CHAPTER-7
MUCK MANAGEMENT PLAN

7.1 INTRODUCTION

For construction of different components of the project substantial surface and underground excavation in over burden and rock for diversion tunnel, dam, spillway, powerhouse of main and regulating dam and appurtenant works shall be involved. The excavation shall result in large quantity of excavated material *i.e.,* muck which shall have to be evacuated, disposed off and roller compacted or laid on mild slopes with the excavation work, to such designated areas where muck piles do not substantially interfere with either environment/ecology or the river flow regime and cause turbidity impairing the quality of water. The development of the disposal areas would advance with the progress of the job which it is catering for. First of all, any trees/property in the disposal area boundary would be dealt with as required. As the muck for disposal would be progressively received at the disposal site, it would be dozed and leveled in a manner as to gradually cover the designated area. Measures to protect/retain the toe of the muck fill would be adopted beforehand so that no loss or injury is caused to the public/ property and no muck roles into the river or other water bodies.

The disposal of muck has been scientifically planned keeping in view the pecuniary aspects necessitating proximity of the muck generating component to the dumping site which reduces travel time of dumpers, no interference to surface flow & ground water aquifer, far away from habitation and on stable slopes away from the active landslides . So far as possible the dumping sites should be located adjacent to the existing approach roads.

In the present case, the total bulk quantity of the muck generated due to project will be 20 lac Cum. Assuming 35% of excavated material will be used in project work, the remaining bulk quantity of muck will be 13 Lac Cum. The disposed muck shall be properly stacked and roller compacted or dumped on slopes and treated to mix and match with the surrounding environment with least change in landscape. No disposal would be made in rivers or nallahs. The toes of the disposal piles would be retained and protected by providing suitably designed gabion walls erected over concrete bases. Gabion walls would be preferred over conventional masonry or concrete toe walls because of various reasons. They are easy to build with locally available

stones/boulders from the muck itself. They do not require any setting/strengthening time as in the case of concrete/masonry walls. Not much technical skill is required for making gabion walls. Prefabricated gabion boxes of different dimensions could be used for obtaining better quality and durability.

Based on the excavation quantities, a muck management plan has been formulated to manage the disposal of muck and restore such areas from further degradation of the environment. The disposed muck shall be either roller compacted to provide stable terraces for green belt development, or dumped in designated areas to provide stable slopes. The location of various dumping sites is depicted in **Annexure II** and details are furnished in Table 7.1. Layout plan and cross-sections of all the three dumping site are attached in **Annexure II**.

Table 0.1: Details of muck generation in Thana-Plaun HEP

S.N.	Name of component from where Muck are to be generated	Qty. Of Muck to be generated (Cum)	Add 20% for over breaks/land slides (cum)	Add 45% swell factor on Qty. of Muck generated (cum)	Total Qty. in cum.	Description & Location of Dumping Site	Capacity after use of 35% for construction material, use in coffer dam
1	Diversion	624580	124916	334273	1086769	Dumping Yard	706400
2	Diversion	29746	5949.2	16063	51758	Dumping Yard Neri Kotla-I	33643
3	Head race	13915	2783	7514	24212	Dumping Yard Neri Kotla-I	15738
4	Power House	244220	48844	131879	424943	Dumping Yard Neri Kotla-II	276213
5	T.R.T	22465	4493	12131	39089	Dumping Yard Neri Kotla-II	25408
6	Road Cutting	60000	12000	32400	104400	Dumping Yard Neri Kotla-II	67860
7	Pressure	12361	2472.2	6675	21508	Dumping Yard Neri Kotla-II	13980
8	Adits	70741	14148.2	38200	123089	Dumping Yard Neri Kotla-II	80008
9	Intake	80000	16000	43200	139200	Dumping Yard Neri Kotla-II	90480
Total		**1158028**	**231606**	**622335**	**2014968**		**1309730**

Total Excavation Rock: 20,14,969 cum (say 20 Lac Cum)

35% of Excavated muck shall be used as construction material: 705239

Balanced muck quantity required to be dumped: 13,09,730 Cum (Say 13.10 Lac Cum)

Capacity of proposed dumping yards:

Neri Kotla-I: 7, 47,947 cum

Neri Kotla-II: 14, 70,759 cum

7.2 IMPLEMENTATION OF ENGINEERING & BIOLOGICAL MEASURES

Engineering measures like providing of GI wire crates and RCC retaining walls will provide stability to the profile of muck pile (whether stacked temporarily or permanently).

7.2.1 Engineering Measures

It has been observed that after excavation, disposal of muck creates problem as it is susceptible to scattering unless muck disposal yards are supported with engineering measures such as retaining structures, crate walls and gabions. In the present case, two muck disposal sites are proposed to be located near the river banks, and therefore, needs 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 by providing in. It is proposed to develop of the muck disposal sites for terraces for labour colonies etc., by erecting RCC toe wall with wire crates.

After placing of the boulder at the toe of muck disposal sites, along the flow and towards the hill side to protect the muck from spilling into the river, the muck shall be brought in dumpers and spread in layers behind the wire crate walls and, then, roller compacted till the level of top most tiers is achieved. The retaining wall shall be laid with proper berm and the muck dumped behind it in layers and compacted by rollers. The process shall be repeated upto the desired height (approximately average 12-15 m) with provision that no dumping shall be done once the maximum slope of 45^0 (max slope 1:1) is met. A buffer of 1.5 m height will be kept to avoid the rollover falling into the river.

7.2.2 Biological Measures

Biological measures require special efforts as the muck disposed in disposal yards will in general 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 ad-mixture of nutrients such as NPK would be done before placing the soil on the top surface of muck disposal areas to support growth of vegetation.

In addition to this, isolation and screening of specialized strains of mycorrhizal fungi, Rhizobium, Azotobacter and phosphate solubilizers (bio-fertilizers inoculum) in accordance with the suitability of the spoil tips will be done at the site based on the following:-

- Inoculation of plants with specific biofertilizers and mycorrhizal strains.
- Periodical evaluation of rhizosphere development for physical, chemical, and microbiological parameters.
- Monitoring of growth response in different plant species periodically and identification of corrective measures, if necessary.

7.2.2.1 Plantation Technique

In view of the peculiar site conditions, particularly soil conditions, the planting technique for all categories of plants has to be very site specific and suited to stress conditions as anticipated and discussed above. The plantation areas would need to be considerably improved to support the plants in their initial stages of establishment. Moisture retention capability, availability of nutrients and soil aeration, permeability and porosity would require intervention and assistance.

Multistoried and multipurpose plantations are proposed to be raised on the muck dumping sites as also on-road side strips using grasses, shrubs and bushes in the under storey and trees in the upper storey. Nursery raised grass slips, seedlings of shrubs and bushes and trees 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 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. Each patch should contain maximum of two species. 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. Balance dug up soil/muck will be stacked along the patch on the downhill side for rain water tapping and enhanced percolation in the patch. Number of such patches in each hectare is proposed to be 500.

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. Balance dug up soil/muck will be stacked along the patch on the downhill side for water tapping and better percolation in the patch. These would be staggered throughout the area numbering 500 per hectare. Each patch would have two rows of planting with staggered spacing between the plants in a row as 15 cm and distance between rows as 15 cm.

Planting of trees would be done in contour staggered pits of 0.60 m x 0.60 m x 0.60 m size numbering 800 per hectare. Out of these 800 plants, about 200 plants per hectare are meant for planting along the periphery of the area. If the periphery gets filled up with lesser numbers, the remainder would be planted in the core/main area. Soil mixture would be used while filling the pits. Balance dug up soil/muck will be stacked on downhill side of the pit for tapping the rain water and allowing it to percolate in the pit.

It is proposed to use soil mixture in the pits and patches consisting of soil imported from nearby areas mixed with compost or humus or vermicompost or all of these. The ratio for the mix would be 5 parts compost: manure 2 parts: Sand 2 parts and humus or vermicompost 1 part. This will make nutrients really available for the plants in the preliminary stages and also help increase soil aeration, porosity & permeability and improve 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 RCC tow walls with the wire crate (gabion) wall on the valley side (towards river) which is not negotiable by animals and human being, 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 proposed costs include nursery costs for initial planting and also for mortality replacement.

The biological measures shall be taken up towards the end of construction. The plantations would be maintained for a period of 5 years by irrigating the plantation during dry seasons, mortality replacement and repair of fencing and inspection paths within the area. The task of irrigation would be performed by the watch & ward staff provided in the cost estimate.

Although the sites would be either leveled or finished in a grade. However, due to rains and sliding etc, it tends to develop rills and gulley causing acceleration in the rate of erosion. Therefore, while carrying out plantation suitable soil conservation measures would also be taken.

7.3 COST ESTIMATE FOR MUCK DISPOSAL PLAN

The cost estimate for muck disposal plan indicating engineering, biological measures and maintenance is provided in Table 7.2.

Table 7.2: Cost estimate for Muck Disposal Plan

Sl. No.	Particulars	Quantity	Unit	Rate (IN.)	Amount in INR
A.	**Engineering Measures**				
1	Supplying and placing in position GI wire crate 8 SWG, 10 cm size (2.25m x 1.25m x 1.25m) at toe on dumping site MD-1 and MD-2. Total length = 366m; no of wire crates in one row : 366/2.25 =163; Total no of rows : 6*163 =978	978	no	4500	4401000
2	CC (M-20) for RCC wall as Toe of wire crates; a) Base = 366 x 1.85 x 0.30 b) Stem = 366 x 1.00 x 0.45	 203 165	 m^3 m^3	 5500 5500	 1116500 907500
3.	Cost of Centering and shuttering a) 2 x 366 x 0.30 b) 2 x 366 x 1.00	 220 732	 m^2 m^2	 200 200	 44000 146400
4.	Cost of Steel reinforcement	22	MT	57500	1265000
	Sub Total (A)				**7880400**
B.	**Biological Measures**				
1.	Plantation of muck disposal sites	15	Ha	500000	7500000
2.	Barbed wire fencing on 2m high RCC posts	15	Ha	30000	450000
3.	Cost of portable pump with accessories	3	No	150000	450000
4.	Cost of sprinkler system of irrigation	5	No	40000	200000
5.	Watch and ward 3 no. @ Rs. 6000 p.m. for 5 years (3 x 12 x 5)	180	Man Months	6000	1080000
				Subtotal (B)	**9680000**
				Grand Total (A + B)	**17560400**
				Say (in Lac)	**176.00**

- L.S : Lump Sum
- RM: Running Meter