

PLAN FOR PREVENTION OF FURTHER DEGRADATION OF CATCHMENTS- TOR TASK-C.

INTRODUCTION:

The Terms of Reference of the work of preparation of Comprehensive Catchment Area Treatment Plan for Satluj River Basin specify under Task-'C' that the Consultant shall examine and suggest ways to prevent further degradation of the Satluj basin catchments. To this end, the consultants shall undertake the following specific works:

- Prepare a draft notification preventing any disposal of construction and excavated waste or muck in hill slopes; minimizing muck disposal (showing balance of cut and fill); and project dumping sites to acceptable standards (with toe walls) for each road agency or road project, including rural roads.
- For each stretch of roads in the state, describe a cost-effective process for the State PWD to prepare a list of designated muck disposal area (and prepare an estimate for protection of these areas). For demonstration, the consultants will take a sample of 250km of roads in the state (50 km national highway, 50 km of state highways, 50 km of district and other district roads, and 100 km of rural roads), and identify the potential muck dumping areas.
- A draft notification to direct all the responsible agencies that any muck from clearing of landslides on roads or from any other construction activity to be dumped in pre-identified sites (to be listed by PWD).

In pursuance of these requirements, NERIL carried out a study in order to prepare the Draft Notification. NERIL also has made a cost effective process for the State Public Works Department to identify such sites. The demonstration sites were selected from different type of roads as tabulated below:

S. No.	Road Type	Road No.	Proposed Sample site	Distance	Potential DS
1.	National Highway (50 Kms)	NH-22	Kumarsain (Murthal village) Kingal to Rampur	50 Kms	2
2.	State Highway (50 Kms)	SH-13	Shimla- Tattapani –Mandi Portion Dhalli -Tattapani 50 kms.	50 Kms	4
3.	District Roads (50 Kms)	DR -21 DR 22	Bakrot-Karsog-Sainj ; Portion Sainj- Luhri 3kms Tattapani-Sunni-Luhri 47 kms	50 KMS	8
4.	Rural Roads (100 Kms)		Koyal-Nithar Roads	18 Kms	3
			Bhadrash-Brandli	32 Kms	6
			Nogli-Taklech-Kareri	25 Kms	4
			Luhri-Nither –Shilla FRH	30 Kms	5

It is important to note that mere site selection will not suffice but such a site has to be prepared and made ready to receive the muck. Once the site is filled to its capacity, it has to be treated through biological measures and engineering measures to ensure that the muck does not further roll downhill to degrade other areas. The muck disposal sites are invariably to be finished with top soil and plantation of local species. The techniques of this activity are also specified in this chapter.

**GUIDELINES FOR SITE SELECTION FOR PUBLIC WORKS DEPARTMENT-
NOTIFICATION AND GUIDELINES FOR SELECTION/ PREPARATION, USAGE AND
RESTORATION OF MUCK DISPOSAL SITES:**

Draft Notification contains the guidelines for consumptive use of muck as well as disposal and restoration of the dumping sites. AND WHERE As it is felt necessary to protect the environment, through conserving the topsoil, and other non-renewable resources used in the construction activities, through proper utilization of muck generated from hydroelectric power plants, tunnelling and road constructions and other development activities.

Under Article 4 of the Forest Conservation Act 1980, Wild Life Protection Act 1972 and the Environment Protection Act 1986 and the Rules made there-under authorizing the Department of Forest through its Officers to issue Notifications from time to time, this Notification is issued for strict compliance by all Central Government, State Government and Private Agencies carrying out any work in the State of Himachal Pradesh which may generate muck of any description due to the project activities undertaken by these Agencies.

For the purpose of this Notification the word "muck" shall mean all inert material, excavated, tunnelled, dislodged or caused to be dislodged as a collateral effect of primary human interference from its natural position to its new location either in a stable area of in an unstable manner.

Every project proponent shall invariably submit his muck disposal plan to the Principal Chief Conservator of Forests and his Conservator of Forests responsible for the area under whose jurisdiction the project falls. This Plan is to be submitted in addition to the Plan submitted in the Environment Management Plan (EMP) for the Environmental Clearance to MOEF and/or any case put up for diversion of forest land for non-forest use under the Forest Conservation Act.

It is reiterated that within the State of Himachal Pradesh, EIA Clearance and FCA Clearance will not be a substitute for specific submission and approval of Muck Disposal Plan which has to be obtained from the Principal Chief Conservator of Forests through his officers.

In addition to the projects needing EIA Clearance or FCA Clearance, there may be other nature of maintenance or maintenance modification, re-construction or new construction related works which may generate muck in excess of 15 Metric Tons, the Project Proponent/Contractor/Agency carrying out the works is charged with the responsibility of obtaining muck disposal approval. The proposal to obtain muck disposal approval shall contain the following details:

- a) Nature of work to be carried out;
- b) Is the work site specific or can it be carried out at an alternate site, if so, site specific drawings for the same;
- c) Volume of muck to be generated;
- d) Machinery and Labour proposed to be employed with the total duration of work;
- e) Specifications of muck disposal site including the location giving longitude-latitude, distance from worksite and arrangements of transportation;
- f) Proposed preparation of muck disposal site with location, drawings etc;
- g) Proposed plan for rehabilitating the disposal site with specific details of source and quantity of top soil and proposed vegetation with plantation and maintenance plan.

VIOLATION:

Any violation of this Notification will be subject to the provisions of Penalties that may be imposed under the Indian Forest Act 1927, Forest Conservation Act 1980 and these may be further enhanced to recover the cost of damage from the person causing the creation of debris or caused disposal of the debris. This Notification empowers the Forest Department Officers of the rank of R.F.O. and above to impound the machinery, vehicles engaged in creation and dumping of muck and to arrest the personnel engaged in this activity.

Now, therefore, we hereby as the project management consultants recommend to the concerned Department to issue the following directions which shall come into force on and from the date of publication of the Notification:

1. Consumptive use of muck

- No person shall within a radius of fifty kilo-meters from hydro power plants, manufacture clay bricks or tiles or blocks for use in construction activities without mixing at least 30 per cent of muck by checking its nutrient status, with soil on weight to weight basis.
- The generated muck to some extent should be used for strengthening of bunds, construction of roads, filling up of low-lying areas, aggregate for concrete work etc; so that cutting and filling will be equalized.
- Some small roads locally required to be constructed on various sites connecting work areas with labor colonies, workshops, stores etc. So some part of muck should be consumed in these roads for soiling as well as protection work.
- Some construction work of schools, dispensary, monuments, gardens, play grounds etc. should also be taken up in the adjoining areas using the muck.
- The muck in excess of above activities should be transported and disposed off at predetermined places, if so required.
- All disposal sites should be properly landscaped when the disposal gets completed so as to merge it in the natural surroundings.

2. Monitoring the utilization of muck

- Local people or private agencies should be allowed to lift and use the muck for their requirements. This muck should be supplied to them free of cost. Action plan for this should be made which would describe, thirty per cent of the muck utilization should be done, within three years from the publication of this notification with further increase in utilisation by atleast ten per cent points every year progressively for the next six years to enable utilisation of the entire muck generated from the various excavating activities atleast by the end of ninth year. Progress in this regard shall be reviewed after five years.
- The State Government Agencies shall facilitate in making available land, electricity and water for manufacturing activities and provide access to the muck lifting area for promoting and setting up of muck -based production units in the proximity of the area where muck is generated by the various activities.
- Provisions in this notification should be submitted every year to the state government.

Following are the guidelines for selection, preparation and maintenance of Muck disposal Sites

Selection of site : DEMO SITES

S. No.	Road Type	Road No.	Proposed Sample site	Distance	Potential DS
1.	National Highway (50 Kms)	NH-22	Kumarsain (Murthal village) Kingal to Rampur	50 Kms	2
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Nearness to the muck generation locations in order to minimize the cost of transport and mitigation of dust pollution which may occur during transportation.

The site should be away from the river, but if any site is selected closed to the river then proper precautionary measures should be taken e. g. Retaining walls of 7m height should be developed along the bank of the river at all muck disposal areas and the height of muck at retaining wall should be kept around 3 m, because there are chances of rolling down of muck/ loose material leading to blockage in river flow or contamination of water due to silting.

Disposal areas should be planned downwind of villages and townships in consultation with the forest department.

The area and depth of the site should be such as, which will accommodate the sufficient volume of muck. For this, we have considered site capacity $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ and 100 % of the muck generated.

Wind direction should be taken into consideration so as to avoid the erosion i.e. on wind shadow region.

The sites should be on the concave side of a meander belt.

The sites should be free from active landslides or creeps and care should be taken so that the sites do not have a possibility of toe erosion related slope failure. For that the slope should be 25 degree.

High Flood Level should be taken into consideration. The base levels of the sites should be at higher elevation than the maximum flood level, so that there will not be any possibility of the dumped material to be mixed with the highest flood water and flowing into the river.

There should not be channel of any small streams flowing through the dumping sites.

These sites should not be pristine habitats containing endangered /threatened species.

There should be scope for capping with plantation after the disposal.

Preparation of site:

The main objectives behind muck dumping are:

- To protect and control soil erosion
- To minimize damages due to the spoilage of muck in the project area.
- To develop the muck disposal sites/ dumping yards to blend with the surrounding landscape

Firstly the site should be prepared which will accommodate the desired quantity of muck. Land can be developed through cut -fill operations.

The compaction factor though existent while dumping / rolling and due to weather effects should be taken into account.

Suitable retaining walls (Gabion) should be constructed prior to dumping of muck. The length of wall shall depend upon the area of the site. In most cases 7-10 m. wall is sufficient.

Masonry retaining walls and Boulder wire crates with cement cladding walls would work well to retain muck.

Terraces should be developed so as to support the muck on vertical slope and for optimum space utilization.

Loose muck would be compacted layer-wise. The muck disposal area will be developed in a series of terraces of retention.

In between the terraces, catch water drains can also be provided. The terraces of the muck disposal area will be ultimately covered with fertile soil and suitable locally growing plants (herbs, shrubs & trees) will be planted adopting suitable bio-technological measures.

Adequate drainage arrangement in form of weep holes with inverted filter behind at a regular spacing and pipes should be kept in the retaining walls.

Pipes should be provided with boulder filling around them for passage of rainwater. Dumping sites which are completed should be levelled or dressed. If necessary, PVC/jute geotextile should be provided on the dressed slopes. Reno mattresses can also be provided. It is a layer of stones packed in a mesh wire. It will help to develop vegetation on the site.

Restoration/ Maintenance of dumping sites:

The loosely held muck can lead to the rise in SPM levels and sedimentation load. Therefore, it requires stability with appropriate methods to avoid the subsequent ecological problems. The muck disposal notification involves both engineering and biological measures that depend on the eco-climatic conditions.

I) Engineering Measures:

These majorly include construction of retaining walls, gabion walls and mattresses, terraces, trenches, construction of wire crates, water retention tanks and iron fencing.

II) Biological Measures:

Mostly the muck generated is inert without fertile soil having no organic matter where it is very difficult to raise vegetation. Special efforts will be required to raise vegetation cover of grasses, shrubs and trees. The local grass sodding should be done on the muck when grass seed will be germinating and the grass will add humus to the dumped material.

Vegetation cover plays a very important role in holding the dumped material over a period of time and controls the hydrological and mechanical effects on the soils and slopes.

Following steps are envisaged:-

- 1) Plantation of suitable local species and soil binding using bio-fertilizer technology.
 - Turfing of the exposed area and improvement of environment with fast growing hardy species.
 - Protection with mechanical support.
 - Social fencing through the mass public awareness.
- 2) For implementation of the Plantation on Muck Disposal Areas
 - The plant species should be selected which faster growth and which will be helpful in stabilizing the dump sites i.e species which can do Phytoremediation and soil erosion control.
 - Species of high ecological and economic value, which can adapt to local habitat.
- 3) There should be "Integrated Biological and Biotechnological Approach" used for Phytoremediation of dumping sites based on following parameters : -
 - Depending upon the quality of muck material, formulation of appropriate blends of organic waste and soil should be there to enhance the nutrient status of rhizosphere.
 - Isolation and screening of specialized strains of Mycorrhizal fungi, Rhizobium, Azotobacter and phosphate solubilizers (bio-fertilizers inoculum) suitable for the dumped material should be done.
 - Mass culture of plants specific biofertiliser and mycorrhizal, fungi shall be procured from soil conservation office. Deptt. of Agriculture, Govt. of Himachal Pradesh.
 - Plantation of dumping sites/areas using identified blend and bio fertilizer inoculum should be done.
- 4) Soil work and plantation technique:
 - No. of pits in disposal site should be decided for planting. Size of each pit can be taken as 0.6 m x 0.6m. Spacing between pits 2.5m x 2.0m is recommended. The excavated material from the pits to be mixed with 43.2 liters of external soil, 10 kg of apple peel and 5 kg of farmyard manure, and 2 kg of vermicompost.
 - The pit will be refilled with the mixture and 10-15 gm of mycorrhizal inoculum near the root system should be added.
 - After this, plant saplings already inoculated with biofertilizers (Rhizobium and Azotobacter bacteria) would be planted and refilling will be done to cover the entire plant root system.
 - Turfing (sodding) and suitable shrubs will be grown at slopes. At the initial stage 4-5 tufts of local grass to be planted per square meter.
 - About 5 cm of thick layer external soil will be spread on the slope area. Adequate amount of original soil should remain stuck to the roots of the grass tufts.
 - Before sowing, the area should be properly amended with the manure at the rate of 2 kg/meter square.
 - Water sprinkling arrangements should be made.
- 5) Species for Plantation:

Following species are the most suitable for plantation which will serve as Erosion control, phytoremediation, ornamental purpose:-

a) Plants suitable for erosion control / Phytoremediation :

Acacia catechu, *Alnus nitida*, *Alnus nepalensis*, *Acer palmatum*, *Broussonetia papyrifera*, *Salix denticulata*, *Pinus roxburghii*, *Rhododendron arboreum*, *Aesculus indica*, *Castanea sativa*, *Melia azadarach*, *Morus alba*, *Albizia lebeck*, *Ailanthus excelsa*, *Terminalia chebula*, *Bauhinia variegata*, *Betula alnoides*, *Robinia pseudo acassia*, *Acacia mollissima*, *Luecaena leucocephala*, *Acer caesium*, *Betula alnoides*, *Cedrus deodara*, *Populus ciliata*, *Pinus wallichiana*, *Quercus semecarpifolia*,

b) Herbs and grasses suggested for erosion control are:

Pioneer species – *Rumex hastatus* seed should be spread immediately then other herbs and grasses will follow like *Artemisia* species, *Mentha arvensis*, *Peristrophe speciosa*, *Amaranthus hybridus*, *Lotus corniculatus*, *Eriophorum comosum*, *Carex alpine*, *Trigonella corniculata*, *Salvia moorcroftiana*, *Cynodon sp.*, *Digitaria cruciata*, *Arundo donax*, etc.

c) Shrubs suitable for erosion control & ornamental purpose :

Salix elegans, Rosa spp., Hibiscus spp., Rubus species, Prinsepia utilis, Cotoneaster microphyllus, Desmodium elegans, Indigofera heterantha, Euphorbia royleana, Agave americana, Sorbaria tomentosa and Wikstroemia canescens, Berberis aristata, Bougainvillea, Carrisa karaunda, Desodium tiliifolium Dodonaea viscose, Elaeagnus umbellate, Ipomia Carnia, Murraya koenigii, Nerium odorum, Sassor vifolia, Vitex negundo, Withania somnifera, Xanthozylum alatum, Zizyphus numeralia

B) Iron Fencing

After plantation all dumping sites should be protected from grazing by the domestic as well as stray cattle. In order to protect from grazing by the stray cattle, the fencing over the muck deposits is required. Barbed wire strands with 2 diagonal strands, clamped to wooden/concrete posts placed 3 m. apart is proposed for this purpose. Both the ends of the wooden fence posts should be coated with coal tar to ensure longevity of the intervention.

Recommendations :

- The recommendations for smooth implementation of the Muck Disposal Plans are delineated below:
- Suggestions from the local population should be taken for smooth implementation of the Muck Disposal Plans and involved in its management.
- The efforts should be made to utilize maximum dumped material for the project activities and backfilling to avoid further environmental damage.
- Some watchmen/guards would be employed for protection and maintenance of sites for further five years. Their duties would include replacement of casualties, weeding, watering, repair of fence line, watch and guard the things, protect it from any further bad interventions etc.

Project authorities should ensure frequent meetings with the local community as well as the project team to enable smooth implementation of the Plan.

General references

1. S.O.763(E), [14/9/1999] - Dumping and disposal of fly ash discharged from coal or lignite based thermal power plants on land THE GAZETTE OF INDIA EXTRAORDINARY, PART II -- Section 3 -- Sub-section (ii) MINISTRY OF ENVIRONMENT AND FORESTS NOTIFICATION
2. Draft Notification on Fly Ash S.O.2623(E), [6/11/2008] - [Published in the Gazette of India, Extraordinary, Part II, Section 3, Subsection (ii)] MINISTRY OF ENVIRONMENT AND FORESTS NOTIFICATION
3. Environmental Impact Assessment and management plan for Rampur Hydropower project in H.P.-Final report July 2007.
4. Environmental Impact Assessment of Kol dam hydroelectric project
5. EIA and EMP report for integrated Kashang hydroelectric project (H.P)
6. EMP report of Bajoli Holi hydroelectric project (H.P)
7. EMP report of Tawang hydroelectric project (H.P)
8. EMP report of Dibang hydroelectric project