

## Chapter 2

# MUCK DISPOSAL & MANAGEMENT PLAN

### 2.1 INTRODUCTION

Proposed Standalone Pumped storage component of Pinnapuram Integrated Renewable Energy Project (IREP) is in Kurnool District of Andhra Pradesh. Proposed Scheme will involve construction of Rock fill embankments of average height of around 12m to 14m with maximum of 33m height in lower reservoir and 35m in upper reservoir for very short reach for creation of Standalone Pumped storage component of Pinnapuram Integrated Renewable Energy Project reservoirs. Water is proposed to be diverted through five numbers of independent penstocks and one number of independent penstocks bifurcated into two from Power block of Pinnapuram IREP upper reservoir. A surface Power House will be located on the downstream of the power block and shall be equipped with five turbines and a pump/turbine having generating/pumping capacity of 200MW/244MW and two units of 100MW/130MW, respectively. The layout map of the project showing main construction sites and water conductor system is given at **Figure 2.1**.

### 2.2 QUANTITY OF MATERIAL TO BE EXCAVATED

The construction activities of the project would generate muck from excavation of various project structures. The total quantity of muck likely to be generated from excavation including construction of roads is about 9.73 Mcum. The component-wise quantity of muck to be generated is given at **Table 2.1**. However, after the utilization of muck for different project components and considering the swell factor of 40% for excavated material, the total quantity of muck to be disposed shall be **2.97 Mcum**. The entire excavated material is proposed to be dumped at one location identified specifically for this purpose.

**Table 2.1. Muck to be generated from various components of the project**

| S. No. | Project Component                  | Total Quantity of Muck to be generated (Cum) |
|--------|------------------------------------|----------------------------------------------|
| 1      | Upper Reservoir                    | 19,91,592                                    |
| 2      | Concrete Power Block               | 124150                                       |
| 3      | Lower Reservoir                    | 661056                                       |
| 4      | Approach Channel – Upper Reservoir | 1200210                                      |
| 5      | Power Intake                       | 1071000                                      |
| 6      | Pressure Shaft                     | 2,58,826                                     |
| 7      | Power House                        | 10,80,044                                    |
| 8      | TRC                                | 24,27,689                                    |
| 9      | Approach Channel – Lower Reservoir | 9,15,779                                     |
|        | <b>Total</b>                       | <b>97,30,346</b>                             |

**Table 2.2. Quantity of muck to be disposed**

| S. No. | Description                                                                                 | Quantity in MCum |
|--------|---------------------------------------------------------------------------------------------|------------------|
| 1      | Total quantum of muck generated from the project                                            | <b>9.73</b>      |
| 2      | Total quantity of aggregate requirement                                                     | 0.58             |
| 3      | Total quantity of Rockfill                                                                  | 7.03             |
| 4      | <b>Total quantity to be utilised = (2+3)</b>                                                | <b>7.61</b>      |
| 5      | Quantity of muck to be disposed = (1-4)                                                     | 2.12             |
| 6      | Total quantity of muck to be disposed after considering Swelling factor for loose muck @40% | <b>2.97</b>      |

## 2.3 MUCK DISPOSAL SITE

For the disposal of 2.97 MCum of muck an area of 21 Ha has been identified. The disposal site was identified taking into consideration availability of suitable area, minimum distance from generation sites.

### 2.3.1 Criteria for Selection of Dumping Site

The following points were considered and followed as guidelines for finalization of the areas to be used as dumping sites:

- i) The dumping sites have been selected as close as possible to the project area to avoid long distance transport of muck.
- ii) The site is free from any landslides or creep and care has been taken that the sites do not have a possibility of toe erosion and slope instability.
- iv) There is no active channel or stream flowing through the dumping sites.
- v) The site is away from human settlement areas.

The identification of muck disposal areas was done in line with the topographic and site-specific conditions as specified above.

**Table 2.3. Details of muck disposal site**

| S. No. | Chainage     | Area (sq m)    | Capacity in Cum  | Total muck to be dumped in MCum |
|--------|--------------|----------------|------------------|---------------------------------|
| 1      | 0 m          | 7558.77        | 0                | -                               |
| 2      | 150 m        | 8035.99        | 820633.25        | -                               |
| 3      | 300 m        | 8540.65        | 1243248.00       | -                               |
| 4      | 500 m        | 7361.25        | 1225637.5        | -                               |
|        | <b>Total</b> | <b>31496.7</b> | <b>3289518.8</b> | <b>2.97</b>                     |

### 2.3.2 Methodology of Dumping

The muck that needs disposal would be piled at  $\emptyset$  (angle of repose) maximum of 30° at the proposed dumping site. The description regarding the stabilization of the stacked material along the proposed roads has been discussed in the following paragraphs.

The options like dumping muck in stages and allowing it to consolidate/settle through the monsoon, compacting the dumped muck with Bulldozer movement, zoning of the dump judiciously to ensure the stability of 30° slope under all superimposed conditions will be explored and utilised. The plan and cross-sections of the proposed muck dumping site is given at **Figures 2.2**.

The main objectives of process of muck dumping and restoration of these muck disposal sites are:

- to protect and control soil erosion;
- to create greenery in the muck disposal area;
- to improve and develop the sites into recreational site;
- to ensure maximum utilization of muck for the construction purpose;
- to develop the muck disposal site/ dumping yard to blend with the surrounding landscape; and
- to minimise damages due to the spoilage of muck in the project area.

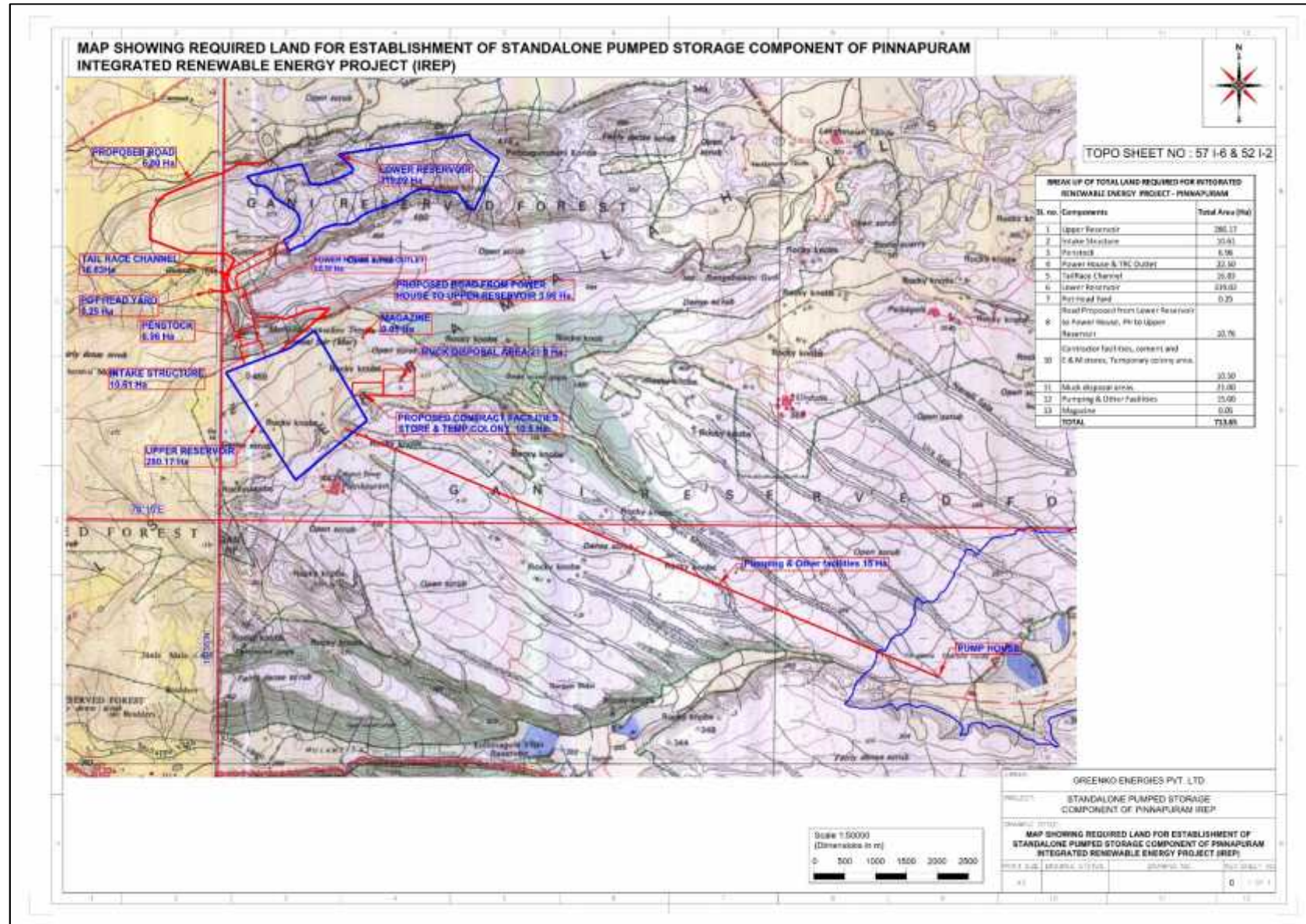
In Standalone Pumped storage component of Pinnapuram Integrated Renewable Energy Project, a scientific approach and methodology was followed for identification of the dumping site. All possible alternate sites were inspected and examined before rejecting or selecting any site. The dumping site is characterized by:

- i) no forest cover,
- ii) the populated /settlement areas are away from the dumping site and therefore will have least impact on human settlements, and
- iii) the identified muck site is close to the area of generation to avoid hazards related to transport of muck for long distances and minimizing traffic problems.

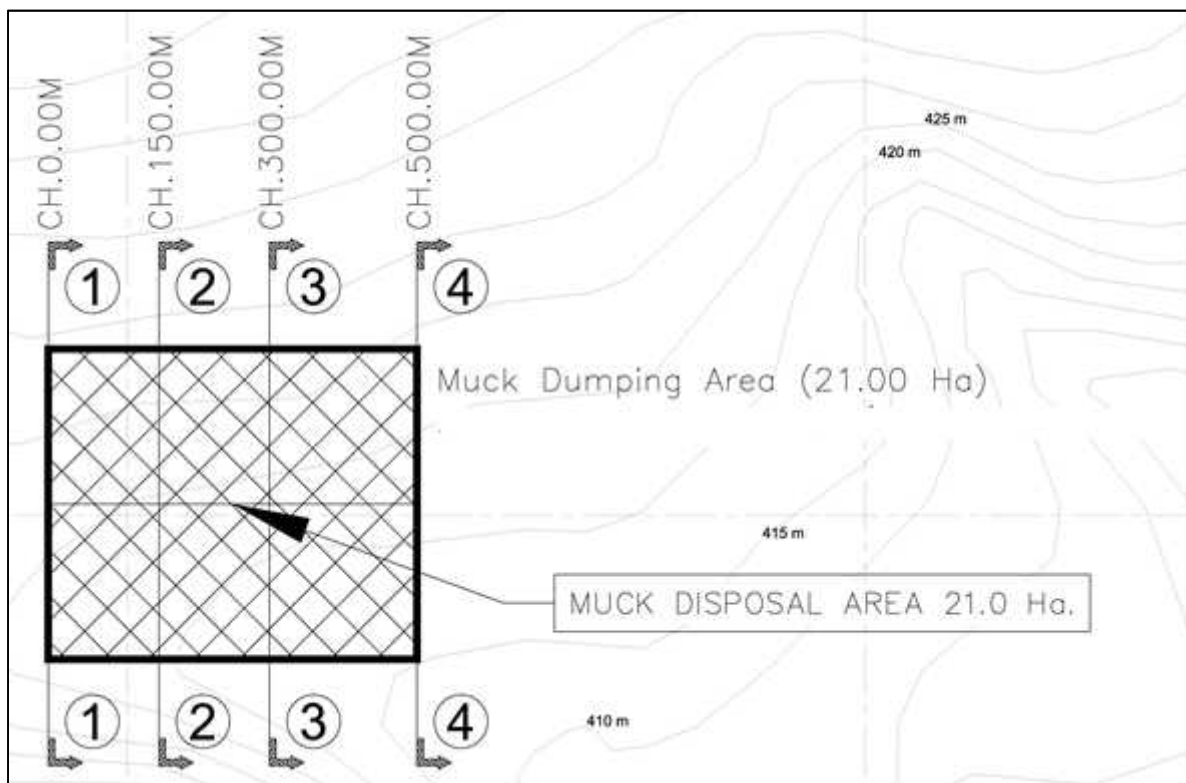
The generated muck will be carried in dumper trucks covered properly in line with approved best practices. All precautionary measures will be followed during the dumping of muck. All dumpers will be well maintained to avoid any chances of loose soil from being falling during the transportation. All routes will be periodically wetted with the help of sprinklers prior to the movement of dump trucks. Dumping would be avoided during the high-speed wind, so that suspended particulate matter (PM<sub>10</sub>) levels could be maintained. Further, the dumping will be avoided during heavy traffic. After the dumping the surface of dumps will be sprayed with water with the help of sprinklers and then compacted.

The capacity/volume of the muck dumping sites is more than the volume of the muck to be disposed i.e. for 2.97 Mcum of muck to be disposed and area having a capacity of 3.28 Mcum has been identified (**see Table 2.3**). The spare capacity has been earmarked for temporary storage of usable muck, traffic movement of dumpers and lifters. The spoil from various construction sites would be disposed of at designated site in a controlled and orderly manner. All measures would be adopted to ensure that the dumping of muck does not cause injury or inconvenience to the people or the property around the area. The general topography of the disposal area has a very mild slope. The spillage of muck proposed to be prevented by making concrete retaining walls to retain the piled muck. The top surface would be leveled and graded after the capacity of any dumping site is exhausted. The top surface will be covered with soil and grass seeding will be ensured to promote vegetation cover

Suitable retaining walls shall be constructed prior to dumping of muck and terraces would be developed to support the muck on vertical slope and for optimum space utilization. Loose muck would be compacted layer-wise. The compacted muck will be ultimately covered with fertile soil, and suitable plants will be planted adopting suitable bio-technological measures (**see Figures 2.2**).



**Figure 2.1 : Layout Plan of Pumped Storage component of Pinnapuram IREP showing location of muck disposal site**



**Figure 2.2 : Plan of Muck Dumping Site**

### **2.3.3 Rehabilitation of Muck Disposal Site**

The Rehabilitation plan of muck dumping site includes engineering and biological measures. The project authorities would ensure that the dumping yards blend with the natural landscape to develop the site with patches of greenery in and around it. The site can also be developed later as recreational park or any other purpose with sufficient greenery by planting ornamental plants. The muck dumping site would be developed as Eco-Park which would not only aid in rehabilitation of disposed muck but also help in propagating biodiversity conservations measures.

The following engineering and biological measures have been proposed for the development of spoiled areas.

#### **2.3.3.1 Engineering Measures**

For stacking of dumped material, concrete reinforced retaining wall is proposed to be built before dumping of any material on the site (refer **Figures 2.2**). The minimum length of dumping site is 1940m and height of retaining wall is proposed to be 6m (see **Figures 2.3 & 2.4**). The retaining wall shall have RCC base of 100m thick and a width of about 4.5 m. The masonry wall is proposed with weeping pipes with PVC pipes of 100mm for drainage. The leveling & Sloping would be done after dumping the material after every cycle and simultaneously improving the drainage of the disposal site.

All the approach road to various project structures will be constructed by with minimal environmental damage. The methodology consists in developing the formation width is half cutting and half filling, so that the materials obtained from cutting are utilised in filling. The excavation on hill side will be done to get a stable slope for the materials

encountered. At places breast wall, gabion walls shall be done in natural slope to retain filled material, particularly where there is problem of retaining the slope.

### i) Retaining Wall

Total area for the dumping of muck is 21.0 ha which can accommodate more than **3.28 Mcum** though the estimated muck to be disposed is **2.97 Mcum**. The height of the retaining wall will be approximately 6 m. A typical sketch of the retaining wall is given at **Figure 2.2**. Total financial outlay for the retaining walls is **Rs.332.10** lakhs, and breakup is given in **Table 2.4**.

### ii) Compaction

Compaction is an engineering measure, which would reduce bulk density of the muck thereby optimising the use of muck disposal area and would make it suitable for the plantation and other biological measures. Top surface would be levelled and graded to make the alternative use. The muck will be spread in layers of 500-700mm thick layers. Top surface would be levelled and graded to make the alternative use. On top a layer of soil would be spread to make the land suitable for plantation. The total cost for the process of compaction is **Rs. 50.00 lakhs**.

### iii) Fencing

Fencing is a bio-engineering measure. After rehabilitation of muck the dumping area need protection for some time from disturbing by human and domestic animals. For this reason, fencing around the muck deposited is required. Barbed wire strands with two diagonal strands, clamped to wooden/ concrete posts placed at 3 m distance are proposed around the dumping piles. Project authorities will establish temporary wind barriers around 3 sides of dumps in close of settlement area.

**Table 2.4: Estimated Cost of Engineering Measures**

| S. No. | Particular                                                           | Volume (cum) | Rate in Rs./cum | Cost in Rs. Lakhs |
|--------|----------------------------------------------------------------------|--------------|-----------------|-------------------|
| 1      | Earthwork for foundation                                             | 3281         | 135             | 4.43              |
| 2      | PCC 100 mm Thick M10 Grade Concrete                                  | 386          | 3500            | 13.51             |
| 3      | R.R. Masonry                                                         | 10440        | 2450            | 255.76            |
| 4      | Weep Holes with PVC Pipe 100 mmØ @1.5m C/C Vertically & Horizontally | 7000         | 120             | 8.4               |
| 5      | Compacting and land leveling, etc.                                   | LS           | LS              | 50.00             |
|        | <b>Total</b>                                                         |              |                 | <b>332.10</b>     |



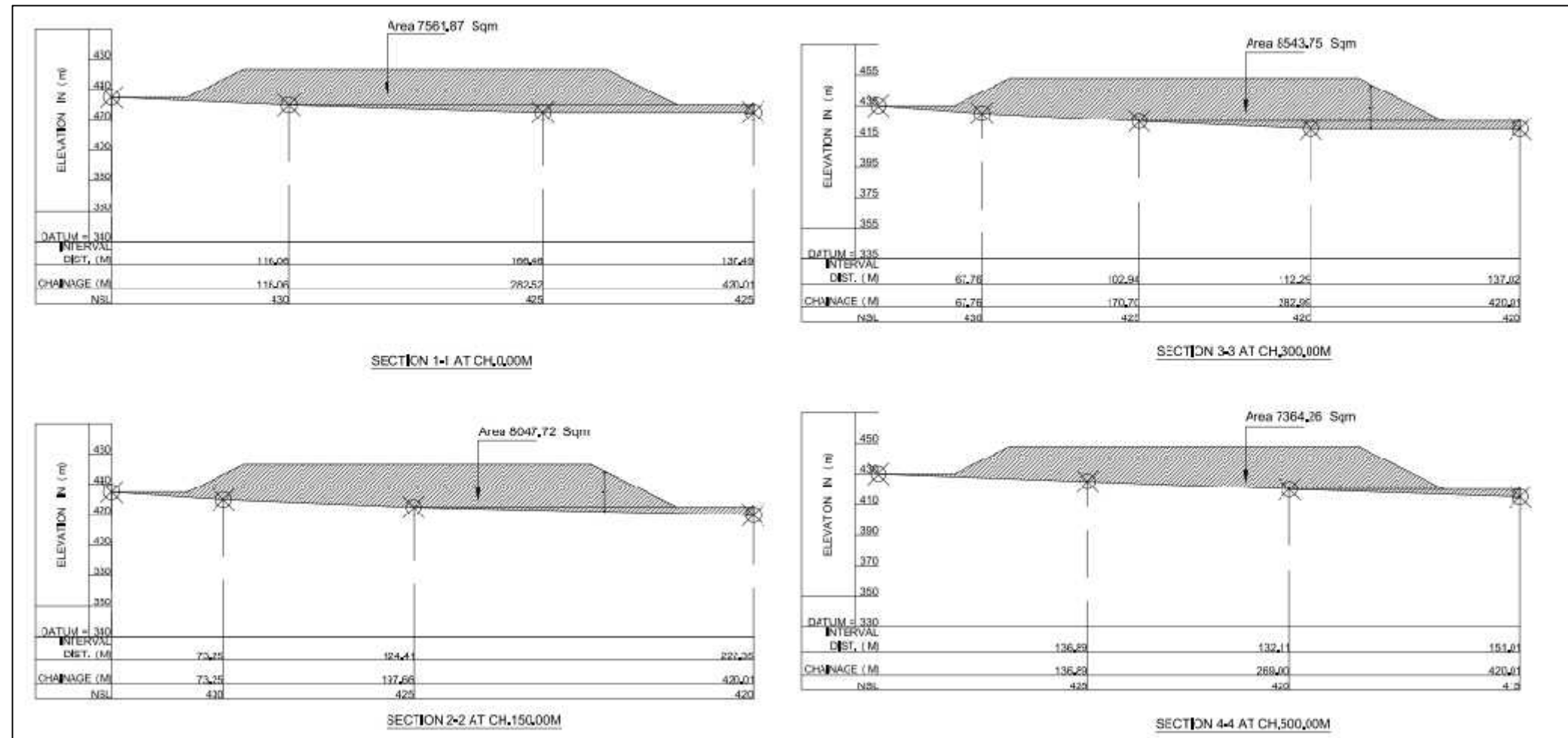
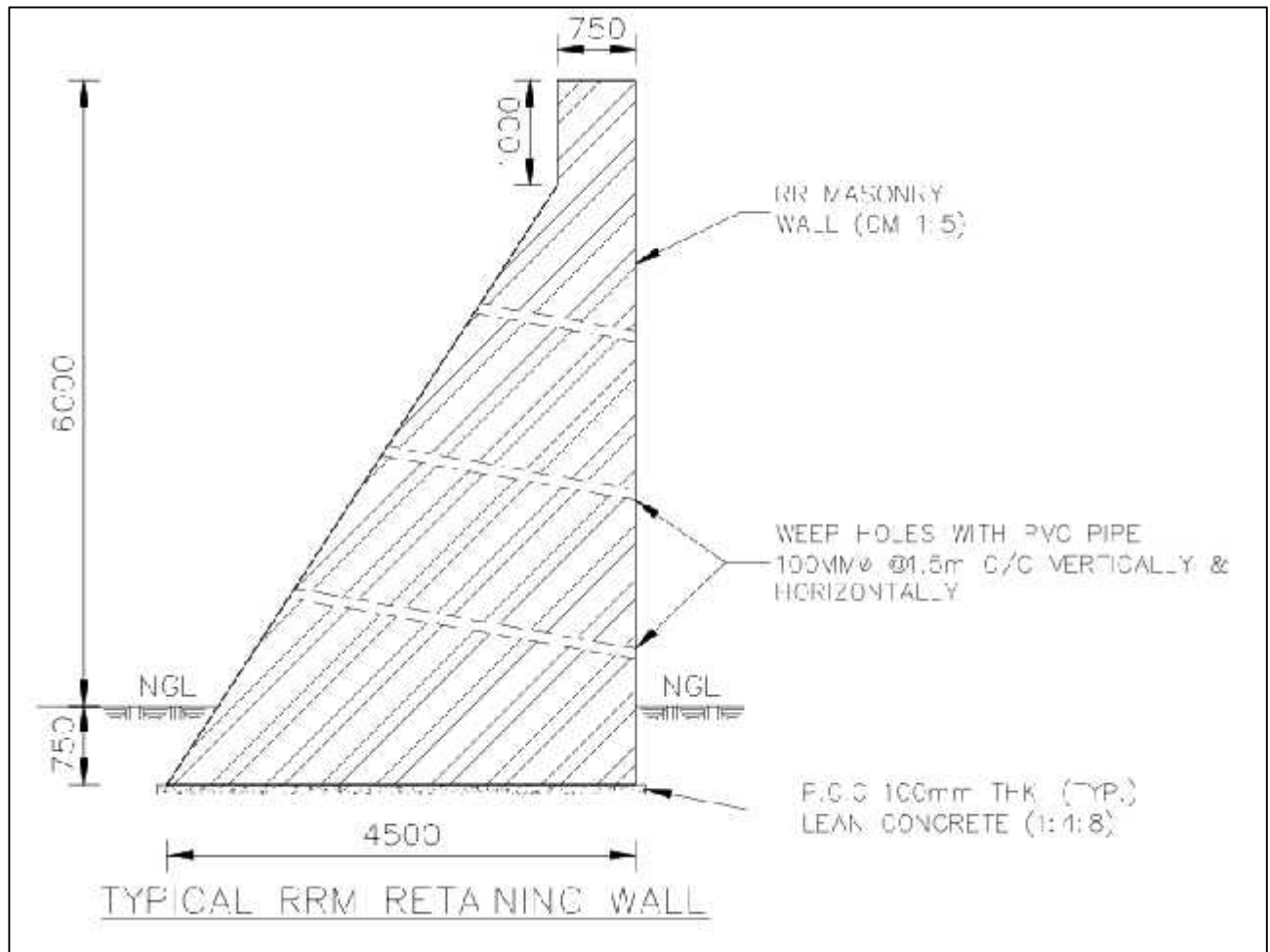


Figure 2.3 : Cross-sections of Muck Dumping Site



**Figure 2.4 : Cross-section of Retaining Wall**

### **2.3.3.2 Biological Measures**

Top surface area of the dumping is about 21.0 ha. This area will be treated for the purpose of plantation. Vegetation cover controls the hydrological and mechanical effects on soils and slopes. Therefore, biological measures to stabilize the loose slope are essential. To implement the biological measures in dumping area the following activities would be taken into account. The biological measures include the following:

#### **i) Soil treatment**

Muck dumped at various sites is not considered to be nutrient rich as it is excavated from tunnels and other structures. In order to make it suitable for the plantation it will be provided bio treatment.

#### **ii) Plantation**

The selected species will be planted after their nurseries have been developed. The dumping areas are very small therefore; separate nursery would not be required. A nursery would be developed for the raise saplings for revegetation of dumping area. Nearly 1-2 years old saplings would be used for the plantation. Grasses and herbaceous species would be used in the inter space of tree and shrub species. They will help in providing the continuous chain of support in retaining debris, reinforcing soil and increasing the infiltration capacity of the area.

After the process of compaction dumping site will be available for the plantation. In consultation with the horticultural department as well as forest department.



The afforestation with indigenous plant species of high ecological and economic value which can adapt to local habitat will be undertaken with 400-600 plants per hectare depending upon the canopy cover required. Major tree species which would be planted are listed in table below.

| Family        | Scientific Name of Plant Species | Habitat |
|---------------|----------------------------------|---------|
| Acanthaceae   | <i>Justicia adhatoda</i>         | Shrub   |
| Anacardiaceae | <i>Mangifera indica</i>          | Tree    |
| Anacardiaceae | <i>Semecarpus anacardium</i>     | Tree    |
| Anonaceae     | <i>Polyalthia longifolia</i>     | Tree    |
| Apocyanaceae  | <i>Wrightia tinctoria</i>        | Tree    |
| Apocynaceae   | <i>Nerium indicum</i>            | Shrub   |
| Bignoniaceae  | <i>Jacaranda mimosifolia</i>     | Tree    |
| Combretaceae  | <i>Terminalia catappa</i>        | Tree    |
| Euphorbiaceae | <i>Jatropha curcas</i>           | Shrub   |
| Fabaceae      | <i>Albizia lebbeck</i>           | Tree    |
| Fabaceae      | <i>Bauhinia racemosa</i>         | Tree    |
| Fabaceae      | <i>Cassia fistula</i>            | Tree    |
| Fabaceae      | <i>Dalbergia paniculata</i>      | Tree    |
| Meliaceae     | <i>Azadirachta indica</i>        | Tree    |
| Moringaceae   | <i>Moringa concanensis</i>       | Tree    |
| Rutaceae      | <i>Aegle marmelos</i>            | Tree    |
| Verbenaceae   | <i>Vitex negundo</i>             | Shrub   |

The estimated cost of these measures would be **Rs.148.75 lakh**. This cost includes the cost of turfing of slopes, preparation of ground, spreading of manure, etc., providing 5 cm of soil cover and transportation and carriage. It also includes the cost of fencing, irrigation, watch and ward, etc. (see Table 2.5).

**Table 2.5: Total financial outlay for the biological measures at dumping sites**

| S. No. | Particulars                                                         | Quantity  | Rate (in Rs.) | Amount (Rs. in lakh)             |
|--------|---------------------------------------------------------------------|-----------|---------------|----------------------------------|
| 1      | Rolling of Muck                                                     | 2.97 Mcum | -             | Included in Engineering measures |
| 2      | Pitting (size: 0.45 m x 0.45 m x 0.45 m)                            | 25000     | 75.00         | 18.75                            |
| 3      | Manure and soil filling in pits including transportation            | -         | Lumpsum       | 25.00                            |
| 4      | Raising of plants (including nursery cost, manure, transport, etc.) | -         | Lumpsum       | 75.00                            |
| 5      | Fencing, maintenance, watering, transport, etc.                     | -         | Lumpsum       | 30.00                            |
|        | <b>Total</b>                                                        |           |               | <b>148.75</b>                    |

## 2.4 MONITORING & COMPLIANCE

Muck shall be dumped from bottom in layers of 500-700mm depending on size of boulders.

- Each layer shall be rolled compacted.
- A layer of soil shall be spread on top of it to make it suitable for plantation.
- Prescribed norms of SPCB shall be followed.

- iv) All norms of Forest department, SPCB and MoEF&CC and their acts related to muck disposal shall be complied with.
- v) Design consultant shall be engaged for designing of retaining structures.
- vi) Plantation shall be done on the reclaimed land and native variety of plants and trees shall be planted.

## 2.5 FINANCIAL REQUIREMENT

The estimated cost of the relocation and rehabilitation of excavated material is given in **Table 2.6**. The total cost of these measures will be **Rs. 480.85 lakh**.

**Table 2.6: Financial requirements for implementation of Muck Disposal Plan**

| S. No. | Item                 | Amount (Rs.in lakh) |
|--------|----------------------|---------------------|
| 1.     | Engineering measures | 332.10              |
| 2.     | Biological measures  | 148.75              |
|        | <b>Total</b>         | <b>480.85</b>       |