj):** This site is proposed about 1070m downstream of dam axis along right bank of the Marusudar River (**Fig. 7.1**). The site is located near Champaj, which falls between Gagargot and Ethel Rar 60m away from the river line in uphill direction, spread over 7 ha of land (having approximate dimensions of 300m x 235 m) where contour elevation range from 1900m to 2080m displaying slope angles varying from  $25^{\circ}$  to  $30^{\circ}$ . In view of limited area and given slope angles, the site does not offer huge potential to dump the muck. Hence, if required, only 7,28,327  $m^3$  of the muck shall be dumped here. For retention of this small spoil tip, erection of sausage walls has been provisioned in the estimates.

**7.4.2. Site-2 (Dumbai Village):** This site is proposed 2.5 Km downstream of the dam-axis along right bank of the Marusudar River, near village Dumbai, and stretch between Dumbai Nallah and Helipad (**Fig. 7.2**). The site is elongated and the river line, whose elevation points range from 1835m to 1860m, is about 1700m long along this stretch. The average width of the area is 240m. In general the terrain display wider contours along the right river course of Marusudar near this site however, at some locations above contour EL 1905 slope angle of  $10^{\circ}$  and above contour EL 1915 slope angle of  $16^{\circ}$  to  $20^{\circ}$  are noticed. Minor portion of this patch of land below the footpath, display slope angles ranging from  $23^{\circ}$  to  $38^{\circ}$ . A footpath extends all along this stretch connecting Lopara and Pakal Villages. This footpath in the proposed dumping site runs along 1850m to 1865m contours along which the Dumbai Village is located with a few scattered houses.

The site is spread over 41 ha of land where the contours of the site range from 1835m to 1895m and rise up to 1920m. It is envisaged to dump 46,65,914  $m^3$  of muck here. It is pertinent to mention here that near this site within an elevation range of 1835m-1895m, over a surface area of 59782 sq. m and 5m average depth, it is proposed to borrow a quantity of 25,00,000  $m^3$  of material for the project construction which has been named as Dumbai Shoal Deposit designated as BRG-10. Some of the portion of the borrow area is flatter and undulating having widely spaced contours. As the project authority envisages the removal of 25,00,000  $m^3$  material from this location, hence a crater / depression like feature would be created and in this feature/depression, an



about 1070m downstream of dam axis (Fig. 7.1). The site is located near Champaj, 50m away from the river line in uphill. Approximate dimensions of 300m x 235 m) displaying slope angles varying between slope angles, the site does not offer required, only 7,28,327 m<sup>3</sup> of the muck disposal tip, erection of sausage walls has

proposed 2.5 Km downstream of the dam-village Dumbai, and stretch between is elongated and the river line, whose about 1700m long along this stretch. The terrain display wider contours at this site however, at some locations above contour EL 1915 slope angle of of land below the footpath, display path extends all along this stretch in the proposed dumping site runs Dumbai Village is located with a few

contours of the site range from 1835m to 1915m. To dump 46,65,914m<sup>3</sup> m<sup>3</sup> of muck here. In an elevation range of 1835m-1915m, on average depth, it is proposed to construct the project construction which has BRG-10. Some of the portion of the site spaced contours. As the project material from this location, hence a depression in this feature/depression, an



equivalent quantity of muck shall be backfilled and accommodated matching the pre-existing topography. Thus only for 21,65,914m<sup>3</sup> volume of muck, the project authority shall be requiring sausage walls for retention of the spoil tip.

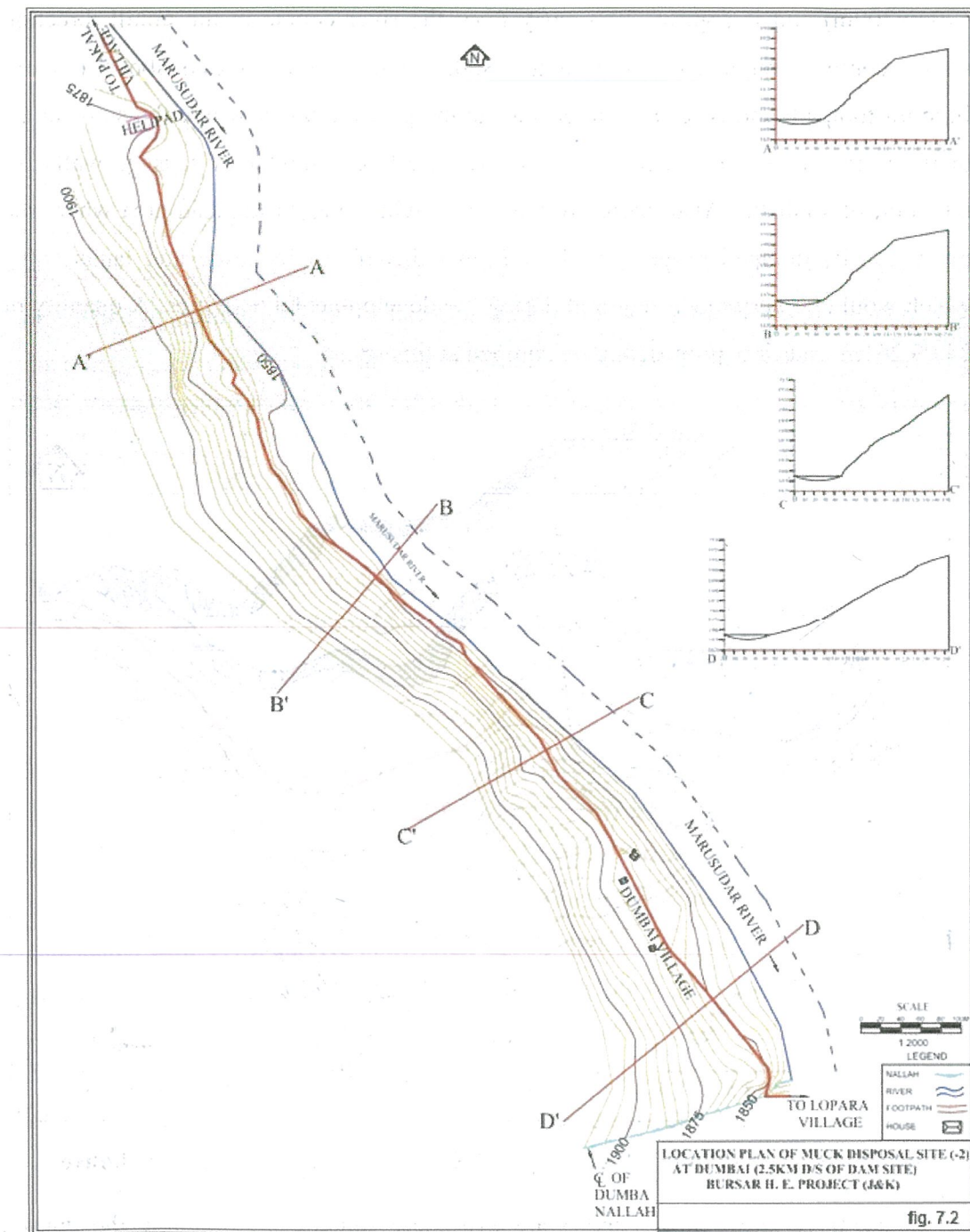
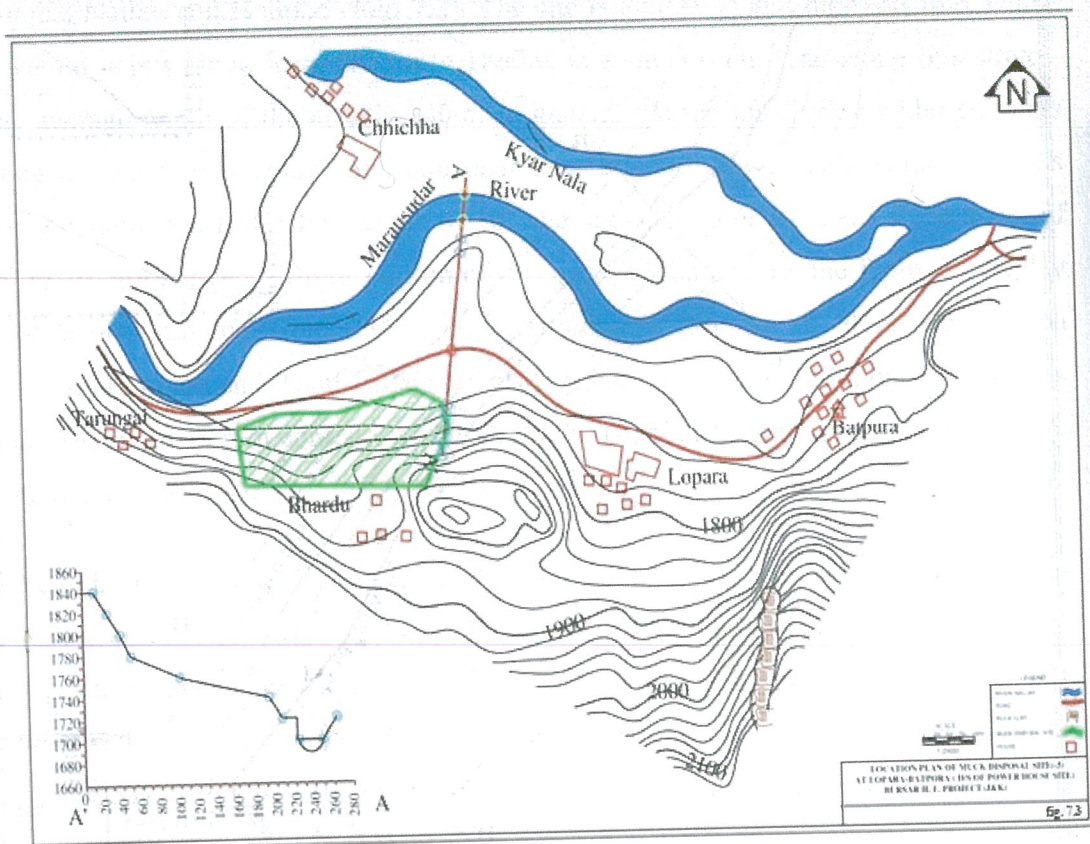


Fig 7.2 Location Plan of Muck Disposal Site 2 at Dumbai (2.5 km d/s of Dam Site)





**7.4.3 Site-3 (Lopara-near Power House area):** This site is proposed along the right bank of Marusudar river downstream of Lopara Power house near villages Lopara-Bhatpora. The site located has been designated as Lopara dumping site, which forms an elongated patch of land spread over an area of 17ha (having approximate dimensions 570mx300m) and is approx. 70m away from the river course in the uphill direction whose contours range from 1740m to 1860m. The area is located above Lopara-Batpora footpath and is ideally suited for dumping of the muck where the slope angle of the terrain is about  $5^{\circ}$  hence does not require huge number of sausage walls for retention of spoil tip. Also, there are many low lying sites in the said area where the muck can be dumped properly with additional benefit of levelling and landscaping which would be very much required during the developmental activities. A quantity of  $24,09,261\text{m}^3$  muck is proposed to be dumped at this site.



**Fig 7.3 Location Plan of Muck Disposal Site 3 at Lopara near Power house**

Of all the three sites, sites-2 and 3 are extremely suitable for dumping the unused excavated muck. In case an inconvenience is felt with regard to developing Champaj as





dumping site-1, it is recommended to dump the proposed muck of the order of  $7,28,327\text{m}^3$  of site-1 at site-2, where adequate space shall remain available.

### 7.5. Stabilization of dumped muck

The unused quantity of muck has been worked out to be  $78,03,502\text{m}^3$  of the total muck to be generated or extracted. This muck would be piled at a proper angle of repose at the proposed identified muck disposal sites. For the stabilization of the dumped muck, various engineering measures recommended include construction of sausage walls, crate works, gabions to be constructed in steps; 2-3 tier constructions wherever required in order to give an angle of repose to the slopes that shall be developed by dumping of the muck. This initial wall will separate the river line from the dumping sites and prevent the dumped muck to find a way to the river course. This wall be designed as a strong toe wall. Other measures contemplated are retaining walls and breast walls etc. wherever needed and this should be followed by biological measures.

Biotechnological approach is also currently in vogue as a restoration measure for the consolidation of unused dumped material to stabilize the same with vegetation by employing traditional method of afforestation supplemented by modern biotechnological approach. The spoil tip area would be treated through turfing and afforestation with suitable plant species, using biotechnology, i.e. biofertilizer (VAM- Vascular Arbuscular Mycorrhiza and nitrogen fixing bacteria). Under this combined approach, the fungi form partnership with plant roots. The fungus grows on and extends the reach of plant roots for water and nutritional requirements. The seedlings inoculated with VAM survive better after transplanting and grow faster in nutrient poor soils. The "re-vegetation of spoil tips through this integrated biotechnological approach" is also suggested..

The Project authorities may also adopt traditional biological measures as a means of stabilization. Plantation of indigenous species of grasses, shrubs and trees should be preferred. The indigenous tree species suggested are mainly cedar and blue pine for higher reaches and the lower reaches of which should be afforested with *Acer*





*pentapomicum, Aesculus indica, Cedrus deodara, Celtis australis, Ilex dipyrena, Pinus gerardiana, Pinus wallichiana and Rhus succedanea.* Besides, some bushy medicinal plants can also be experimented for slope stabilization. Plants required for revegetating the dumping areas can be obtained from nursery to be developed for bio-conservation and as such provision has been kept for the purchase of plant saplings for revegetation under Muck Disposal programme.

### 7.6 Cost estimates

Since the project envisages dumping of considerable quantity of muck, its disposal and rehabilitation has also to be managed and will involve considerable expenditure. The total financial estimate on account of the relocation and rehabilitation of excavated material includes costs mostly on account of engineering and biological measures which will be around **Rs. 356.00 Lakhs** (Table 7.4).

**Table 7.4 Financial outlay for relocation and rehabilitation measures of for muck disposal sites of Bursar Project**

Item of Work	Unit	Qty	Rate (Rs)	Amount in Lakh (Rs)
<b>A. Engineering Measures</b>				
i)Construction of Sausage /Retaining/ Breast walls (W=2m; H=1.5m) to be constructed in steps; 2-3 tier constructions wherever required	RM	7600	1800	137.00
ii)Crate Wire Walls /gabbions (W=2m; H=1.5m) to be constructed in steps; 2-3 tier constructions wherever required	RM	1000	1100	11.00
<b>Sub-total (A)</b>				<b>148.00</b>
<b>B. Biological Measures</b>				
i) Revegetation of dumping area using traditional biological measures	ha	15	20000	3.00
ii)Maintenance of plantation (Rs 1.00 Lakh/year)			L.S.	5.00
iii)Stabilization and Revegetation of dumped material using VAM technology			L.S.	200.00
<b>Sub-total (B)</b>				<b>208.00</b>
<b>Total (A+B)</b>				<b>356.00</b>