

MUCK DISPOSAL PLAN

RESSING SMALL HYDRO ELECTRIC PROJECT

PAPUM PARE DISTRICT, ARUNACHAL PRADESH



M/S GEKAM POWER PRIVATE LIMITED, ARUNACHAL PRADESH

PLANNED AND DESIGNED BY:

G S GEO ENVIRONS PVT., LTD

Dehradun, Uttarakhand

MUCK DISPOSAL PLAN

1.1 INTRODUCTION

The project envisages construction of Gated Barrage on Pare River to divert water through 245 m long feeder channel up to Desilting tank and then by 2200 m long HRT up to Surge Shaft and finally by penstock up to Power House. Quantity of material would be excavated from the barrage site, feeder channel, desilting tank, HRT, Surge Shaft, Penstock Pipe and power house. Muck generated from excavation of any project components are required to be disposed in a planned manner so that it takes a least possible space and is not hazardous to the environment. Moreover the disposal is also essential to avoid degradation/denudation of land and significant change of land use.

1.2 QUANTITY OF MUCK TO BE GENERATED

The total quantity of muck expected to be generated has been estimated to be the order of about **107180 cum**. About **34170 cum** of estimated muck is to be used for the construction/protection works. Therefore, the total quantity of muck to be disposed is about **73010 cum**. The details are given in **Table 1**. The balance muck generated from all the components will be dumped in the designated muck disposal areas.

Table .1:Quantity of muck to be generated and muck to be disposed

SINo	Description Of Item	Unit	Quantity Genarated	Quantity Utilised
1	Earth work Excavation in all kinds of soil for foundation of Barrage, Undersluice & Other Structures with a lead up to 5Km lead.			
a	Gated Barrage	Cum	15,800	6600
b	Feeder Channel	Cum	1,500	700
c	Desilting Tank	Cum	750	450
d	Head Race Tunnel	Cum	2,300	1600
e	Surge Shaft	Cum	350	150
f	Penstock	Cum	3,100	1500
g	Power House	Cum	6,300	3100
h	Tail Race Channel	Cum	550	190
	Total	Cum	30,650	14,290

2	Excavation in hard rock of all toughness by blasting for Barrage, Undersluice & Other structures with a lead upto 5Km. (Controlled blasting) a) Up to 6m			
a	Gated Barrage	Cum	28,800	4,800
b	Feeder Channel	Cum	2,100	1100
c	Desilting Tank	Cum	480	250
d	Head Race Tunnel	Cum	25,000	9,250
e	Surge Shaft	Cum	1,500	400
f	Penstock	Cum	1,200	680
g	Power House	Cum	16,700	3,150
h	Tail Race Channel	Cum	750	250
	Total	Cum	76,530	19,880
	Net Quantity of Muck generated	Cum	107180	34,170

1.3 DUMPING SITES

The identification of muck disposal areas are done in line with the topographic and site specific conditions. Muck is to be dumped in pre-identified sites only (**Figure 1**).

1.3.1 Criteria for Selection of Dumping Sites

Based on the geological nature of the rocks and engineering properties of the soil, a part of the muck can be used as construction material. However, the balance requires being suitably disposed. In the proposed project **34170 cum** is to be reused and rest of the **73010 cum** is to be disposed at muck disposal sites in a total area of 1.20 ha.

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 sites are free from active landslides or creep and care has been taken that the sites do not have a possibility of toe erosion and slope instability.
- iii) The dumping sites are either at higher level than the flood level or are far away from the river course so that the possibility of muck falling into the river is avoided.
- iv) There is no active channel or stream flowing through the dumping site

1.3.2 Description of Sites Selected

The selection of muck disposal sites was done based upon site inspections and available best conditions of the land in consideration, land stability, accessibility from the portals, sloping pattern, minimum vegetative and tree cover, away

from any ecological sensitive area, river bed conditions and away from high flood levels of the Pare river. After survey four suitable sites based on the requirement were identified located on the both banks of Pare River.



Fig.2: Muck Disposal Site 1 located near the Left Flank of river.

Site 1 has been selected on the downstream side of diversion to accommodate the muck from the diversion, feeder channel, desilting tank and some part of HRT (Fig. 2 & 5).



Fig.3: Muck Disposal Site 2 located near the river front.

Site 2 is selected on the upstream side of proposed powerhouse site and adjacent to the approach road (Fig. 3&6).

The proposed locations are spread over land area of **1.20ha**. Total capacity of muck disposal areas is more than total quantity of unused muck to be disposed (**see Table 2**). The unused excavated material expected to be comprised of fragmented rock mixed with soil would be piled at an angle of repose around 36° at the proposed dumping sites. This

will be done to provide stability to the slopes and also to provide ample space for planting of trees which would further help in holding and consolidation of the material stacked at the proposed dumping sites.

In order to maintain an angle of repose less than 36 at the proposed dumping sites, the slopes at dumping sites would be broken up by creating benches across the slope. This will be done to provide stability to the slopes and also to provide ample space for planting trees, which would further help in holding and consolidating the material stacked at 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 dozer movement, zoning the dump judiciously to ensure the stability of 35° slope under all superimposed conditions will be utilized.

Table 2: Details of Muck Dumping Sites

S. No.	Dumping Site	Plan Area (Ha)	Capacity (cum)	Muck to be dumped (Cum)
1	Dumping Site-1	0.82	70356	73010
2	Dumping Site-2	0.44	47840	
	Total	1.26	118196	

1.4 METHODOLOGY OF DUMPING

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 areas;
- to improve and develop the sites into recreational sites;
- to ensure maximum utilization of muck for the construction purpose;
- to develop the muck disposal sites/ dumping yards to blend with the surrounding landscape; and
- to minimize damages due to the spoilage of muck in the project area.

In Ressing SHP during identification of the dumping site above mentioned aspects were kept in mind. All possible alternate sites were inspected and examined before rejecting or selecting any site. The selected dumping site:

- i) have minimum possible forest cover,
- ii) the settlement areas are far away from the identified dumping sites so as to have least impact on human life,
- iii) the proposed dumping sites are located at a distance 30 to 50 m away from the HFL at these sites as all the dumping sites are at a higher level than the flood level from the river course to provide protection from high flood, and
- iv) The identified muck sites are close to the sites from where muck is to be generated to avoid hazards related to transport of muck to long distances.

1.4.1 Dumping Process

The generated muck will be carried in dumper trucks covered with heavy duty tarpaulin properly tied to the vehicle in accordance with best international 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 dumper trucks. Dumping would be avoided during the high speed wind, so that suspended particulate matters (SPM) level 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.

A retaining wall of 4.5m/5m has been proposed to hold the muck on the lower part of the dumping site and shall be constructed prior to dumping of muck (**Figure 4**). Loose muck would be compacted layer-wise. The height of Gabion Wall is proposed to be 6 m on an average. The muck brought by dumpers will be spread in layers behind the wire crate walls and then compacted by rollers till the top level 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 up to 50 cm level below the desired height which shall be laid with good soil for providing grass cover. At a regular vertical interval of 1.5 m and 3.0 m c/c masonry drains (catch water drains) shall be provided to drain off the rain water. Proper fencing of the entire area will be done.

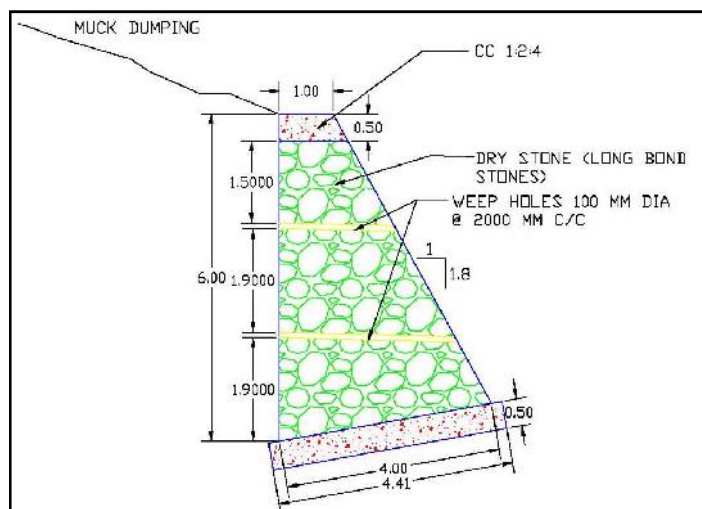


Figure 4: Cross Sections of the proposed retaining wall

The muck disposal area will ultimately be covered with fertile soil and suitable plants will be planted adopting suitable bio-technological measures. The project authorities would ensure that the dumping yards blend with the natural landscape by developing the site with gentle slope, patches of greenery in and around them. These sites can also be developed later as recreational parks and tourist spots with sufficient greenery by planting trees.

The Rehabilitation plan of muck dumping sites includes engineering and biological measures. Most of the total unused excavated muck would be placed at an angle of repose to avoid any slippage of the muck at the proposed dumping sites. Besides, required quantity would be stacked along the roads, which would be utilized either in widening of the road or in newly constructed roads. In the former case slopes would be broken up by creating benches across the slope. This will be done to provide stability to the slopes and also to provide ample space for planting of trees which would further help in holding and consolidating the material stacked at different sites. As stated earlier, efforts will be made to dispose the muck within short distances from sites of its generation.

The capacity/volume of the muck dumping sites is more than the volume of the muck to be disposed. 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 spillage of muck into the river at any site would be prevented by making concrete retaining walls to retain the muck pile. It shall be ensured that dumping is carried out at a minimum distance of 30 to 50 m away from the active river bank. 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.

1.5 REHABILITATION OF DUMPING SITES

The project authorities would ensure that the dumping yards blend with the natural landscape to develop the sites with gentle slopes, bunds, terraces and patches of greenery in and around them. These sites can also be developed later as recreational parks and tourist spots with sufficient greenery by planting ornamental plants. The re-vegetation of dumping yards through 'Integrated Biotechnological Approach' would be undertaken. It may be necessary to inoculate the spoil dumps for development of landscape as the soils would be poor in nutrients. This can be developed through culture of microorganism or vermiculture practices at the nurseries developed for this purpose. This task can be undertaken by Horticulture Department, Government of Arunachal Pradesh.

All the spoiled areas will be developed as per the latest technology of dumping, impact of rain, time and angle of soil setting. In addition sprinkling of water may also be resorted to, if required to avoid or minimize dust pollution. Proper drainage system also has to be provided to ensure unobstructed flow of runoff. Planting with suitable species of trees, shrubs and other biomass will also be initiated.

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

1.5.1 Engineering Measures

For stacking of dumped material retaining wall is proposed to be built before dumping of any material on to the site. In all total length of about **303 running meters** of retaining walls would be required to be built. In addition, leveling would also be done after dumping the material on every cycle and simultaneously improving the drainage of the disposal site.

All the approach roads to various project structures will be constructed by employing the methodology recommended by Border Roads 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 utilized 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 hill slope.

In case of steep gorge, retaining wall and gabion structure shall be constructed to retain filled material. To minimize the environmental damage, construction material like stones, sand, etc., required for the construction of road will be obtained mostly from the excavated material. In the streams, box culverts will be provided to prevent the erosion. In addition, stone/concrete work on the downstream area will also be provided at vulnerable places to minimize erosion.

1.5.2 Biological Measures

In order to stabilize the stacked dumped material, vegetation cover would be provided to hold dumped material over a period of time. Following steps are envisaged:

- Plantation of suitable tree species and soil binding using bio-fertilizer technology.
- Turfing of the exposed area and improvement of environment with ornamental species.
- Protection with mechanical support.
- Social fencing through mass public awareness.

The work plan formulated for re-vegetation of the dumping sites through 'Integrated Biotechnological Approach' is based on following parameters:

- i) Evaluation of dumped material for their physical and chemical properties to assess the nutrient status to support vegetation.
- ii) Formulation of appropriate blends of organic waste and soil to enhance the nutrient status of rhizosphere.
- iii) Isolation and screening of specialized strains of mycorrhizal fungi, rhizobium, azotobacter and phosphate solubilizers (biofertilizers inoculum) suitable for the dumped material.
- v) Mass culture of plant specific biofertilizer and mycorrhizal fungi.

The afforestation with suitable 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 *Albizia odoratissima*, *Albizia procera*, *Altingia excelsa*, *Brassaiopsis aculeata*, *Bischofia javanica*, *Castanopsis armata*, *Kydiacalycina*, *Toona ciliata*, *Prunus domestica* and *Pyrus communis*. The shrubs are planted in between the trees are *Asparagus racemosus*, *Actinidia callosa*, *Boehmeria macrophylla*, *Bambusa tulda*, *Debregeasia longifolia*, *Murraya paniculata*, *Mussaenda roxburghii*, *Rosa* spp., *Leea asiatica* etc. The herbaceous layer is also helpful for the soil binding it reduces soil erosion due to rain. Herbs and grasses suggested for plantation is *Aporosa myriantha*, *Ageratum conyzoides*, *Begonia nepalensis*, *Bidens bipinnata*, *Digitaria ciliaris*, *Fragaria nubicola*, *Mikania macaranta* and *Hedychium spicatum*. A list of plant suggested for revegetation of spoil dumps is given below.

Remedial measures would be carried out on an area of **1.20 ha**. The estimated cost of these measures would be **Rs.10.38 lakhs**. 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 3).

1.6 MONITORING & COMPLIANCES

Muck shall be dumped from bottom in layers of 50-70 cm depending on size of boulders.

- i) Each layer shall be rolled compacted.
- ii) A layer of soil shall be spread on top of it to make it suitable for plantation.
- iii) Water testing facilities shall be set up for checking quality parameter of water.
- iv) Prescribed norms and approvals will be sought from APSPCB wherever necessary.
- v) All norms of Forest department, APSPCB and MoEF & CC and their acts related to muck disposal shall be complied with.
- vi) Design consultant shall be engaged for designing of retaining structures.
- vii) Plantation shall be done on the reclaimed land and native variety of plants and trees shall be planted.

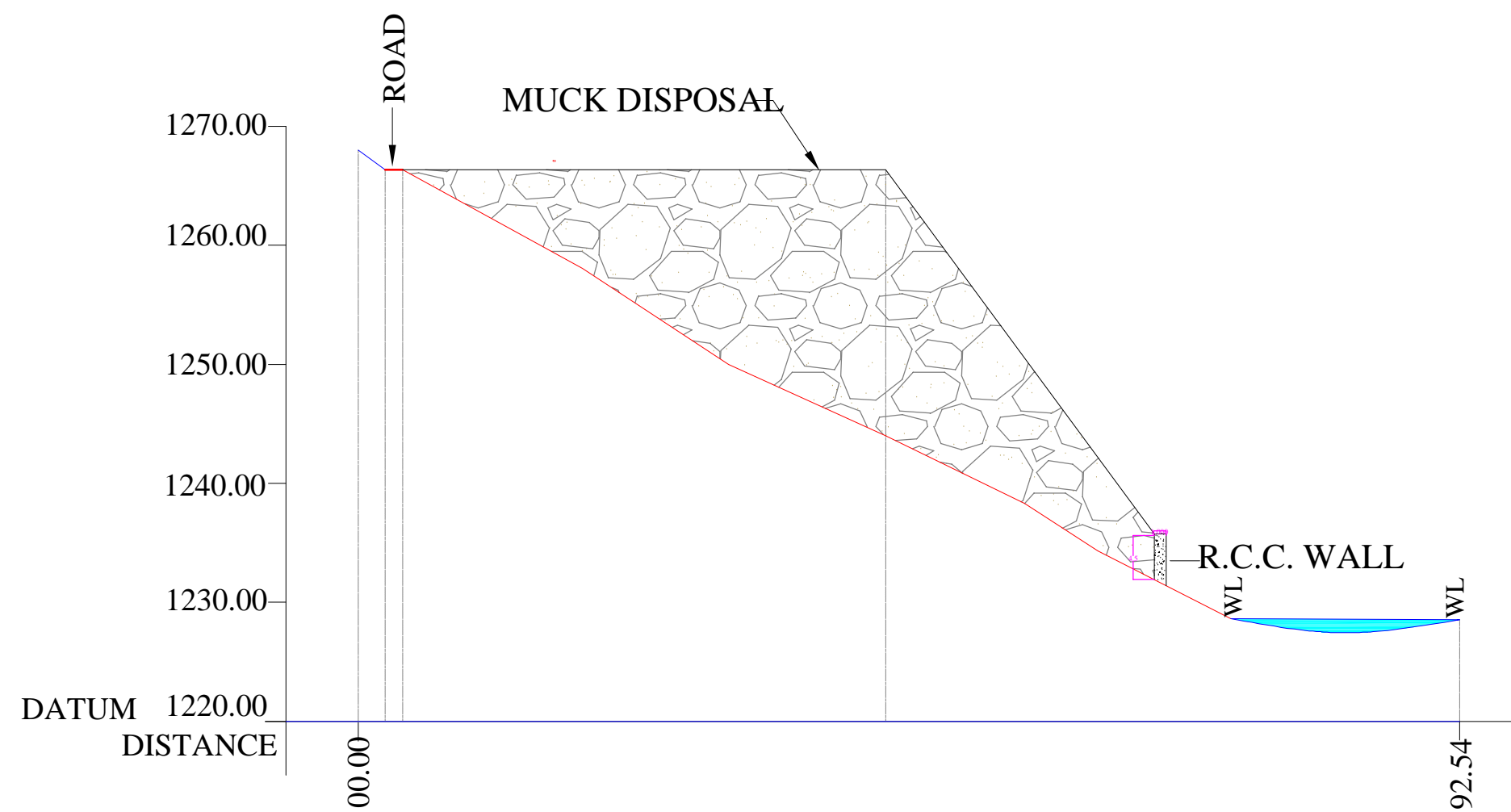
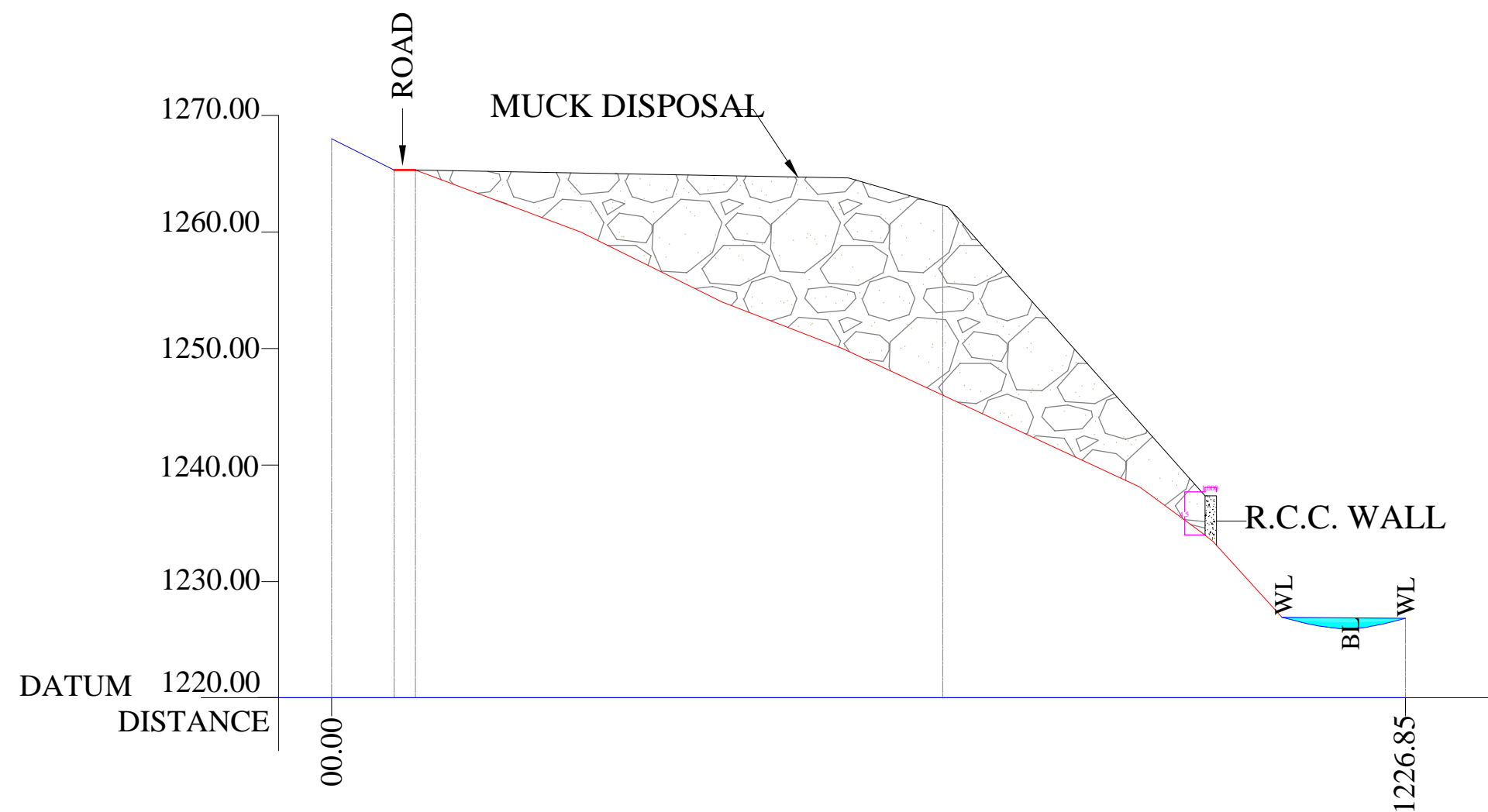
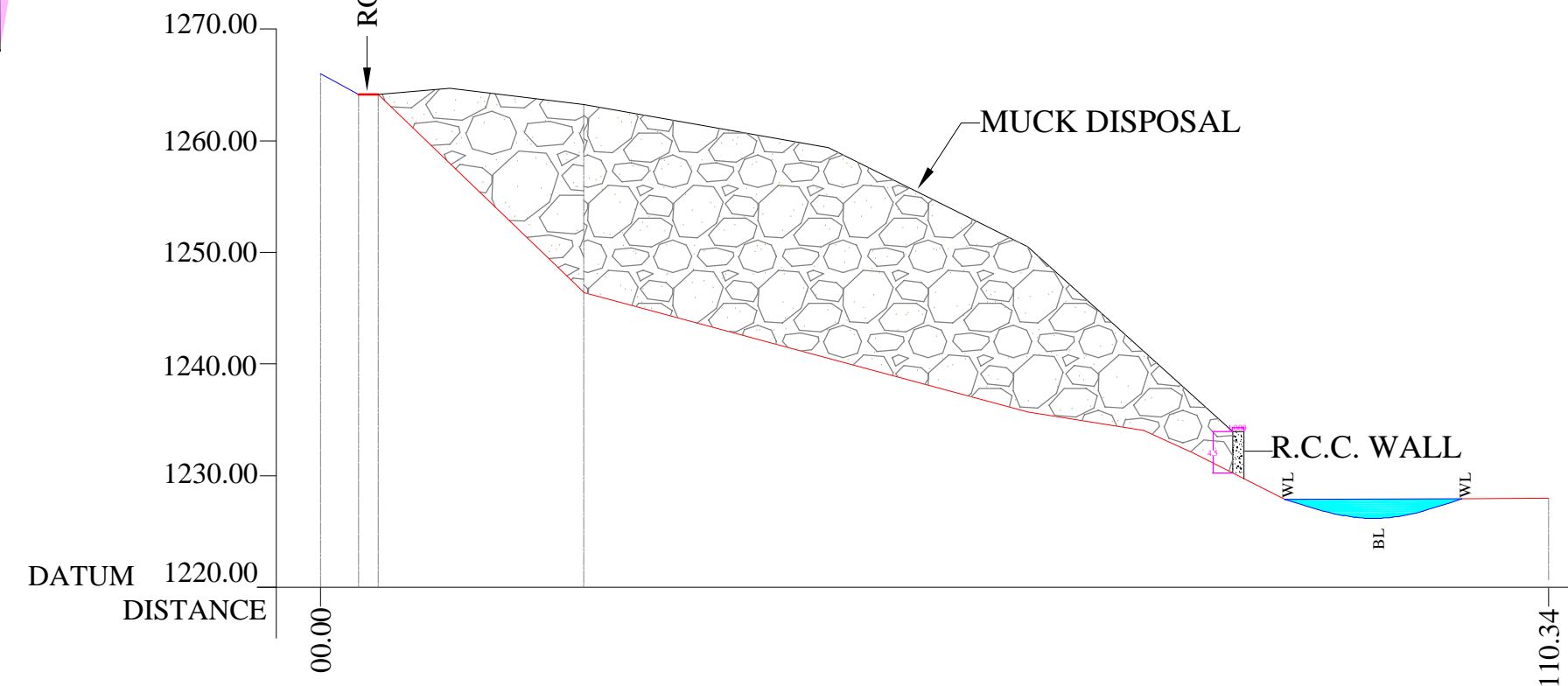
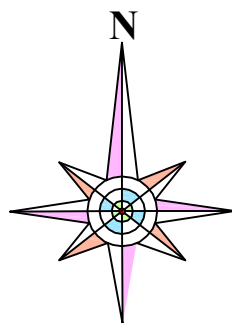
1.7 FINANCIAL REQUIREMENT

The estimated cost of the relocation and rehabilitation of excavated material is given in **Table 3**. The total cost of these measures will be **Rs. 57.38 lakhs**.

Table 3: Financial requirements for implementation of Muck Disposal Plan

S. No.	Item	Amount (Rs. in lakhs)
1	Engineering measures	
	Construction of Retaining walls	42.00
	Compacting and land leveling, etc.	5.00
	Total	47.00

2	Biological measures	
	Plantations with FYM and Fertilizers	3.00
	Turfing by grasses	0.50
	Fencing, sprinkler system, bio-fertilizers, FYM, soil testing, etc.	1.00
	Watch and ward for 3 years @ 8000/- per year for one person	2.88
	Maintenance cost 1 lakh per year	3.00
	Total	10.38
Grand Total (1+2)		57.38



LAYOUT PLAN OF MUCK DISPOSAL SITE-1

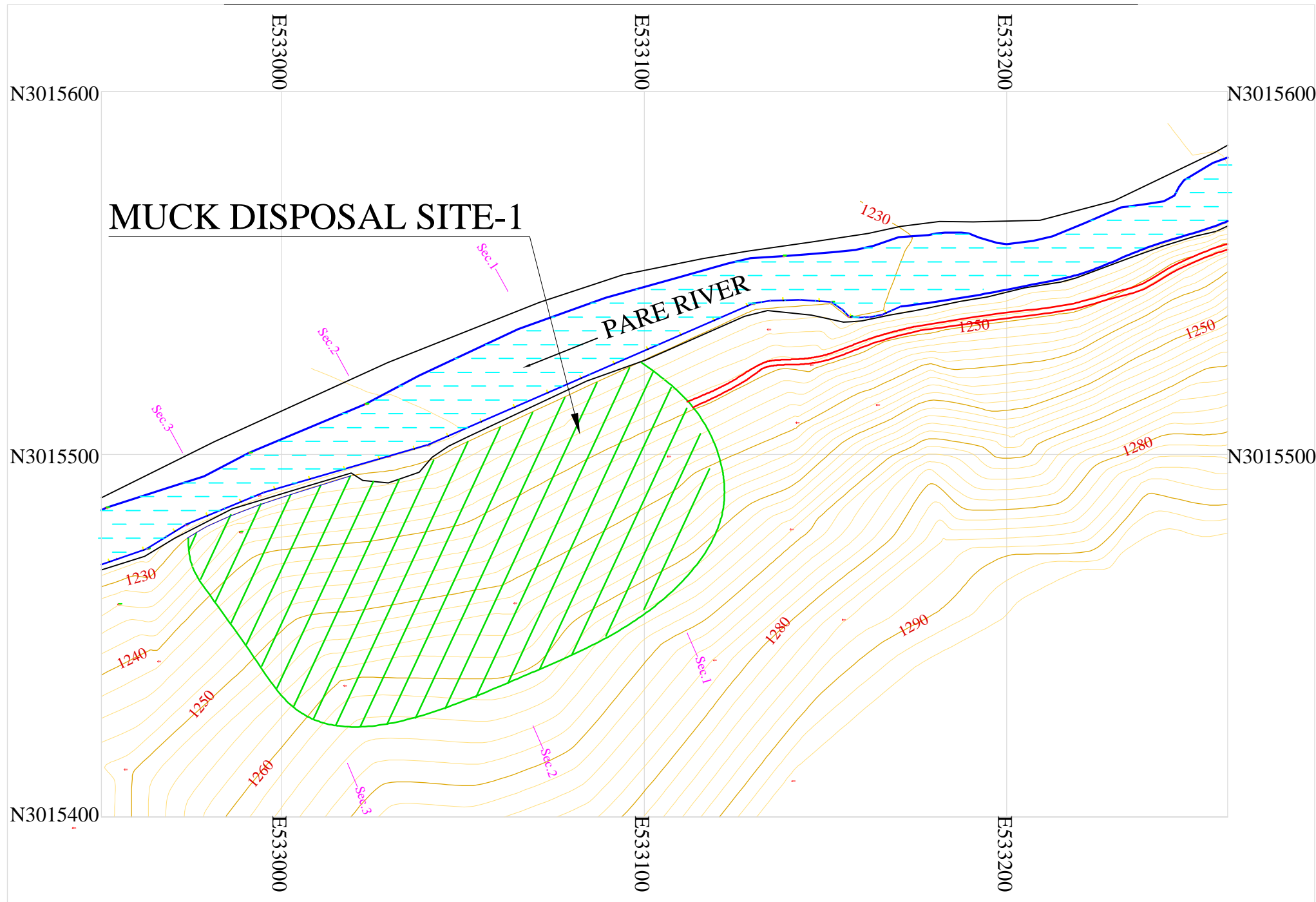
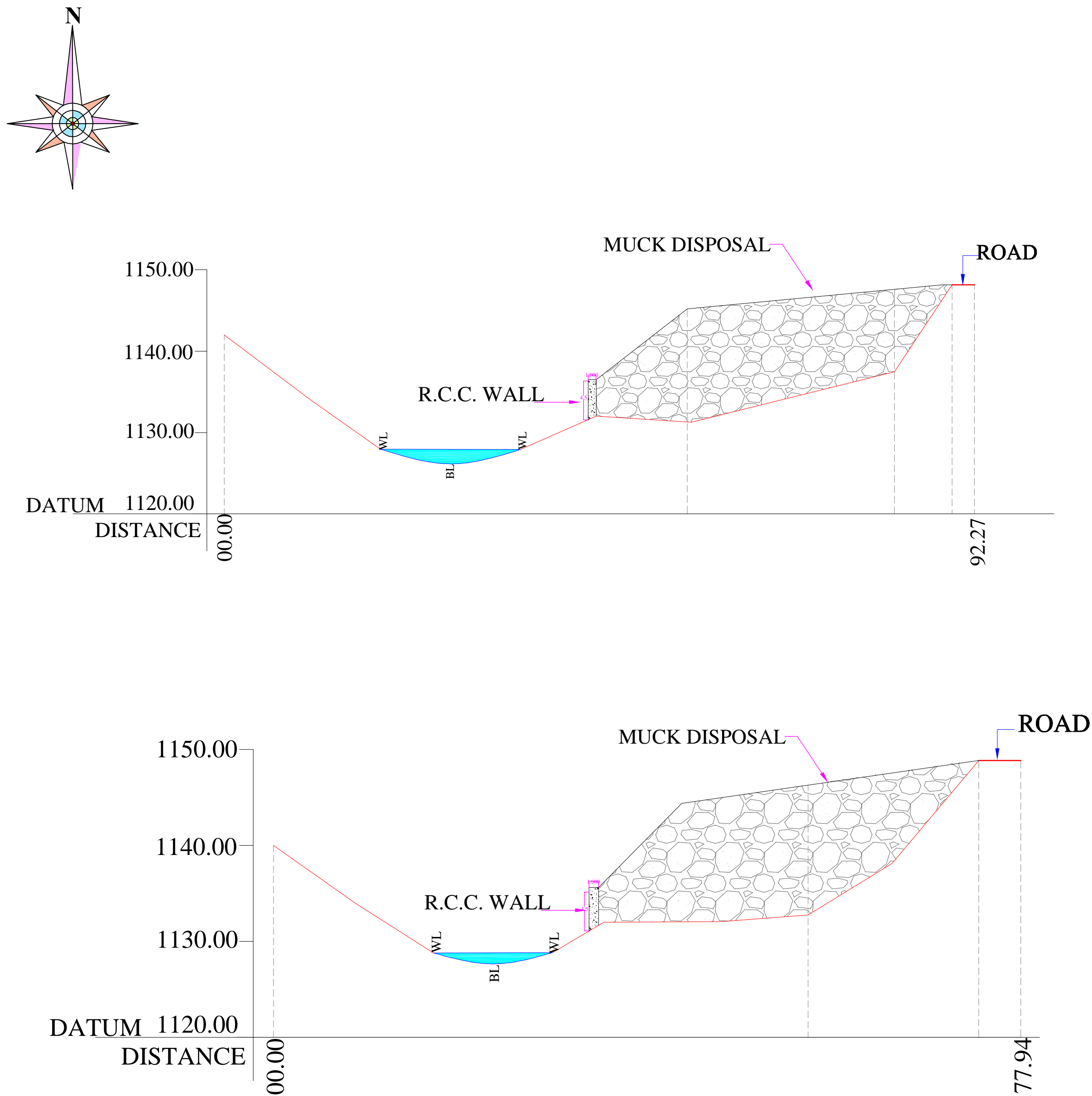
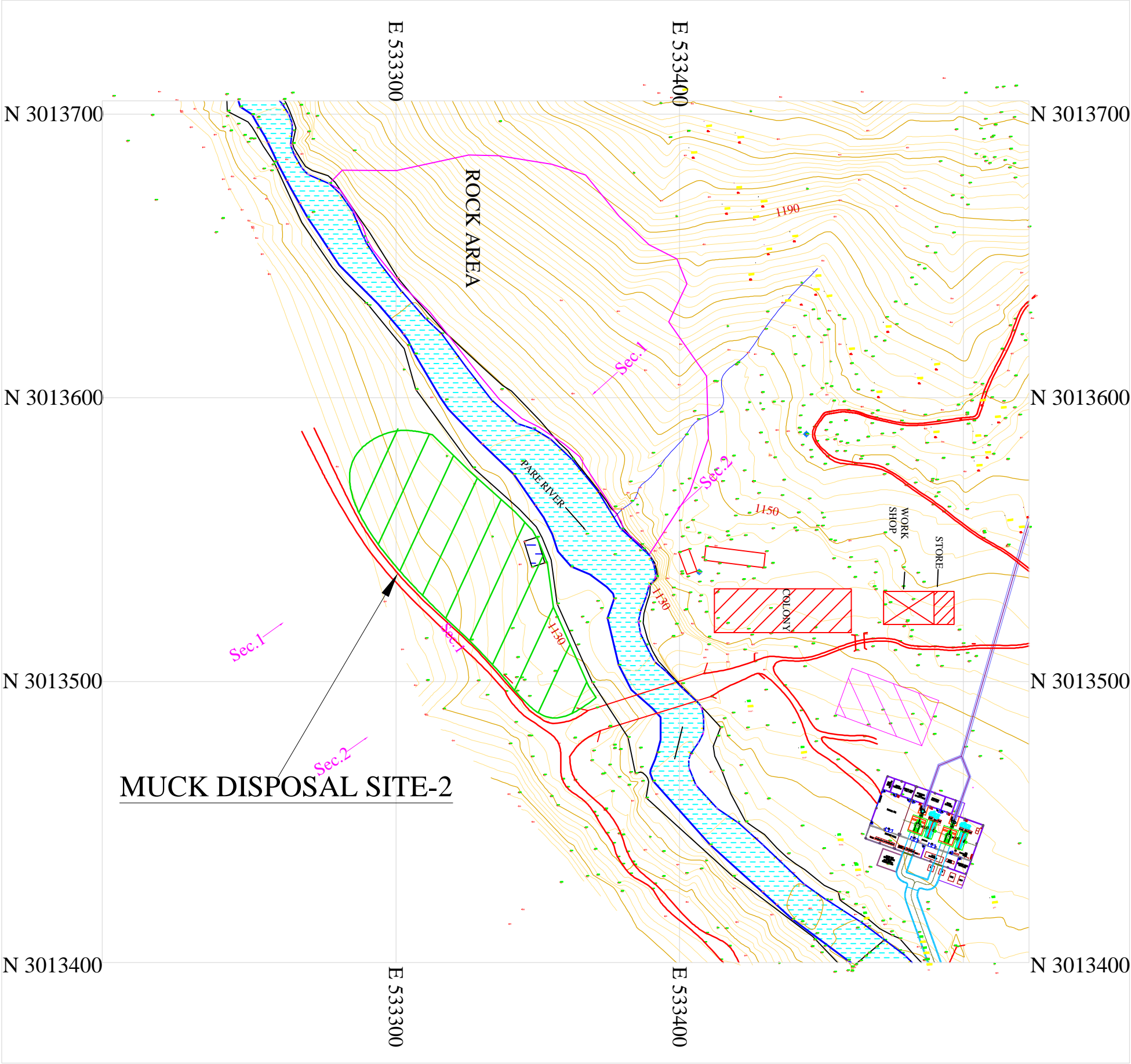


Fig.5

CLEINT: GEKAM POWER Pvt. Ltd. B-SECTOR,NAHARLAGUN DISTRICT: PAPUMPARE, ARUNCHAL PRADESH		
Project: RESSING SMALL HYDEL PROJECT (2x6000 KW) UNDER PAPUM, PARE DISTRICT		
CONSULTANT: <i>G.S.GeoEnVirons Pvt. Ltd.</i> Consultant Enginzer & Planners Geo Tzechnology Energy Environment Kewal Villa, Sahastradhara Road Dzhhradun, India		
TITLE: MUCK DISPOSAL SITE-1		
Surveyed by: DP LAKHERA	Checked by: Dr. G.C.S. GAUR	
Drawn by: SUNDEEP DWIVEDI / SONAM NEGI	Approved by: Dr. G.C.S. GAUR	
Drawing no: 0000		Rev.
Dated: 09-10-2019	Sheet - 01 OF 01	



LAYOUT PLAN OF MUCK DISPOSAL SITE-2



CLEINT: GEKAM POWER Pvt. Ltd. B-SECTOR,NAHARLAGUN DISTRICT: PAPUMPARE, ARUNCHAL PRADESH		
Project: RESSING SMALL HYDEL PROJECT (2x6000 KW) UNDER PAPUM, PARE DISTRICT		
CONSULTANT: G.S.GeoEnVirons Pvt. Ltd. Consultant Enginerg & Planners Geo Teehnology Energy Environment Kgwai Villa, Sahastradhara Road Dghradun, India		
TITLE: MUCK DISPOSAL SITE-2		
Surveyed by: DP LAKHERA	Checked by: Dr. G.C.S. GAUR	
Drawn by: SUNDEEP DWIVEDI / SONAM NEGI	Approved by: Dr. G.C.S. GAUR	
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Dated: 09-10-2019	Sheet - 01 OF 01	

Fig.6