



## CHAPTER – 6

### MUCK DISPOSAL PLAN

AUSTRALIA | ASIA | MIDDLE EAST | AFRICA | PACIFIC

  
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## 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 required. 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 pecuniary aspects necessitating nearness to the muck generating component of work, which understandably reduce the travel time of dumpers, causeless 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

Total quantity of muck / debris, generated due to the project, shall be 488000 cum which shall amount to 695420 cum with swell factor. Out of the total muck generated 322,180 cum shall be utilised on project work leaving 373240 cum to be dumped with 20% compaction at designated sites. It is proposed to utilize about 46.3% of the excavated material as construction material for back fill and for construction of various project components. The balance 53.7% shall have to be disposed off away from sites so as to make available the site clear for construction activities. 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			
A- Head works Area										
River Diversion	-	50000	-	60240	25000	-	35240	28190	Muck Dumping Area-1	149475
Barrage	-	158000	-	190360	48000	-	142360	113888		
Sub-Total 1		208000	-	250600	73000	-	177600	142078		149475
B- WCS, Power House Complex										
Intake, Feeder Tunnel	9820	-	15600	-	8750	6850	-	5480	Muck Dumping Area-2	77296
Desilting Chamber	60300	-	95800	-	53650	42150	-	33720		
HRT	33480	-	53200	-	29800	23400	-	18720	Muck Dumping Area-3	126988
Adits	47720	-	75800	-	42450	33350	-	26680		
Surge Shaft	3350	-	5320	-	3000	2320	-	1856		
Pressure Shaft	3830	-	6100	-	3420	2680	-	2144		
Power House	117250	-	186200	-	104300	81900	-	65520		
TRT	4250	-	6800	-	3810	2990	-	2392		
Sub-Total 2	280000		444820		249180	195640		156512		204284
Total	280000	208000	444820	250600	322180	185640	177600	298590		353759



### 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. Three muck dumping sites viz. D-1, D-2 and D-3 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.	Location of Dumping Site	Area in Ha	Capacity in cum	Quantity to be dumped with 20 % compaction (cum)
1.	D-1, located about 500 m d/s of barrage axis	1.17	149475	142078
2.	D-2, located about 1300m d/s of barrage axis	0.37	77296	156512
3.	D-3, located about 1500 m d/s of barrage axis	3.32	126988	
<b>Total</b>		<b>4.86</b>	<b>353759</b>	<b>298590</b>

The Layout plans of Muck Disposal Sites are shown in **Figure 6-1, 6-2, 6-3 and 6-4**.



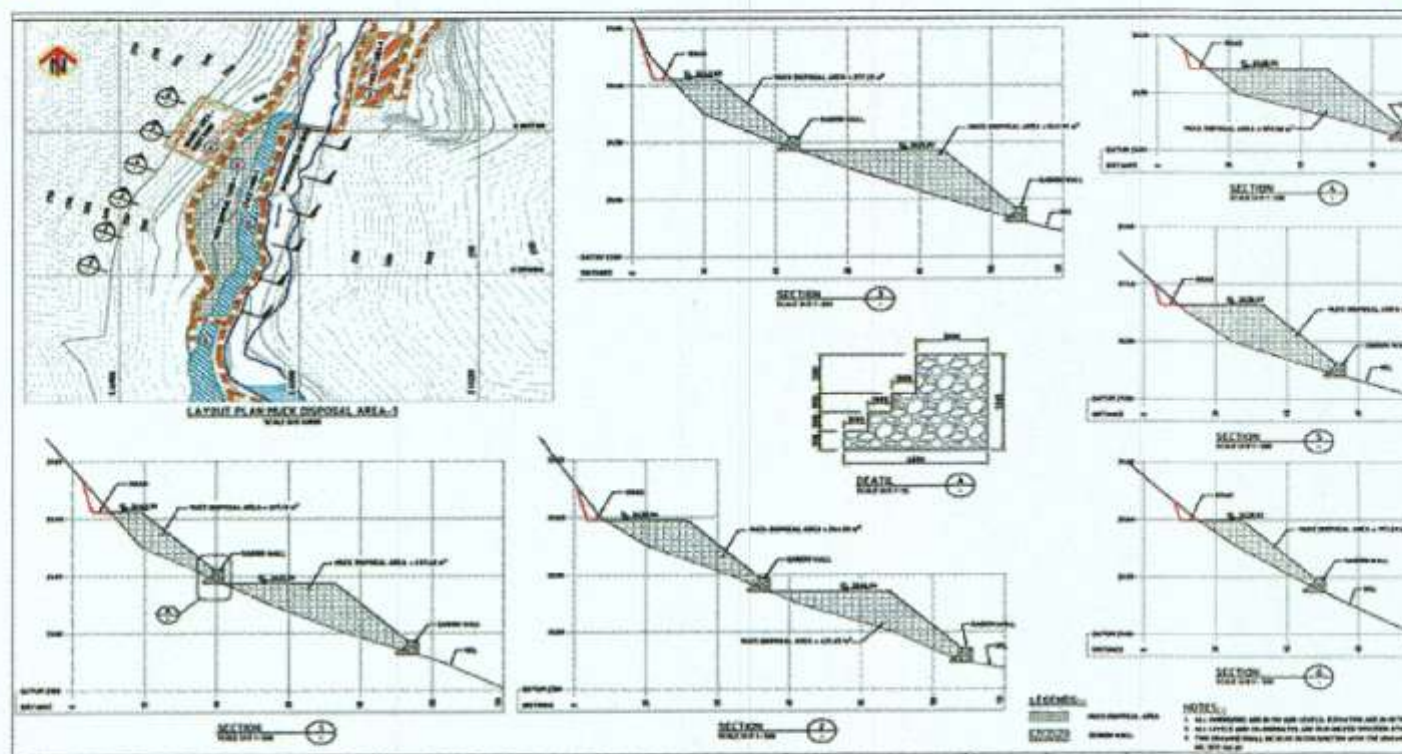


Figure 6-1: Layout plan of Muck Disposal Site -1

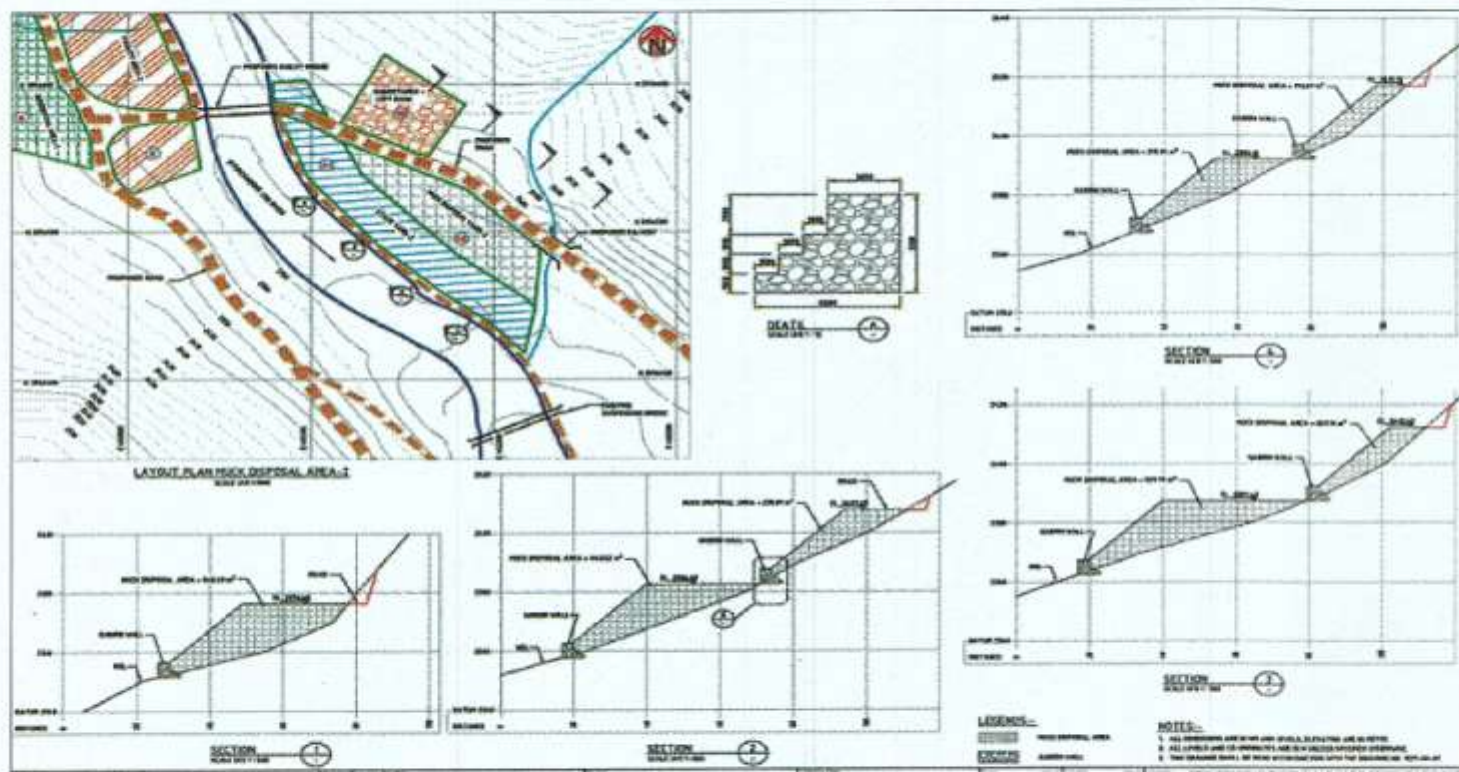


Figure 6-2: Layout plan of Muck Disposal Site- 2

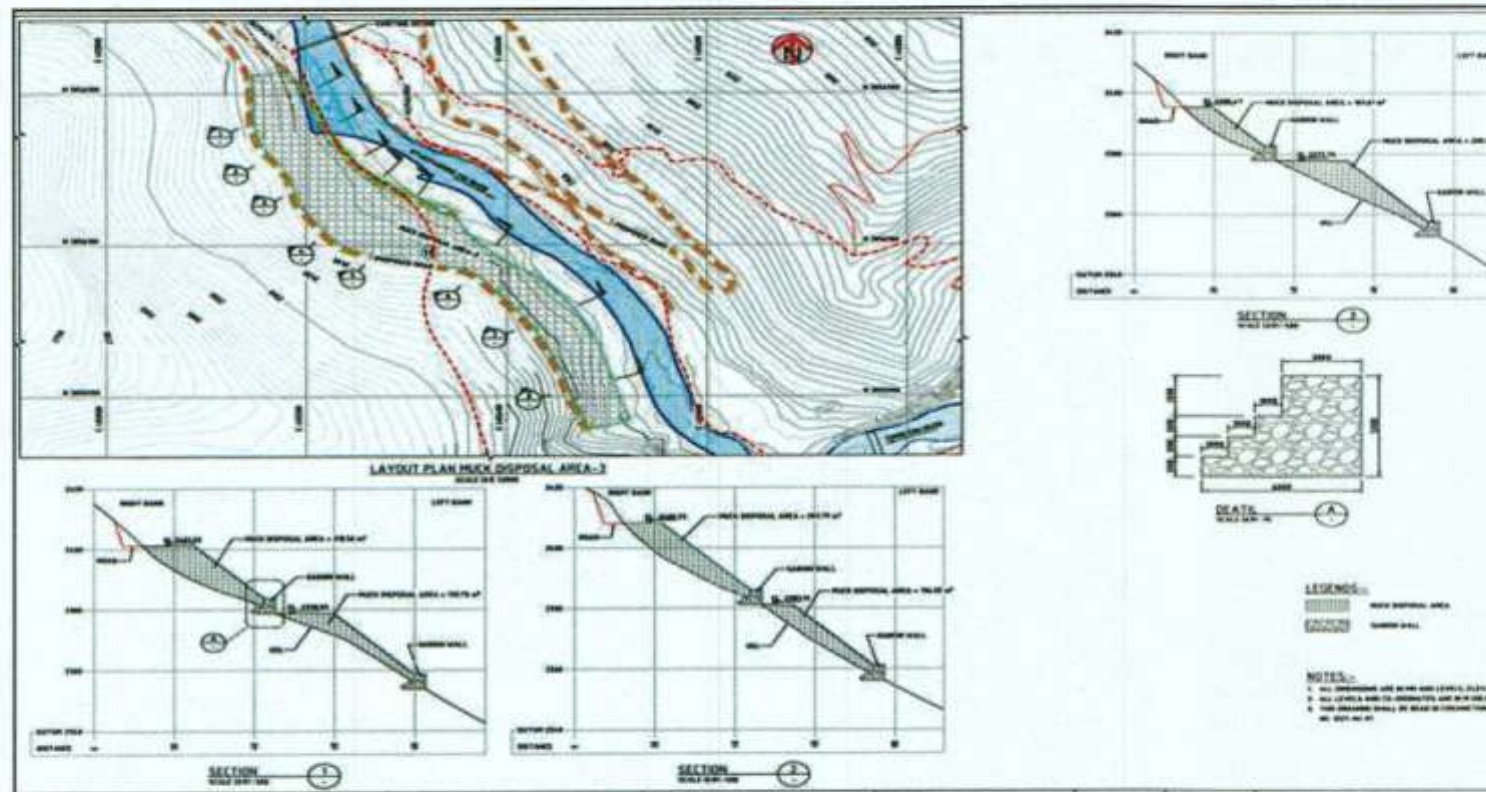


Figure 6-3: Layout plan of Muck Disposal Site3-A



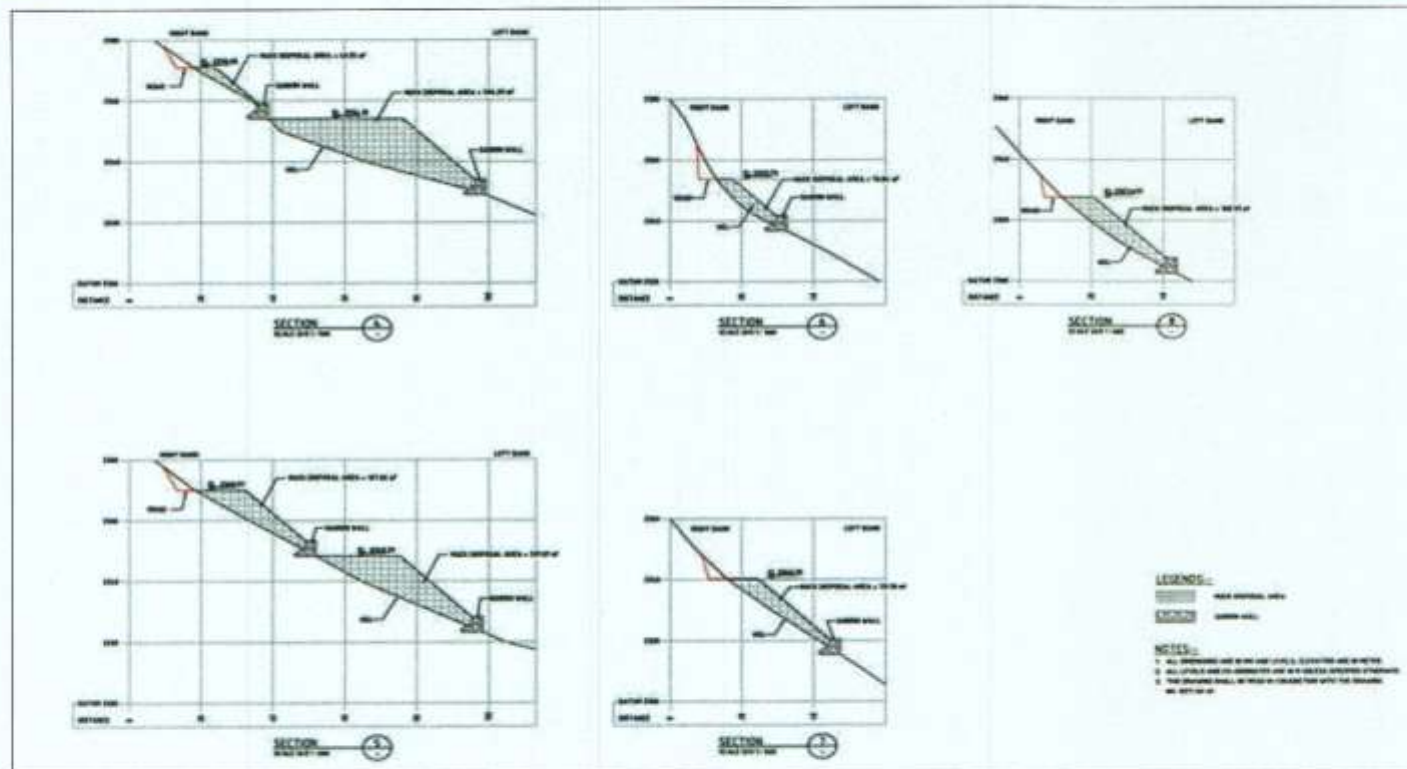


Figure 6-4: Layout plan of Muck Disposal Site3-B





## 6.4 DESCRIPTION ON MUCK DISPOSAL SITES

### 6.4.1 MUCK DISPOSAL SITE D-1

The proposed muck disposal site is located about 500 m d/s on right bank of barrage axis. It is capable of holding 1,49,475 cum of muck against which 1,42,078 cum quantity, to be obtained from excavation of barrage is proposed to be dumped. The site is located more than 30 m away from the river bed. The plan area of the site is 1.17 ha.



### 6.4.2 MUCK DISPOSAL SITE D-2

The proposed muck disposal site is located about 1300 m d/s left bank of barrage axis. It is capable of holding 77,296 cum of muck. The site is located more than 30 m away from the river bed. The plan area of the site is 0.37 ha.



### 6.4.3 MUCK DISPOSAL SITE D-3

The proposed muck disposal site is located about 1500 m d/s of barrage axis. It is capable of holding 1,26,988 cum of muck. The site is located more than 30 m away from the river bed. The plan area of the site is 3.32 ha.

In total 1,56,512 cum shall be dumped in Muck Disposal Site 2 & 3 and properly roller compacted.



## 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 retaining structures, crate walls and 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. The muck disposal sites have to be developed from the ground level either by providing stone masonry or by gabion structure at D-1, D-2 and D-3. 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, 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.

### **6.6.1.1 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 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 0.45 m x 0.45 m x 0.45 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 Compost/manure 2 parts, Sand 2 parts, 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, monitoring of survival rate and repair of fencing & inspection paths within the area. The task of watering would be performed by the guard/ watchman provided in the cost estimate. The proposed costs include raising plants, grass seedlings and mortality replacement.

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

#### 6.6.1.2 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>Daphniphyllum papyraceum</i>	Thymelaeaceae
9.	<i>Lyonia ovalifolia</i>	Ericaceae
10.	<i>Pinus roxburghii</i>	Pinaceae
11.	<i>Pinus wallichiana</i>	Pinaceae
12.	<i>Populus sp.</i>	Salicaceae
13.	<i>Rhododendron campanulatum</i>	Ericaceae



Sl. No.	Name of species	Family
14.	<i>Rhododendron cinnabarium</i>	Ericaceae
15.	<i>Solix sp.</i>	Salicaceae
16.	<i>Tsuga dumosa</i>	Pinaceae
17.	<i>Zanthoxylum armatum</i>	Rutaceae

## 6.7 BUDGET FOR MUCK DISPOSAL PLAN

The cost estimate for muck disposal plan indicating engineering, biological measures and maintenance is about **Rs. 167.40 Lakhs**. The break-up of the costs are as follows:

Table 6-4: Cost Estimate for Engineering Measures

S. No.	Name of the work	Quantity	Unit	Rate	Amount (Rs. Lakhs)
<b>A. Muck Disposal Site – 1</b>					
1	Gabion Wall construction	650	m	5000	32.5
2	Filling of earth /Top Soil	1200	cum	20	0.24
3	Levelling	1.5	ha	2000	0.03
<b>Sub-Total</b>					<b>32.77</b>
Contingencies @ 10%					3.28
<b>Total (A)</b>					<b>36.05</b>
<b>B. Muck Disposal Site – 2</b>					
1	Gabion Wall construction	330	m	5000	16.5
2	Filling of earth /Top Soil	6000	cum	20	1.20
3	Levelling	0.5	ha	2000	0.01
<b>Sub-Total</b>					<b>17.71</b>
Maintenance Cost @10%					1.77
<b>Total (B)</b>					<b>19.48</b>
<b>C. Muck Disposal Site – 3 (Near Road to Rho)</b>					
1	Gabion Wall construction	1300	m	5000	65.00
2	Filling of earth /Top Soil	25000	cum	20	5.00
3	Levelling	3.5	ha	2000	0.07
<b>Sub-Total</b>					<b>70.07</b>
Maintenance Cost @10%					7.01
<b>Total (C)</b>					<b>77.08</b>
<b>Grand Total T1 = (A + B + C)</b>					<b>132.61</b>

Table 6-5: Cost Estimate for Biological Measures

	Description	Quantity	Unit	Rate	Amount (Lakhs)
<b>1.</b>	<b>Muck Disposal Site – 1</b>				
	Raising of Plantation (Creation Cost)				
1.1	Survey/ demarcation/plantation planning/ site clearance	18	Days	150	0.03





	Description	Quantity	Unit	Rate	Amount (Lakhs)
	Pit Digging /Soil working/ Manuring & Planting	33	Days	150	0.05
	Seedling cost	1300	Number	8.25	0.11
					<b>0.18</b>
	Maintenance of Plantation Cost for 3 years				
	Seedling casualty replacement (2nd year 15% and 3rd Year 10%)	325	Number	8.25	0.03
	Tending Operation (1st Year Operation)				
1.2	3 weeding (1 DLS per weeding for 100 plants)	39	Days	150	0.06
	Tending Operation (2nd Year Operation)				
	2 weeding (1 DLS per weeding for 100 plants)	26	Days	150	0.04
	Tending Operation (3rd Year Operation)				
	1 weeding (1 DLS per weeding for 100 plants)	13	Days	150	0.02
					<b>0.14</b>
	Fencing Cost				
1.3	i) Erection of barbed wire fencing (1.2 m) cost	660	Meter	227.85	1.50
	ii) Maintenance of barbed wire fencing @5 % of erection cost for 2nd and 3rd year				0.15
					<b>1.65</b>
1.4	Grass carpeting cost	1.17	Ha.	30000	0.35
	<b>Sub-total 1 (1.1 to 1.4)</b>				<b>2.33</b>
<b>2</b>	<b>Muck Disposal Site – 2</b>				
2.1	Raising of Plantation (Creation Cost)				
	Survey/ demarcation/plantation planning/site clearance	6	Days	150	0.01
	Pit Digging /Soil working/ Manuring & Planting	11	Days	150	0.02
	Seedling cost	411	Number	8.25	0.03
					<b>0.06</b>
2.2	Maintenance of Plantation Cost for 3 years				
	Seedling casualty replacement (2nd year 15% and 3rd Year 10%)	103	Number	8.25	0.01
	Tending Operation (1st Year Operation)				
	3 weeding (1 DLS per weeding for 100 plants)	13	Days	150	0.02
	Tending Operation (2nd Year Operation)				
	2 weeding (1 DLS per weeding for 100 plants)	8	Days	150	0.01
	Tending Operation (3rd Year Operation)				
	1 weeding (1 DLS per weeding for 100 plants)	4	Days	150	0.01
					<b>0.05</b>
2.3	Fencing Cost				
	i) Erection of barbed wire fencing (1.2 m) cost	241	Meter	227.85	0.55



	Description	Quantity	Unit	Rate	Amount (Lakhs)
	ii) Maintenance of barbed wire fencing @5 % of erection cost for 2nd and 3rd year				0.02
					0.57
2.4	Grass carpeting cost	0.37	Ha.	30000	0.11
	Sub-total 2 (2.1 to 2.4)				0.79
3	Muck Disposal Site – 3 (Near Road to Rho)				
	Raising of Plantation (Creation Cost)				
3.1	Survey/ demarcation/plantation planning/site clearance	51	Days	150	0.08
	Pit Digging /Soil working/ Manuring & Planting	94	Days	150	0.14
	Seedling cost	3685	Number	8.25	0.30
					0.52
	Maintenance of Plantation Cost for 3 years				
	Seedling casualty replacement (2nd year 15% and 3rd Year 10%)	921	Number	8.25	0.08
	Tending Operation (1st Year Operation)				
3.2	3 weeding 1 DLS per weeding for 100 plants)	111	Days	150	0.17
	Tending Operation (2nd Year Operation)				
	2 weeding (1 DLS per weeding for 100 plants)	74	Days	150	0.11
	Tending Operation (3rd Year Operation)				
	1 weeding (1 DLS per weeding for 100 plants)	37	Days	150	0.06
					0.41
	Fencing Cost				
3.3	i) Erection of barbed wire fencing (1.2 m) cost	1299	Meter	227.85	2.96
	ii) Maintenance of barbed wire fencing @5 % of erection cost for 2nd and 3rd year				0.13
					3.09
3.4	Grass carpeting cost	3.32	Ha.	30000	1.00
	Sub-total 3 (3.1 to 3.4)				5.02
4	Watering and maintenance, watch and ward for 5 years	2		15000	18.00
5	Consumable as water pipes etc.				5.00
6	Miscellaneous items				2.00
	Total (1 to 6)				33.13
	Contingency @5%				1.66
	Grand Total				34.79

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