



CHAPTER – 6

MUCK DISPOSAL PLAN



6 MUCK DISPOSAL PLAN

6.1 GENERAL

For construction of different components of the project, substantial surface and underground excavation in over burden and rock for Barrage intake structure, intake tunnel, desilting chambers, silt flushing tunnel, headrace tunnel, surge shaft, pressure shaft, powerhouse and tailrace tunnel would be generated. The excavation shall result in large quantity of excavated material i.e. muck which have to be evacuated, disposed off and roller compacted or laid on mild slopes pari-passu with the excavation work to such designated areas where the muck piles do not substantially interfere with either environment / ecology or the river flow regime and do not cause turbidity impairing the quality of water. The disposal of muck has to be scientifically planned keeping in view the economic aspects necessitating nearness to the muck generating component of work, which understandably reduce the travel time of dumpers, less interference to surface flow and ground water aquifer and disposition of habitation.

Based on the quantities of surface and underground excavation including 10% over break a muck management plan, therefore, has been formulated to manage the disposal of muck and restore such areas from further degradation of the environment. During construction of the project, huge quantities of excavation will be carried out from the underground and surface components and shall be dumped in designated areas to provide stable slopes. The quantity of muck to be disposed has been worked out on the basis of 63% swell factor for rock and 83% for overburden.

6.2 QUANTITY OF MUCK GENERATED AND ITS CONSUMPTIVE USE

During construction of the various components of the project, muck is generated both from soil or slide material and from rock excavation. Total quantity of muck / debris, generated due to the project, shall be 4,24,219 cum which shall amount to 5,97,375 cum with swell factor. Out of the total muck generated, 3,06,369 cum shall be utilized on project work leaving 2,91,007 cum to be dumped with 20% compaction at designated sites. It is proposed to utilize about 51.29% of the excavated material as construction material for back fill, shotcreting and for construction of various project components. The balance 48.71% shall have to be disposed off away from sites to make available the site clear. The muck shall be properly roller compacted and dumped on slopes and treated to mix and match with the surrounding environment with least change in landscape.


Table 6-1: Abstract of Muck Generated and its Disposal

Project Component	Quantity of muck/debris generated (cum)		Quantity of muck due to swell factor (cum)		Estimated quantity of muck/debris proposed to be utilized (cum)		Balance quantity of muck/debris (cum)		Effective Muck to be dumped (cum) (with 20% compaction)	Name of the dumping site	Capacity of the dumping site (cum)
	Rock	Soil	Rock (63%)	Soil (83%)	Rock	Soil	Rock	Soil			
Cofferdam		47,533	0	57,269		65,464	0	-8195*		Muck Dump Yard 1	1,89,785
Barrage & Desilting Site	30,240	73,427	48,000	88,466	1,67,693		-119693*	88466			
Intake		77,710	0	93,626	8,107		-8107*	93626			
Feeder Tunnel	1,119		1,776		482		1295	0			
Head race Tunnel	80,348		1,27,536		28,137		99399	0			
Adits	23,467		37,249		4,802		32447	0	2,32,805	Muck Dump Yard 2	1,23,856
Surge Shaft	3,637		5,773		2,222		3551	0			
Pressure shaft	5,918		9,394		4,860		4533	0			
Power House & Transformer Cavern	72,703		1,15,402		16,431		98971	0			
Tail Race Tunnel	8,118		12,886		8,170		4715	0			
TOTAL	2,25,549	1,98,669	3,58,015	2,39,361	2,40,905	65,464	1,17,110	1,73,897			

*Balance quantities of muck will be utilised from muck generated at other project components.



6.3 SELECTION OF MUCK DISPOSAL SITE

The selection of muck disposal sites was carried out considering the quantity of the muck, landscape, cost effectiveness, nearness to source of generation, absence of ground and surface water, relief and scope for afforestation works. All the dumping locations shall be well supported at base and at higher elevation by suitable retaining structures. Subsequently all the spoil tips (muck disposal sites) will be developed by taking up plantation through bio-technological methods to generate a thick forest canopy over them. Two (2) muck dumping sites have been identified matching the criteria. The details of dumping sites along with their total capacity and amount of muck to be disposed are enumerated in **Table 6-2**.

Table 6-2: Details of Muck Disposal Sites

Sl. No.	Name of Dumping Site	Location of Dumping Site	Area in Ha	Capacity in cum	Vol. of muck to be dumped
1.	Muck Disposal Area 1	Approx. 3603 m downstream from Barrage axis, Right Bank	3.14	1,89,785	2,32,805
2.	Muck Disposal Area 2	Approx. 2240 m downstream from Barrage axis, Right Bank	1.81	1,23,856	
Total			4.95	3,13,641	

The layout plans of Muck Disposal Sites are shown in **Figure 6-1** and **Figure 6-2**.

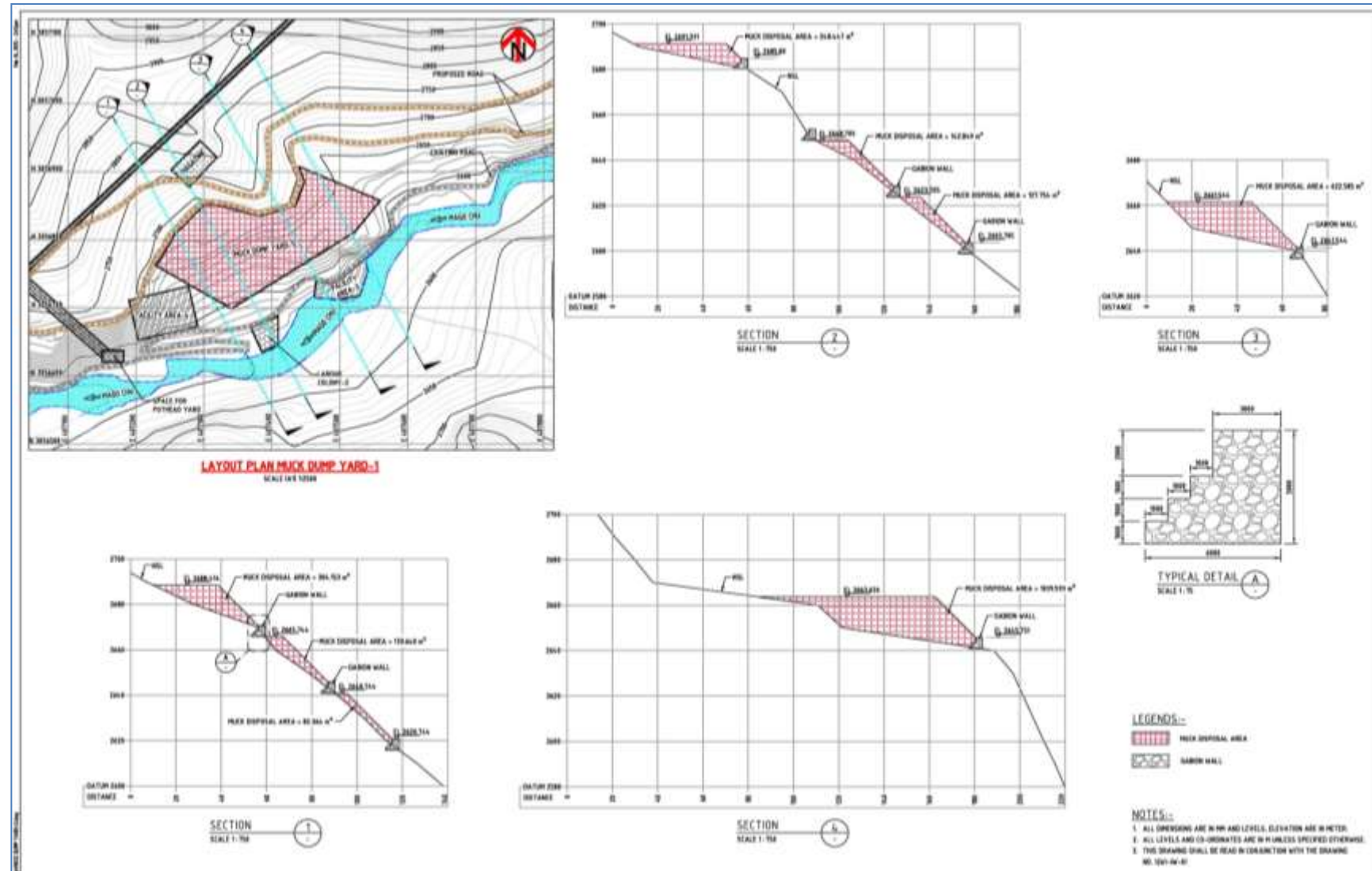


Figure 6-1: Layout Plan of Muck Disposal Site -1

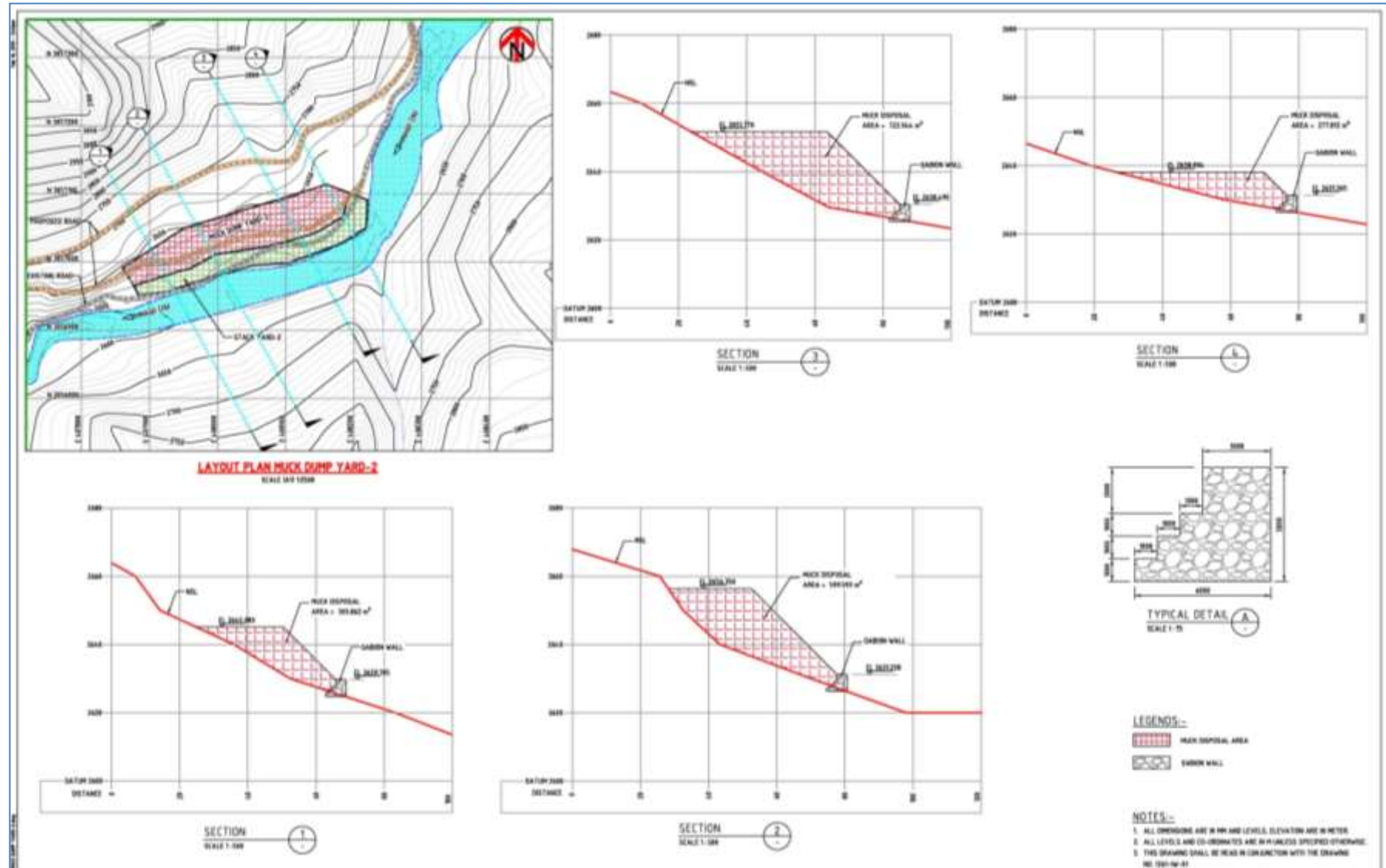


Figure 6-2: Layout Plan of Muck Disposal Site -2



6.4 DESCRIPTION ON MUCK DISPOSAL SITES

6.4.1 MUCK DISPOSAL SITE D-1

The proposed muck disposal site 1 is located about 3603 m downstream of barrage axis on Right bank of Mago Chu, just upstream of TRT discharge point. The site is located approx. 48 m away from the river bank at HFL. The plan area of the site is 3.14 ha.

6.4.2 MUCK DISPOSAL SITE D-2

The proposed muck disposal site 2 is located about 2240 m downstream of barrage axis on right bank of Mago Chu, near. The site is located more than 33 m away from the river bank at HFL. The plan area of the site is 1.81 ha.

In total 2,32,805 cum shall be dumped in Muck Disposal Site 1 and 2 and properly roller compacted. After the capacity of any disposal area is exhausted, the top surface would be levelled, graded and provided a gradual slope for efficient drainage. The surface so available would be put to greenery development.

6.5 IMPLEMENTATION OF ENGINEERING MEASURES AT MUCK DISPOSAL SITE

It has been observed that after disposal of muck, it creates problem as it is susceptible to scattering unless the muck disposal yards are supported with engineering measures such as gabions. All the dumping sites need proper handling to avoid spilling of muck into the river water while dumping and in the post dumping stages. All the muck disposal sites have to be developed from the ground level either by providing stone masonry or by gabion structure. The costing of engineering measures has been worked out based on gabion structure. In all the muck dump sites, the muck brought in dumpers shall be dumped and manually spread behind the crates and roller compacted in such a manner that rock mass is properly stacked behind the crates with minimum of voids.

6.6 IMPLEMENTATION OF BIOLOGICAL MEASURES AT MUCK DISPOSAL SITE

Biological measures, however, require special efforts as the disposed muck will be devoid of nutrients and soil contents to support vegetation. The selection of soil for spreading over such an area would require nutrient profiling of soil for different base elements. Suitable mixture of nutrients would be done before placing the soil on the top surface of muck disposal areas to have administered growth of forest canopy.

6.6.1 PLANTATION TECHNIQUE

In view of the peculiar site conditions, particularly the soil conditions, the planting technique for all the categories of the plants has to be very site specific and suited to the stress conditions as anticipated and discussed above. The planting substrates would need to be considerably improved to support the plants in their initial stages of



establishment. The moisture retention capability, availability of nutrients and soil aeration, permeability and porosity would require intervention and assistance.

Multi-level and multipurpose plantations are proposed to be raised on the muck dumping sites as also in road side strips using grasses, shrubs and bushes in the under story and trees in the upper story. Nursery raised grass slips, seedlings of shrubs & bushes and tree species would be planted in the area combined with grass sowing in patches. In addition, cuttings of bushes and shrubs can also be planted to supplement the nursery raised stock but this would substitute requirement of raising the nursery of these species. Intimate mixture of species would be avoided right at the planning stage and would be strictly followed during planting. Grasses would be mixed by groups in rows, shrubs and bushes by group again in rows.

Grass slip planting and grass seed sowing would be done in strips at 0.10 m x 0.10 m spacing in the prepared staggered patches of 1 m x 0.5 m with a depth of 0.30 m. Soil mixture would be used while filling the patches.

Shrubs and bushes would be planted in elongated strips of 1.5 m x 0.5 m with a depth of 0.45m. Soil mixture would be used while filling the patches. Each patch would have two rows of planting.

Planting of trees would be done in pits of 0.60 m x 0.60 m x 0.60 m size. Soil mixture would be used while filling the pits. Balance dug up soil/ muck will be stacked on downhill side of the pit for trapping the rain water and allowing it to percolate in the pit.

It is proposed to use soil mixture in the pits & patches consisting of soil imported from nearby areas mixed with compost or vermin-compost manually. The ratio for the mix would be 5 parts: Compost/manure 2 parts: Sand 2 part: and humus or vermin-compost 1 part. This will make nutrients available for the plants in the preliminary stages and also help increase soil aeration, porosity & permeability and improved moisture available for the plants.

The stabilization sites from the time of execution of biological measures would be protected with barbed wire fencing on 2m high RCC posts and provided with inspection paths. Since the muck dumping sites are being provided with the wire crate (gabion) wall on the valley side (towards river) which is not negotiable by animals and human beings, fencing would not be required along the entire perimeter. Hence, it would be done on the vulnerable sections i.e. towards the hillside only.

The plantations under biological measures would be maintained for a period of 3 years by watering the plantation during dry seasons, mortality replacement and repair of fencing & inspection paths within the area. The task of irrigation would be performed by the watchmen provided in the cost estimate.

The proposed costs include raising plants, grass seedlings and also for mortality replacement.



Although the sites would be either levelled or finished in a grade, yet due to rain and sliding etc., they tend to develop rills and gulley. As such, while carrying out plantation; suitable soil conservation measures would also be taken.

6.6.2 SPECIES FOR PLANTATION

Afforestation with suitable plant species of high ecological and economic value and adaptable to local conditions will be undertaken in accordance with canopy cover requirement. Some plant species have been suggested in the **Table 6-3**. The selection of plant species, propagation and cultivation technique would be done in co-ordination with the institutes like State Forest Research Institute, Itanagar; Rajiv Gandhi University, Itanagar and North-Eastern Regional Institute of Science and Technology, Nirjuli.

Table 6-3: Suggested Species for Plantation

Sl. No.	Name of species	Family
1.	<i>Abies densa</i>	Pinaceae
2.	<i>Achyranthes aspera</i>	Amaranthaceae
3.	<i>Alangium alpinum</i>	Alangianaceae
4.	<i>Alnus nepalensis</i>	Betulaceae
5.	<i>Aristolochia griffithii</i>	Aristolochiaceae
6.	<i>Berberis aristata</i>	Berberidaceae
7.	<i>Betula alnoides</i>	Betulaceae
8.	<i>Daphnae papyracea</i>	Thymelaeaceae
9.	<i>Lyonia ovalifolia</i>	Ericaceae
10.	<i>Pinus roxburghi</i>	Pinaceae
11.	<i>Pinus wallichiana</i>	Pinaceae
12.	<i>Populus sp.</i>	Salicaceae
13.	<i>Rhododendron campanulatum</i>	Ericaceae
14.	<i>Rhododendron cinnabarium</i>	Ericaceae
15.	<i>Salix sp.</i>	Salicaceae
16.	<i>Tsuga dumosa</i>	Pinaceae
17.	<i>Zanthoxylum armatum</i>	Rutaceae

6.7 BUDGET FOR MUCK DISPOSAL PLAN

An estimation has been made for engineering measures of muck disposal plan as **Rs. 48.05 Lakhs** whereas biological measures as **Rs. 32.21 Lakhs**. The cost break-up of engineering and biological measures are detailed in **Table 6-4 and 6-5**.

Table 6-4: Cost Estimate for Engineering Measures

S. No.	Name of the work	Quantity	Unit	Rate	Amount (Rs.Lakhs)
A. Muck Disposal Site – 1					
1	Gabion Wall construction	315	m	5750	18.11



S. No.	Name of the work	Quantity	Unit	Rate	Amount (Rs.Lakhs)
2	Filling of earth /Top Soil	18000	sq. m	20	3.6
3	Levelling	3.14	ha	2000	0.03
Sub-Total					21.74
Contingencies @ 10%					2.17
Total (A)					23.92
B. Muck Disposal Site – 2					
1	Gabion Wall construction	344	m	5750	19.78
2	Filling of earth /Top Soil	10600	sq. m	20	2.12
3	Levelling	1.81	ha	2000	0.04
Sub-Total					21.94
Maintenance Cost @10%					2.19
Total (B)					24.13
Grand Total T1 = (A + B)					48.05

Table 6-5: Cost Estimate for Biological Measures

Sl. No.	Name of the work	Unit	Qty	Rate	Amount (Rs. Lakhs)
Muck Disposal Site – 1					
1	Raising of Plantation (Creation Cost)				
	Survey/ demarcation/plantation planning/site clearance	Days	49	150	0.074
	Pit Digging /Soil working/ Manuring & Planting	Days	90	150	0.135
	Seedling cost	Number	3330	8.25	0.275
					0.483
2	Maintenance of Plantation Cost for 3 years				
	Seedling casualty replacement (2nd year 15% and 3rd Year 10%)	Number	833	8.25	0.069
	Tending Operation (1st Year Operation)				
	3 weeding (1 DLS per weeding for 100 plants)	Days	100	150	0.150
	Tending Operation (2nd Year Operation)				
	2 weeding (1 DLS per weeding for 100 plants)	Days	67	150	0.101
	Tending Operation (3rd Year Operation)				
	1 weeding (1 DLS per weeding for 100 plants)	Days	33	150	0.050
					0.369
3	Fencing Cost				
	i) Erection of barbed wire fencing (1.2 m) cost	Meter	847	227.85	1.930
	ii) Maintenance of barbed wire fencing @5 % of erection cost for 2nd and 3rd year				0.193
					2.123



Sl. No.	Name of the work	Unit	Qty	Rate	Amount (Rs. Lakhs)
4	Grass carpeting cost for ha	Ha.	3.14	30000	0.942
	Total (1+2+3+4)				3.917
	Contingency@ 5 %				0.196
	Grand Total				4.113
Muck Disposal Site – 2					
1	Raising of Plantation (Creation Cost)				
	Survey/ demarcation/plantation planning/site clearance	Days	30	150	0.045
	Pit Digging /Soil working/ Manuring & Planting	Days	54	150	0.081
	Seedling cost	Number	2009	8.25	0.166
					0.292
2	Maintenance of Plantation Cost for 3 years				
	Seedling casualty replacement (2nd year 15% and 3rd Year 10%)	Number	502	8.25	0.041
	Tending Operation (1st Year Operation)				
	3 weeding (1 DLS per weeding for 100 plants)	Days	60	150	0.090
	Tending Operation (2nd Year Operation)				
	2 weeding (1 DLS per weeding for 100 plants)	Days	40	150	0.060
	Tending Operation (3rd Year Operation)				
	1 weeding (1 DLS per weeding for 100 plants)	Days	20	150	0.030
					0.221
3	Fencing Cost				
	i) Erection of barbed wire fencing (1.2 m)	Meter	755	227.85	1.720
	ii) Maintenance of barbed wire fencing @5 % of erection cost for 2nd and 3rd year				0.172
					1.892
4	Grass carpeting cost for ha	Ha.	1.81	30000	0.543
	Total (1+2+3+4)				2.948
	Contingency@ 5 %				0.147
	Grand Total				3.096
Provision for maintenance					
1	Wages for 2 persons for 5 years	Month	15000		18.00
2	Consumables and Tools cost				5.00
3	Miscellaneous expenditure				2.00
	Total (1+2+3)				25.00
Grand Total Cost For Biological Treatment					32.21

Thus, total budget for muck disposal plan has been estimated as **Rs. 80.26 Lakhs**.