86 Road Constr Coy (GREF)
Pin 930 086
C/o 99 APO

211/Bharatmala/Pkg-VI/ 66 /E2

27 Jul 2022

**The CCF-cum-Nodal Officer,**
Forest Conservation Act (FCA),
Office of the Addl. Chief Secretary-cum-PCCF,
Forest and Environment Department,
Forest Secretariat, Deorali, Gangtok-737 102,
Government of Sikkim
Email: fca.sikkim@gmail.com

**CONSULTANCY SERVICE FOR CARRYING OUT FEASIBILITY STUDY, PREPERATION OF DETAILED PROJECT REPORT AND PROVIDING PRECONSTRUCTION SERVICES ON RESPECT OF UPGRADATION OF TWO LANE WITH PAVED SHOULDERS NH CONFIGURAION OF CORRIDORS UNDER BHARATMALA PROJECT, NH CONNECTIVITY TO BACKWARD AREAS /RELIGIOUS/TOURISTS PLACES OF THE COUNTRY AND ADB FUNDED PROJECTS IN THE STATE OF SIKKIM : MANGAN (310A) KODIYONG CHUNGTHANG – LACHUNG – YUMTHANG – YEME-SAMDONG BORDER & CHUNGTHANG – LACHEN MONASTERY LOG BRIDGE – MUGUTHANG & NAKU TO NAKULA IN STATE OF SIKKIM**

**Sub:** Diversion of 116.1 ha forest land for widening/upgradation of existing road (NH 310A) to NHDL specification with paved shoulder from Yumthang of Design km 52+808 to Yume Samdang Border (Zero point) of design 84.160 km by BRO in Sikkim.

Sir,

1. Refer: - (a) FC proposal no.: FP/SK/ROAD/154584/2022, dated 18 Apr 2022 for Diversion of forest land (116.1 ha).
(b) Observations raised by Nodal Officer received through E-mail on 26 Jun 2022.

2. Please refer to the above cited Forest clearance proposal details and the EDS given by the addressed good office dated 21/06/2022.In this regard, it is submitted the compliance of the said EDS for further processing of the FC proposal for PKG-I submitted on 21/06/2022.

3. The details of the compliance are as follows:

**a. COMPLIANCE FOR OBSERVATION No. 1: Site Inspection Report**
Report is already submitted vide Range Incharge, Lachung (Territorial) Range, Territorial Division, Mangan, Forest & Environment Department, Government of Sikkim vide letter no. 02/LTR dated 18.04.2022.

**b. COMPLIANCE FOR OBSERVATION No. 2: Muck Disposal Certificate and Plan**
Certificate and Report are submitted herewith as "ANNEXURE-I" and "ANNEXURE-II".

**c. COMPLIANCE FOR OBSERVATION No. 3: Village-wise Forest land breakup**
There is no revenue land found is confirmed by the Sub Divisional Magistrate, Sub Division Office, Chungthang, North Sikkim District, Govt. of Sikkim vide Memo no. 1049/SDO/GoS/C dated 16.02.2022.

As per the Site Inspection Report submitted by the Range Incharge, Lachung (Territorial) Range, Territorial Division, Mangan, Forest & Environment Department, Government of Sikkim vide letter no. 02/LTR dated 18.04.2022, the subject stretch (PKG-6) falls under Reserved Forest under Lachung Territorial Range, Forest & Environment Department, Government of Sikkim.

**Cont.../P2**

4. Importantly, it is to place before that the subject Forest Clearance proposal was submitted on 18.04.2022 after completion of Joint Site Inspection on 11th/12th/21st of December 2021 for the main project and 15th/21st/28th of March 2022 for Muck disposal/dumping area verification. Joint Site Inspection Report of the said visit was submitted to the concerned Divisional Forest Officer vide letter no. Ref. no. 02/LTR dated 18.04.2022 by the Range Incharge, Lachung(T) Range, Territorial Division, Mangan, Forest & Environment Department, Govt. of Sikkim.

5. It is requested to process the subject proposal at the earliest to enable us to commence the work in this alignment please.

(Vaibhav Srivastava)
Lt Col
Officer Commanding

**Encls:-** **Sheets**

**Copy to**:-

**O/o The Divisional Forest Officer**
Mangan
North Sikkim
Pin 737116 - For info please

**HQ CE (P) Swastik**
C/o 99 APO
Pin 931717 - For info please

**HQ 758 BRTF**
C/o 99 APO
Pin 930758 - For info please

**M/S EPTISA India Private Limited**
Unit 1203, 12th Floor, Tower-1,
PS Srijan Corporate Park, Plot No. 2,
Block EP & GP, Sector V, Salt Lake City
Kolkata – 700 091, (W.B)
E – Mail: Vsehgal@eptisa.com
saibalkumarbanerjee@eptisa.com
- For info w.r.t your letter No. EPTISA/BRO /DPR/22-23/Sikkim Pr.- 26 dated 14 Jul 2022 and EPTISA/BRO /DPR/22-23/Sikkim Pr.- 28 dated 15 Jul 2022 requested to liaise with state Govt for the further necessary action please.

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## Compliance for Essential Details Sought dated 21.06.2022 by Nodal Officer, FCA, Govt. of Sikkim

**COMPLIANCE FOR OBSERVATION No. 1:** Site Inspection Report

Site Inspection Report: Site Inspection Report was already being submitted and it is re-submitted which is jointly signed by the (vide Range Incharge, Lachung (Territorial) Range, Territorial Division, Mangan, Forest & Environment Department, Government of Sikkim vide letter no. 02/LTR dated 18.04.2022):

a. Sub-Division Magistrate, Land Revenue & Disasater Management Department, Chungthang, Government of Sikkim.
b. Divisional Forest Officer, North Territorial Forest Divsiion, Government of Sikkim
c. Range Officer In-Charge, Lachung Territorial Range, Forest and Environment Departmet, Government of Sikkim.
d. Assisstant Executive Engineer, Second-in-Commanding, 86 RCC(GREF), Ministry of Defence, Government of India.
e. Authorized representative of Eptisa India

**Requirement of any other Site Inspection Report can be received from the internal State Forest Department of Sikkim since all the documents are not shared with the User Agency by any office of the Forest Department / Comepetent Authority.**

**COMPLIANCE FOR OBSERVATION No. 2:** Muck Disposal Certificate and Plan

Muck Disposal Certificate and Plan **(copy Enclosed herewith as "ANNEXURE - I" & "ANNEXURE-II")** are submitted herewith. The Muck Disposal Site Inspection Report is already being signed by the:

a. Sub-Division Magistrate, Land Revenue & Disasater Management Department, Chungthang, Government of Sikkim.
b. Divisional Forest Officer, North Territorial Forest Divsiion, Government of Sikkim
c. Range Officer In-Charge, Lachung Territorial Range, Forest and Environment Departmet, Government of Sikkim.
d. Assisstant Executive Engineer, Second-in-Commanding, 86 RCC(GREF), Ministry of Defence, Government of India.
e. Authorized representative of Eptisa India

**COMPLIANCE FOR OBSERVATION No. 3:** Village-wise Forest land breakup

As per the Site Inspection Report submitted by the Range Incharge, Lachung (Territorial) Range, Territorial Division, Mangan, Forest & Environment Department, Government of Sikkim vide letter no. 02/LTR dated 18.04.2022 **(copy Enclosed herewith),** there are no village(s) present along the said PKG-6 proposed alignment (Yumthang to Yumesamdaong Border). **The subject stretch (PKG-6) falls**



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(Environmental Expert)

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**under Reserved Forest under Lachung Territorial Range, Forest & Environment Department, Government of Sikkim.**

There is no revenue land found within said proposed road alignment is also confirmed by the Sub Divisional Magistrate, Sub Division Office, Chungthang, North Sikkim District, Govt. of Sikkim vide Memo no. 1049/SDO/GoS/C dated 16.02.2022 **(which was already being submitted and copy is re-enclosed herewith).**

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# MUCK DISPOSAL CERTIFICATE

This is to certify that nine (9) Muck Disposal Site(s) are selected by the State Forest & Revenue Department of Sikkim with a total area of 28.94 ha for dumping the surplus muck proposed to be generated for the **"WIDENING OF EXISTING ROAD (NH 310A) TO NHDL SPECIFICATION WITH PAVED SHOULDER FROM YUMTHANG OF DESIGN KM 52+808 TO YUME SAMGDANG OF DESIGN KM 84+160 IN THE STATE OF SIKKIM UNDER PROJECT SWASTIK OF BRO"**. The entire stretch falls under forest land. All the Muck Disposal Site(s) are selected in Forest Land and therefore the same has been incorporated in the Forest Clearance proposal. The diversion point GPS co-ordinates are given below and further detail plan is given in the Muck Disposal Plan Report.

| **Muck Disposal Site** | | |
|---|---|---|
| **Site no. 01** | | |
| **Area** | 2.0203 ha | |
| **Perimeter** | 732.765 m | |
| **Altitude** | 3635 m | |
| **Vegetation** | **Tree** | Nil |
| | **Shrubs** | Nil |
| | **Herbs** | Primula, Chushing Hambu |
| **GPS location no.** | **Longitude** | **Latitude** |
| A | 88° 42' 5.55" E | 27° 48' 45.54" N |
| B | 88° 42' 6.88" E | 27° 48' 43.94" N |
| C | 88° 42' 9.01" E | 27° 48' 39.14" N |
| D | 88° 42' 8.68" E | 27° 48' 38.03" N |
| E | 88° 42' 8.95" E | 27° 48' 36.94" N |
| F | 88° 42' 9.51" E | 27° 48' 36.13" N |
| G | 88° 42' 7.76" E | 27° 48' 35.44" N |
| H | 88° 42' 6.36" E | 27° 48' 36.65" N |
| I | 88° 42' 5.62" E | 27° 48' 37.75" N |
| J | 88° 42' 5.59" E | 27° 48' 38.96" N |
| K | 88° 42' 5.77" E | 27° 48' 40.3" N |
| | | |

| **Muck Disposal Site** | | |
|---|---|---|
| **Site no. 02** | | |
| **Area** | 1.0018 ha | |
| **Perimeter** | 400.6026 m | |
| **Altitude** | 3868 m | |
| **Vegetation** | **Tree** | Silver fir poles 8 nos |
| | **Shrubs** | Rhododendron campanulatum, R. nivale, R. setosum, Salix sps |
| | **Herbs** | Primula, Chushing Hambu, Gaultheria sps. |
| **GPS location no.** | **Longitude** | **Latitude** |
| A | 88° 41' 34.9" E | 27° 50' 41.1" N |



Muck Disposal Certificate

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| | | |
|---|---|---|
| B | 88° 41' 36.29" E | 27° 50' 41.07" N |
| C | 88° 41' 36.71" E | 27° 50' 40.4" N |
| D | 88° 41' 38.04" E | 27° 50' 40.06" N |
| E | 88° 41' 38.63" E | 27° 50' 39.6" N |
| F | 88° 41' 39.62" E | 27° 50' 38.43" N |
| G | 88° 41' 39.11" E | 27° 50' 37.79" N |
| H | 88° 41' 38.53" E | 27° 50' 37.44" N |
| I | 88° 41' 37.24" E | 27° 50' 37.12" N |
| J | 88° 41' 35.6" E | 27° 50' 38.34" N |
| K | 88° 41' 35.46" E | 27° 50' 38.65" N |
| L | 88° 41' 35.66" E | 27° 50' 40.38" N |
| | | |

**Muck Disposal Site**

**Site no. 03**

| | | |
|---|---|---|
| **Area** | 0.9937 ha | |
| **Perimeter** | 551.1077 m | |
| **Altitude** | 3975 m | |
| **Vegetation** | **Tree** | Saur poles 8 nos |
| | **Shrubs** | Rhododendron campanulatum, R. nivale, R. setosum, Salix sps |
| | **Herbs** | Primula, Chushing Hambu, Gaultheria sps., Rumex sps. |

| **GPS location no.** | **Longitude** | **Latitude** |
|---|---|---|
| A | 88°41'36.04" E | 27°51'04.56" N |
| B | 88°41'37.17" E | 27°51'05.54" N |
| C | 88°41'38.02" E | 27°51'05.82" N |
| D | 88°41'38.04" E | 27°51'05.05" N |
| E | 88°41'38.81" E | 27°51'03.09" N |
| F | 88°41'39.11" E | 27°51'03.09" N |
| G | 88°41'39.41" E | 27°51'01.34" N |
| H | 88°41'37.97" E | 27°50'59.02" N |
| I | 88°41'36.93" E | 27°50'58.93" N |
| J | 88°41'36.12" E | 27°50'59.51" N |
| K | 88°41'37.98" E | 27°51'01.39" N |
| L | 88°41'37.46" E | 27°51'03.07" N |
| | | |

**Muck Disposal Site**

**Site no. 04**

| | |
|---|---|
| **Area** | 2.0279 ha |
| **Perimeter** | 614.8997 m |
| **Altitude** | 4074 m |



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| | | |
|---|---|---|
| Vegetation | Tree | Saur fir poles 7 nos |
| | Shrubs | Rhododendron campanulatum, R. nivale, R. setosum, R. anthopogon, Juniper sps. Salix sps |
| | Herbs | Primula, Chushing Hambu, Gaultheria sps., Rumex sps. |
| GPS location no. | Longitude | Latitude |
| A | 88° 41' 39.43" E | 27° 51' 31.72" N |
| B | 88° 41' 41.09" E | 27° 51' 32.04" N |
| C | 88° 41' 41.24" E | 27° 51' 30.32" N |
| D | 88° 41' 40.83" E | 27° 51' 28.83" N |
| E | 88° 41' 40.79" E | 27° 51' 26.91" N |
| F | 88° 41' 40.21" E | 27° 51' 24.74" N |
| G | 88° 41' 37.96" E | 27° 51' 24.29" N |
| H | 88° 41' 37.43" E | 27° 51' 25.33" N |
| I | 88° 41' 37.01" E | 27° 51' 26.62" N |
| J | 88° 41' 37.37" E | 27° 51' 27.65" N |
| K | 88° 41' 37.25" E | 27° 51' 28.18" N |
| L | 88° 41' 38.17" E | 27° 51' 30.11" N |
| | | |
| | | |

| Muck Disposal Site | | |
|---|---|---|
| Site no. 05 | | |
| Area | 2.0187 ha | |
| Perimeter | 563.3169 m | |
| Altitude | 4188 m | |
| Vegetation | Tree | Nil |
| | Shrubs | Rhododendron aeruginosum, R. anthopogon, R. setosum, Salix sps, Siris |
| | Herbs | Primula, Chushing Hambu, Gaultheria sps., Rumex sps., Kutki, Jatamansi, Thotney |
| GPS location no. | Longitude | Latitude |
| A | 88° 41' 37.02" E | 27° 51' 51.61" N |
| B | 88° 41' 40.01" E | 27° 51' 52.61" N |
| C | 88° 41' 40.18" E | 27° 51' 52.01" N |
| D | 88° 41' 40.58" E | 27° 51' 51.59" N |
| E | 88° 41' 40.93" E | 27° 51' 50.82" N |
| F | 88° 41' 41.62" E | 27° 51' 48.86" N |
| G | 88° 41' 42.25" E | 27° 51' 48.36" N |



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| | | |
|---|---|---|
| H | 88° 41' 42.03" E | 27° 51' 47.04" N |
| I | 88° 41' 39.85" E | 27° 51' 46.62" N |
| J | 88° 41' 37.06" E | 27° 51' 47.63" N |
| K | 88° 41' 37.53" E | 27° 51' 48.48" N |
| L | 88° 41' 37.44" E | 27° 51' 48.09" N |
| | | |

**Muck Disposal Site**

**Site no. 06**

| | | |
|---|---|---|
| **Area** | 5.0196 ha | |
| **Perimeter** | 1040.2187 m | |
| **Altitude** | 4427 m | |
| **Vegetation** | **Tree** | Nil |
| | **Shrubs** | Rhododendron anthopogon, R. aeruginosum, R. nivale, R. setosum, Salix sps. |
| | **Herbs** | Primula, Chushing Hambu, Gaultheria sps., Blue poppy, Jatamansi, Kutki, Thotney |

| **GPS location no.** | **Longitude** | **Latitude** |
|---|---|---|
| A | 88° 42' 04.60" E | 27° 53' 03.59" N |
| B | 88° 42' 06.28" E | 27° 53' 02.81" N |
| C | 88° 42' 06.93" E | 27° 53' 02.01" N |
| D | 88° 42' 06.83" E | 27° 53' 00.31" N |
| E | 88° 42' 05.79" E | 27° 52' 58.64" N |
| F | 88° 42' 03.09" E | 27° 52' 54.40" N |
| G | 88° 42' 01.97" E | 27° 52' 52.31" N |
| H | 88° 42' 00.03" E | 27° 52' 50.62" N |
| I | 88° 41' 56.62" E | 27° 52' 53.95" N |
| J | 88° 41' 57.53" E | 27° 52' 54.64" N |
| K | 88° 41' 59.28" E | 27° 52' 56.37" N |
| L | 88° 42' 01.34" E | 27° 52' 58.36" N |
| | | |

**Muck Disposal Site**

**Site no. 07**

| | | |
|---|---|---|
| **Area** | 5.0830 ha | |
| **Perimeter** | 1157.2079 m | |
| **Altitude** | 4518 m | |
| **Vegetation** | **Tree** | Nil |
| | **Shrubs** | Rhododendron anthopogon, R. aeruginosum, R. nivale, R. setosum, Salix sps. |



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| | | |
|---|---|---|
| | **Herbs** | Primula, Chushing Hambu, Gaultheria sps., Blue poppy, Jatamansi, Kutki, Thotney |
| **GPS location no.** | **Longitude** | **Latitude** |
| A | 88° 42' 23.20" E | 27° 53' 58.58" N |
| B | 88° 42' 23.91" E | 27° 53' 58.61" N |
| C | 88° 42' 25.21" E | 27° 53' 56.98" N |
| D | 88° 42' 25.89" E | 27° 53' 56.19" N |
| E | 88° 42' 27.35" E | 27° 53' 55.01" N |
| F | 88° 42' 26.55" E | 27° 53' 53.05" N |
| G | 88° 42' 25.67" E | 27° 53' 50.45" N |
| H | 88° 42' 27.21" E | 27° 53' 44.42" N |
| I | 88° 42' 25.17" E | 27° 53' 42.83" N |
| J | 88° 42' 22.45" E | 27° 53' 47.20" N |
| K | 88° 42' 21.35" E | 27° 53' 49.80" N |
| L | 88° 42' 21.47" E | 27° 53' 53.21" N |
| | | |

**Muck Disposal Site** **Site no. 08**

| | | |
|---|---|---|
| **Area** | 3.4954 ha | |
| **Perimeter** | 715.2094 m | |
| **Altitude** | 4575 m | |
| **Vegetation** | **Tree** | Nil |
| | **Shrubs** | Rhododendron anthopogon,R. nivale, R. setosum, Salix sps. |
| | **Herbs** | Primula, Chushing Hambu, Gaultheria sps., Blue poppy, Jatamansi, Kutki, Gentiana ornata, Cossipore fastigiata, Rheum nobile |
| **GPS location no.** | **Longitude** | **Latitude** |
| A | 88° 42' 28.45" E | 27° 54' 29.50" N |
| B | 88° 42' 29.90" E | 27° 54' 29.54" N |
| C | 88° 42' 30.52" E | 27° 54' 29.31" N |
| D | 88° 42' 31.47" E | 27° 54' 27.91" N |
| E | 88° 42' 32.08" E | 27° 54' 26.26" N |
| F | 88° 42' 31.60" E | 27° 54' 23.91" N |
| G | 88° 42' 31.95" E | 27° 54' 22.15" N |
| H | 88° 42' 31.15" E | 27° 54' 21.06" N |
| I | 88° 42' 28.63" E | 27° 54' 21.34" N |
| J | 88° 42' 25.95" E | 27° 54' 24.40" N |
| K | 88° 42' 25.52" E | 27° 54' 25.61" N |
| L | 88° 42' 26.78" E | 27° 54' 28.12" N |



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| Muck Disposal Site | | |
|---|---|---|
| | | Site no. 09 |
| Area | 7.2841 ha | |
| Perimeter | 1050.8415 m | |
| Altitude | 4722 m | |
| Vegetation | Tree | Nil |
| | Shrubs | Rhododendron anthopogon,R. nivale, R. setosum |
| | Herbs | Primula, Chushing Hambu, Gaultheria sps., Blue poppy, Jatamansi, Kutki, Thotney, Gentiana ornata, Cossipore fastigiata, Rheum nobile |
| GPS location no. | Longitude | Latitude |
| A | 88° 43' 58.50" E | 27° 56' 04.44" N |
| B | 88° 44' 04.80" E | 27° 56' 04.22" N |
| C | 88° 44' 07.34" E | 27° 56' 01.96" N |
| D | 88° 44' 07.84" E | 27° 56' 01.00" N |
| E | 88° 44' 06.86" E | 27° 55' 59.60" N |
| F | 88° 44' 05.04" E | 27° 55' 58.21" N |
| G | 88° 44' 03.35" E | 27° 55' 56.21" N |
| H | 88° 43' 59.17" E | 27° 55' 53.44" N |
| I | 88° 43' 56.70" E | 27° 55' 57.70" N |
| J | 88° 43' 55.62" E | 27° 56' 00.52" N |
| K | 88° 43' 55.88" E | 27° 56' 01.72" N |
| L | 88° 43' 57.99" E | 27° 56' 03.44" N |



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# MUCK DISPOSAL PLAN

July 2022

**CONSULTANCY SERVICES FOR CARRYING OUT FEASIBILITY STUDY, PREPARATION OF DETAILED PROJECT REPORT AND PROVIDING PRECONSTRUCTION SERVICES ON RESPECT OF UP GRADATION TO TWO LANE WITH PAVED SHOULDERS NH CONFIGURATION OF CORRIDORS UNDER BHARATMALA PROJECT, NH CONNECTIVITY TO BACKWARD AREAS/ RELIGIOUS/ TOURIST PLACES OF THE COUNTRY AND ADB FUNDED PROJECTS IN THE STATE OF SIKKIM : MANGAN (NH310A) KODIYONG - CHUNGTHANG - LACHUNG - YUMTHANG-YUME – SAMDANG BORDER & CHUNGTHANG - LACHEN MONASTERY LOG BRIGDE - MUGUTHANG & NAKU TO NAKPOLATOK - NAKULA" IN THE STATE OF SIKKIM**

Yumthang of Design km 52+808 to Yume Samdang Border (Zero point) of design 84.160 km: PACKAGE-VI

Prepared by EPTISA Servicios de Ingenieria,S.L.,(DPR Consultant) for Border Roads Organization under Ministry of Defence, Government of India

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Officer Commanding
86 RCC (GREF)



(Mr. Som Prakash Mitra)
(Environmental Expert)

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Officer Commanding
86 RCC (GREF)



(Mr. Som Prakash Mittal)
(Environmental Expert)

# 1.0 MUCK DISPOSAL PLAN

## 1.1 GENERAL

A large quantity of muck is expected to be generated as a result of tunneling operations, construction of roads, etc. Muck generated from excavation of any project component is required to be disposed in a planned manner so that it takes a least possible space and is not hazardous to the environment. The muck disposal sites cause increased sedimentation in the rivers (though insignificant compared to natural sedimentation) and totally spoils the visual aesthetics of the area. It is of prime importance that these sites will have to be rehabilitated as soon as the disposal sites are full.

Muck generally lacks nutrients and therefore, are difficult to re-vegetate. However, if no attempts to vegetate the slopes are made, the muck could slide further lower down during rain and may eventually wash off other trees and structures. Since, top soils are not available in large quantities in Himalayas, it may not be possible to apply a thin layer of soil over the muck. Bio-fertiliser technique developed by National Environmental Engineering Research Institute (NEERI) can be adopted in this project.

## 1.2 MUCK GENERATION

Based on the geological nature of the rocks and engineering properties of the soil, a part of the muck generated can be used as construction material. The balance needs to be suitably disposed. Normally, muck is disposed in low-lying areas or depressions. Trees, if any, are cut before muck disposal, however, shrubs, grass or other types of undergrowth in the muck disposal at sites perish. The muck disposal sites will be suitably stabilized on completion of the muck disposal.

a. Muck disposal can lead to impacts on various aspects of environment. Normally, the land is cleared before muck disposal. During clearing operation, trees are cut, but undergrowth perishes as a result of muck disposal.

b. In many of the sites, muck is stacked without adequate stabilization measures. In such a scenario, the muck moves along with runoff and creates landslide like situations. Many a times, boulders/large stone pieces enter the river/water body, affecting the benthic fauna, fisheries and other components of aquatic biota.

c. The increased vehicular movement near muck disposal site leads to adverse impacts on ambient air quality as well. However, increase in vehicular traffic is not significant to cause major impact on ambient air quality.

d. Normally muck disposal is done at low-lying areas, which gets filled up due to stacking of muck. This can sometimes affect the natural drainage pattern of the area leading to accumulation of water or partial flooding of some area, which can provide ideal breeding habitat for mosquitoes.

Thus, it is necessary to develop a proper muck disposal plan for amelioration of above referred impacts.

## 1.3 METHODOLOGY OF MUCK DISPOSAL

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



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(Environmental Expert)

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a. To protect and control soil erosion
b. To create greenery in the muck disposal areas
c. To improve and develop the sites into recreational sites
d. To ensure maximum utilization of muck for the construction purpose
e. 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.

During identification of the dumping sites, above-mentioned aspects have been kept in mind. All possible alternate sites have been inspected and examined before rejecting or selecting any site. All the dumping sites adhere to the following points:

a. All the dumping sites have minimum possible forest cover.
b. At all the dumping sites, the settlement areas are far away from the identified dumping sites so as to have least impact on human life,
c. The proposed dumping sites are located at a distance varying from 30m to 40m away from the HFL (highest flood level) of rivers.
d. Muck disposal sites are close to the sites from where muck is to be generated to avoid hazards related to transport of muck to long distances.
e. Approach road(s) suitable for construction truck movment are present to reach the muck dumping site(s).
f. Water reservior(s), natural stream(s) are not present in the selected site(s) and are far beyond 70m to 90m.

## 1.4 MUCK DUMPING SITE

The total excavation quantity likely to be generated for PKG-VI project will be around 17,28,649 cum. Approximately 4,43,513 cum of generated muck will be used as construction material and remaining 13,29,730 cum (including 30% swelling factor and over break of 3,98,919 cum) will be disposed off at 09 (Nine) muck disposal sites in Reserved Forest under Lachung Territorial Range, Forest & Environment Department, Government of Sikkim. However, the capacity of the 09 (Nine) dumping sites is calculated approximatedly as 17,28,649 cum. The detail has been tabulated in the bellow table:

| Cut volume tentative (cum) | Fill volume tentative (cum) | Surplus volume tentative (cum) (incl. swelling factor of 30%) | Total Area required under PKG-I tentative (ha) | Muck Dumping Site Area identified in Revenue Block under Mangan Sub Division (in ha) | | Capacity of Muck Dumping Site tentative (cum) |
|---|---|---|---|---|---|---|
| 17,73,243.00 | 4,43,513.00 | 17,28,649.00 | 28.811 | Total Area (ha) | **28.94** | 17,36,388.9507 |
| | | | | Total plot (nos) | **9** | |

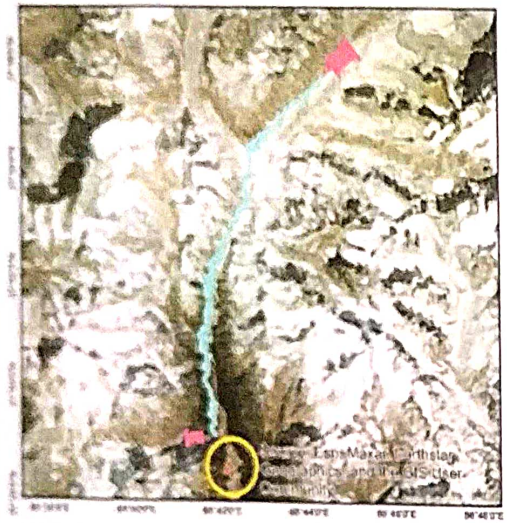
## 1.5 SELECTED MUCK DUMPING SITE

The Departmental Joint Site Insepection was conducted on 11.12.2021, 12.12.2021, 21.12.2021 for the main project and 15.03.2022, 21.03.2022 and 28.03.2022 in order to identify suitable Muck Dumping Site. 09 plots in Reserved Forest under Lachung Territorial Range were identified of total 28.94 ha area under Lachung Territorial Forest Range. The detail boundary of each Muck Dumping Site along with its contour prois presented in later sub-para along with copy of No Objection Certificate received from concerned authorities & owner(s). All the plots fall in Reserved Forest under Lachung Territorial Range, Forest & Environment Department, Government of Sikkim



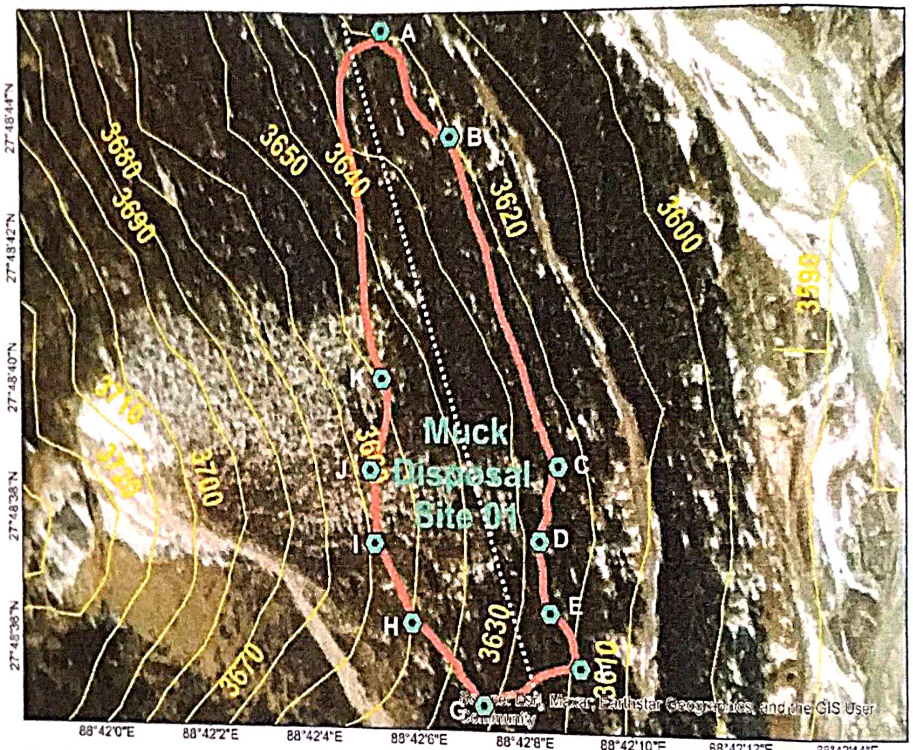
eptsa
(Mr. Som Prakash Mitra)
(Environmental Expert)

Lt Col
Officer Commanding
86 RCC (GREF)

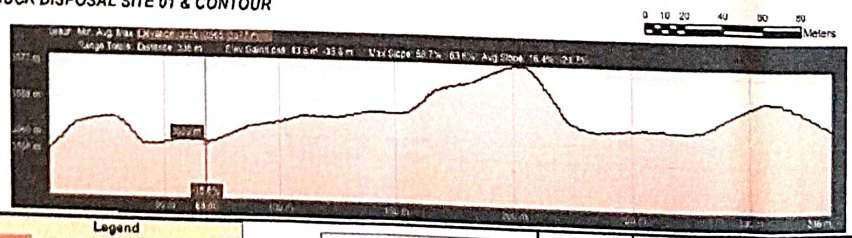


ROW and Muck Disposal Site 01

| Muck Disposal Site | | |
|---|---|---|
| | | Site no. 01 |
| Area | 2.0203 ha | |
| Perimeter | 732.765 m | |
| GPS location no. | Longitude | Latitude |
| A | 88° 42' 5.55" E | 27° 48' 45.54" N |
| B | 88° 42' 6.88" E | 27° 48' 43.94" N |
| C | 88° 42' 9.01" E | 27° 48' 39.14" N |
| D | 88° 42' 8.68" E | 27° 48' 38.03" N |
| E | 88° 42' 8.95" E | 27° 48' 36.94" N |
| F | 88° 42' 9.51" E | 27° 48' 36.13" N |
| G | 88° 42' 7.76" E | 27° 48' 35.44" N |
| H | 88° 42' 6.36" E | 27° 48' 36.65" N |
| I | 88° 42' 5.62" E | 27° 48' 37.75" N |
| J | 88° 42' 5.59" E | 27° 48' 38.96" N |
| K | 88° 42' 5.77" E | 27° 48' 40.3" N |




MUCK DISPOSAL SITE 01 & CONTOUR




**SIKKIM**

PKG-6: Yumthang to Yume Sangdang Road From 52+808 km to 84+160 km

Client: Border Roads Organization

Legend
- Muck Disposal Site 01
- Proposed Right of Way (P-6)
- Muck Disposal Site 01 Contour Line

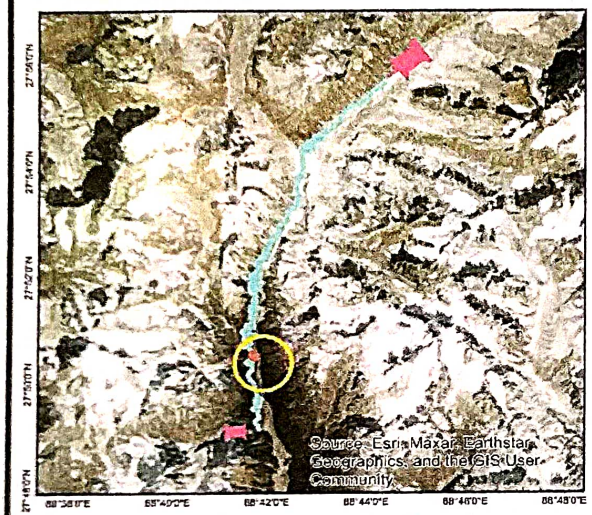
Som Prakash Mitra
Environmental Expert

| Muck Disposal Site 01 | |
|---|---|
| Drawn By: | SOM PRAKASH MITRA |
| Designation: | ENVIRONMENTAL EXPERT |
| Sheet No. | SK/ZM/20220708-M1-1.1 |
| Date: | 08-07-2022 |



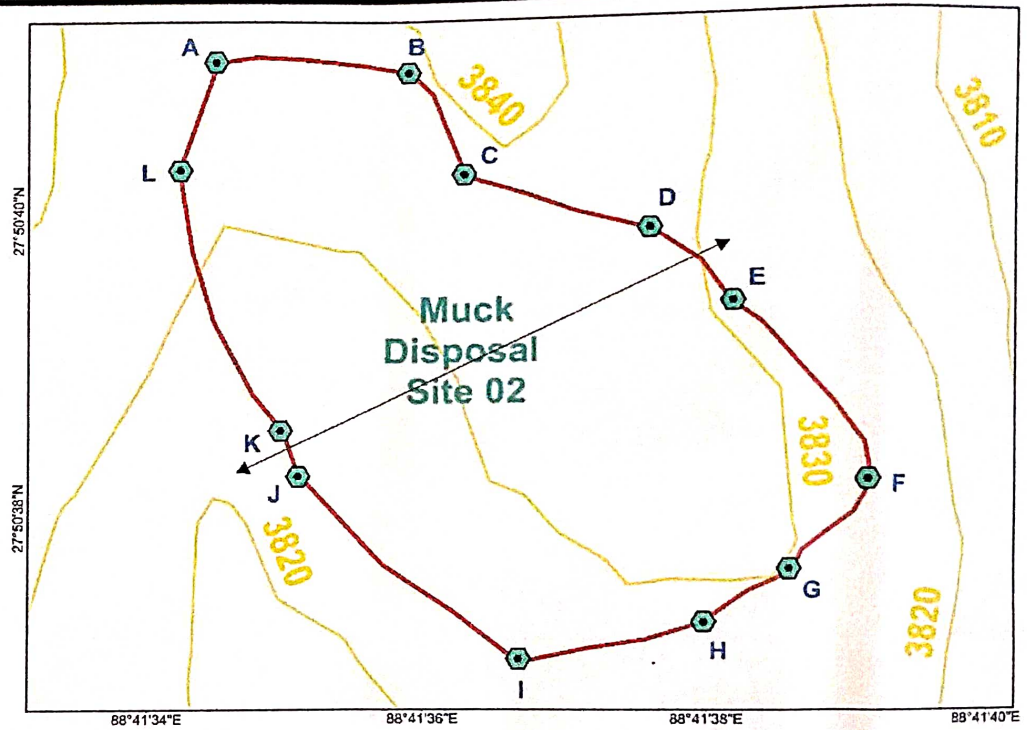
(Mr. Som Prakash Mitra)
(Environmental Expert)

Lt Col
Officer Commanding
86 RCC (GREF)

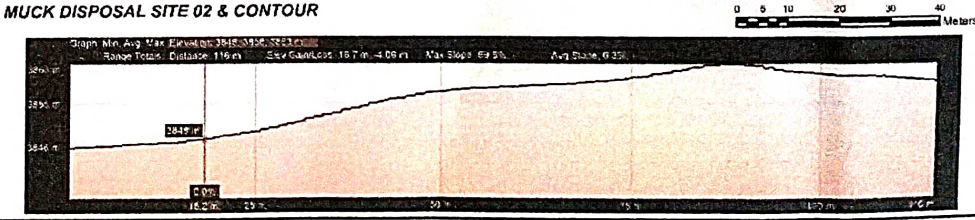



PRoW and Muck Disposal Site 02

| Muck Disposal Site | | |
|---|---|---|
| | Site no. 02 | |
| Area | 1.0018 ha | |
| Perimeter | 400.6026 m | |
| GPS location no. | Longitude | Latitude |
| A | 88° 41' 34.9" E | 27° 50' 41.1" N |
| B | 88° 41' 36.29" E | 27° 50' 41.07" N |
| C | 88° 41' 36.71" E | 27° 50' 40.4" N |
| D | 88° 41' 38.04" E | 27° 50' 40.06" N |
| E | 88° 41' 38.63" E | 27° 50' 39.6" N |
| F | 88° 41' 39.62" E | 27° 50' 38.43" N |
| G | 88° 41' 39.11" E | 27° 50' 37.79" N |
| H | 88° 41' 38.53" E | 27° 50' 37.44" N |
| I | 88° 41' 37.24" E | 27° 50' 37.12" N |
| J | 88° 41' 35.6" E | 27° 50' 38.34" N |
| K | 88° 41' 35.46" E | 27° 50' 38.65" N |
| L | 88° 41' 35.66" E | 27° 50' 40.38" N |




MUCK DISPOSAL SITE 02 & CONTOUR




**SIKKIM**
PKG-6: Yumthang to Yume
Sangdang Road From 52+808 km
to 84+160 km
Client: Border Roads Organization

Legend
Muck Disposal Site 02
Proposed Right of Way (P-6)
Muck Disposal Site 02
Contour Line

Som Prakash Mitra
Environmental Expert

| Muck Disposal Site 02 | |
|---|---|
| Drawn By: | SOM PRAKASH MITRA |
| Sheet No. SK/ZM/ 20220711-M2-1.2 | Designation: ENVIRONMENTAL EXPERT |
| | Date: 11-07-2022 |



(Mr. Som Prakash Mitra)
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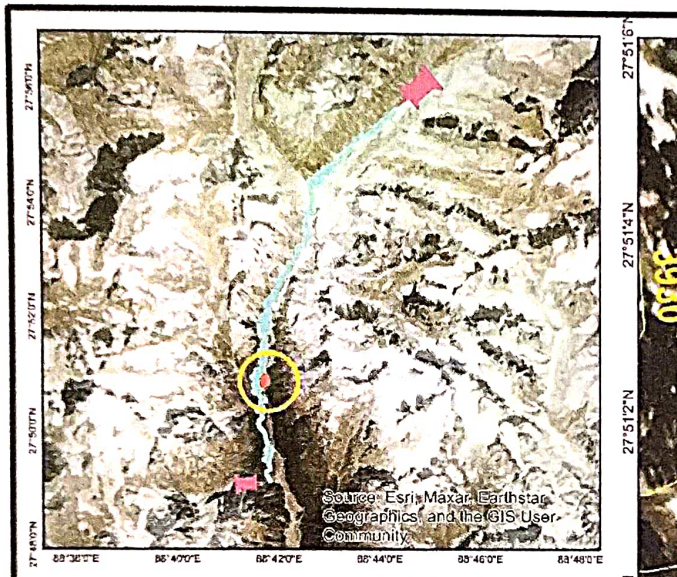
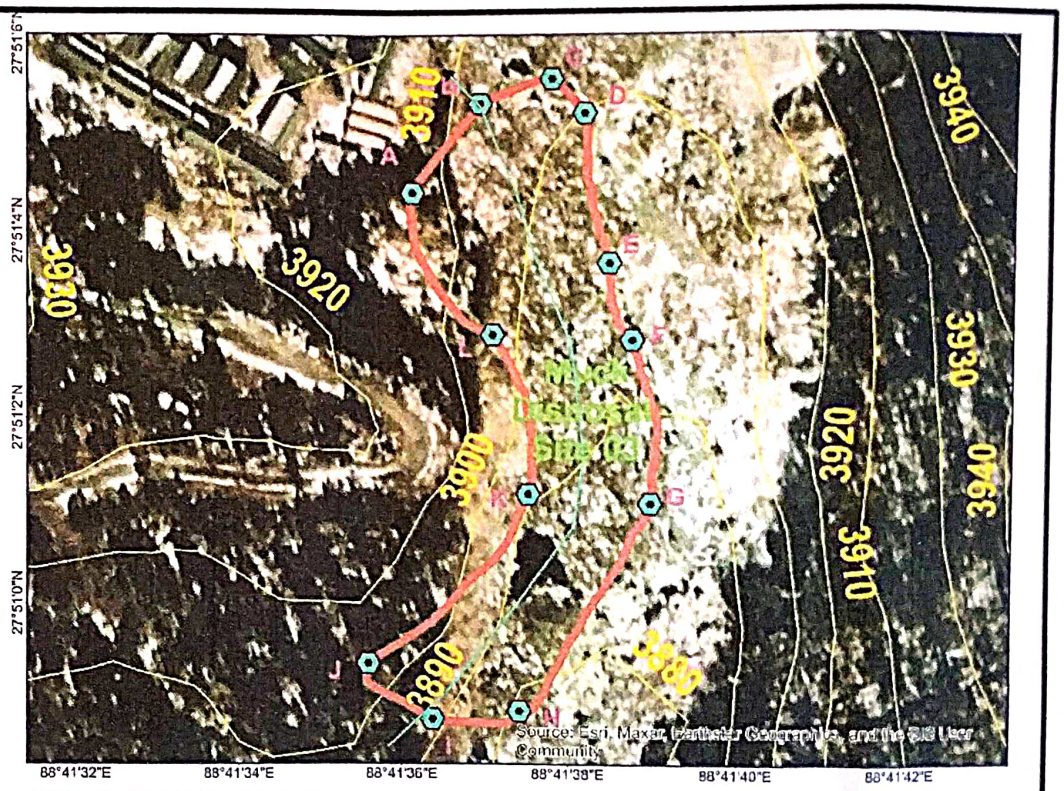
Lt Col
Officer Commanding
86 RCC (GREF)

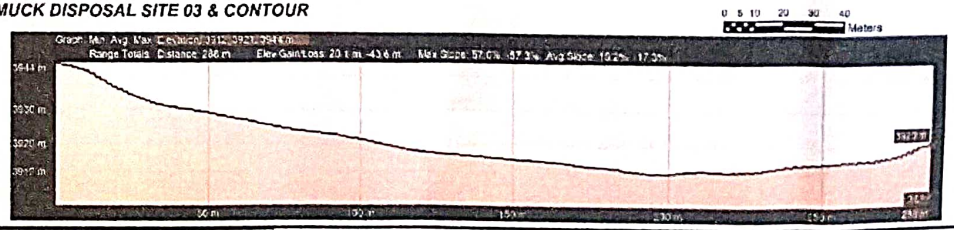



*PRoW and Muck Disposal Site 03*

| Muck Disposal Site | | |
|---|---|---|
| | | Site no. 03 |
| Area | 0.9937 ha | |
| Perimeter | 551.1077 m | |
| GPS location no. | Longitude | Latitude |
| A | 88°41'36.04" E | 27°51'04.56" N |
| B | 88°41'37.17" E | 27°51'05.54" N |
| C | 88°41'38.02" E | 27°51'05.82" N |
| D | 88°41'38.04" E | 27°51'05.05" N |
| E | 88°41'38.81" E | 27°51'03.09" N |
| F | 88°41'39.11" E | 27°51'03.09" N |
| G | 88°41'39.41" E | 27°51'01.34" N |
| H | 88°41'37.97" E | 27°50'59.02" N |
| I | 88°41'36.93" E | 27°50'58.93" N |
| J | 88°41'36.12" E | 27°50'59.51" N |
| K | 88°41'37.98" E | 27°51'01.39" N |
| L | 88°41'37.46" E | 27°51'03.07" N |




*MUCK DISPOSAL SITE 03 & CONTOUR*




**SIKKIM**
PKG-6: Yumthang to Yume
Sangdang Road From 52+808 km
to 84+160 km
Client: Border Roads Organization

Legend
Muck Disposal Site 03
Proposed Right of Way (P-6)
Muck Disposal Site 03
Contour Line

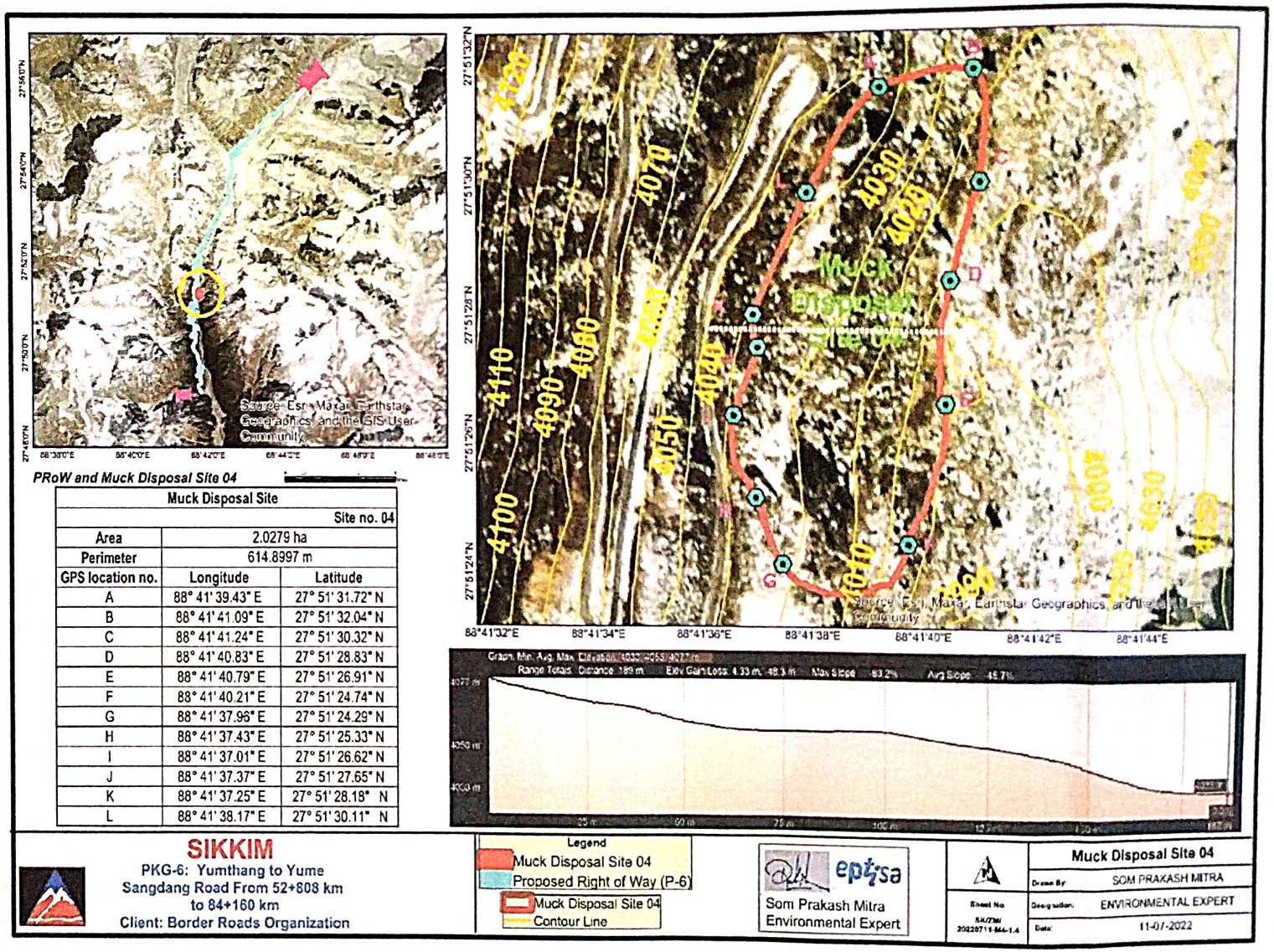
Som Prakash Mitra
Environmental Expert

| Muck Disposal Site 03 | |
|---|---|
| Drawn By: | SOM PRAKASH MITRA |
| Designation: | ENVIRONMENTAL EXPERT |
| Sheet No: SK/ZM/20220711-M3-1.3 | Date: 11-07-2022 |



(Mr. Som Prakash Mitra)
(Environmental Expert)

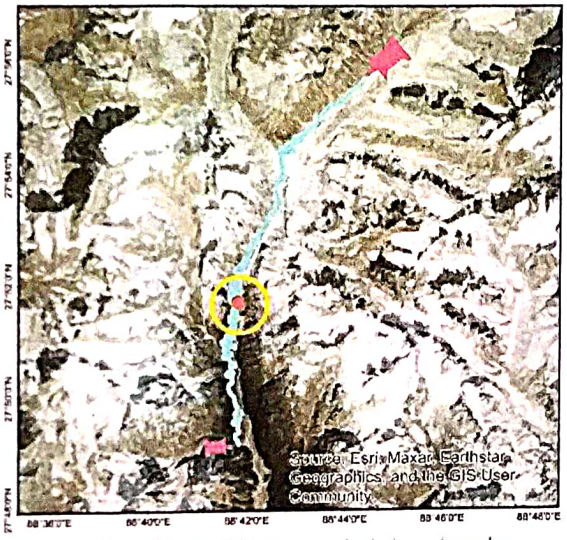
Lt Col
Officer Commanding
86 RCC (GREF)






(Mr. Som Prakash Mitra)
(Environmental Expert)

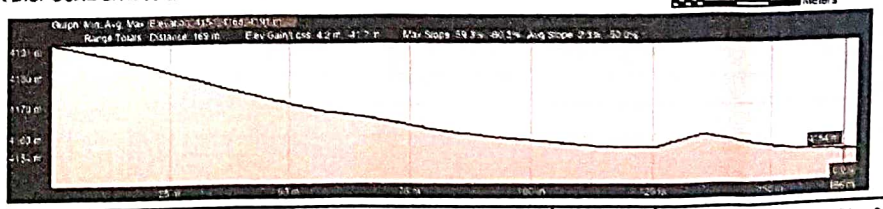
Lt Col
Officer Commanding
86 RCC (GREF)




PRoW and Muck Disposal Site 05

| Muck Disposal Site | | |
|---|---|---|
| | | Site no. 05 |
| Area | 2.0187 ha | |
| Perimeter | 568.3169 m | |
| GPS location no. | Longitude | Latitude |
| A | 88° 41' 37.02" E | 27° 51' 52.61" N |
| B | 88° 41' 40.01" E | 27° 51' 52.61" N |
| C | 88° 41' 40.18" E | 27° 51' 52.01" N |
| D | 88° 41' 40.58" E | 27° 51' 51.59" N |
| E | 88° 41' 40.93" E | 27° 51' 50.82" N |
| F | 88° 41' 41.62" E | 27° 51' 48.86" N |
| G | 88° 41' 42.25" E | 27° 51' 48.36" N |
| H | 88° 41' 42.03" E | 27° 51' 47.04" N |
| I | 88° 41' 39.85" E | 27° 51' 46.62" N |
| J | 88° 41' 37.06" E | 27° 51' 47.63" N |
| K | 88° 41' 37.53" E | 27° 51' 48.48" N |
| L | 88° 41' 37.44" E | 27° 51' 48.09" N |


MUCK DISPOSAL SITE 05 & CONTOUR




**SIKKIM**
PKG-6: Yumthang to Yume Sangdang Road From 52+808 km to 84+160 km
Client: Border Roads Organization

Legend
Muck Disposal Site 05
Proposed Right of Way (P-6)
Muck Disposal Site 05 Contour Line

eptisa
Som Prakash Mitra
Environmental Expert

| Muck Disposal Site 05 | |
|---|---|
| Drawn By: | SOM PRAKASH MITRA |
| Designation: | ENVIRONMENTAL EXPERT |
| Date: | 11-07-2022 |



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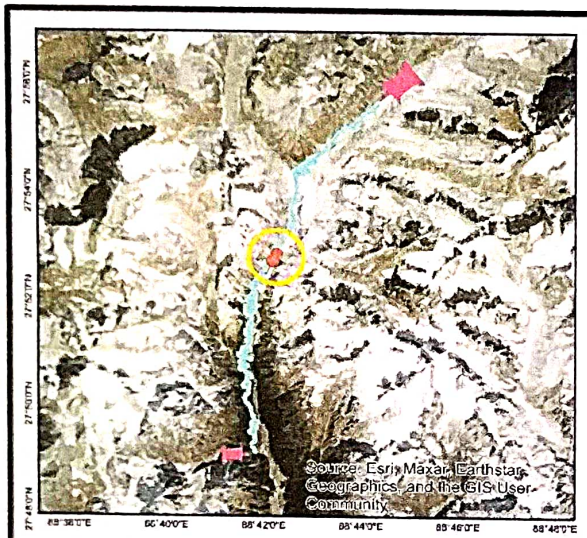
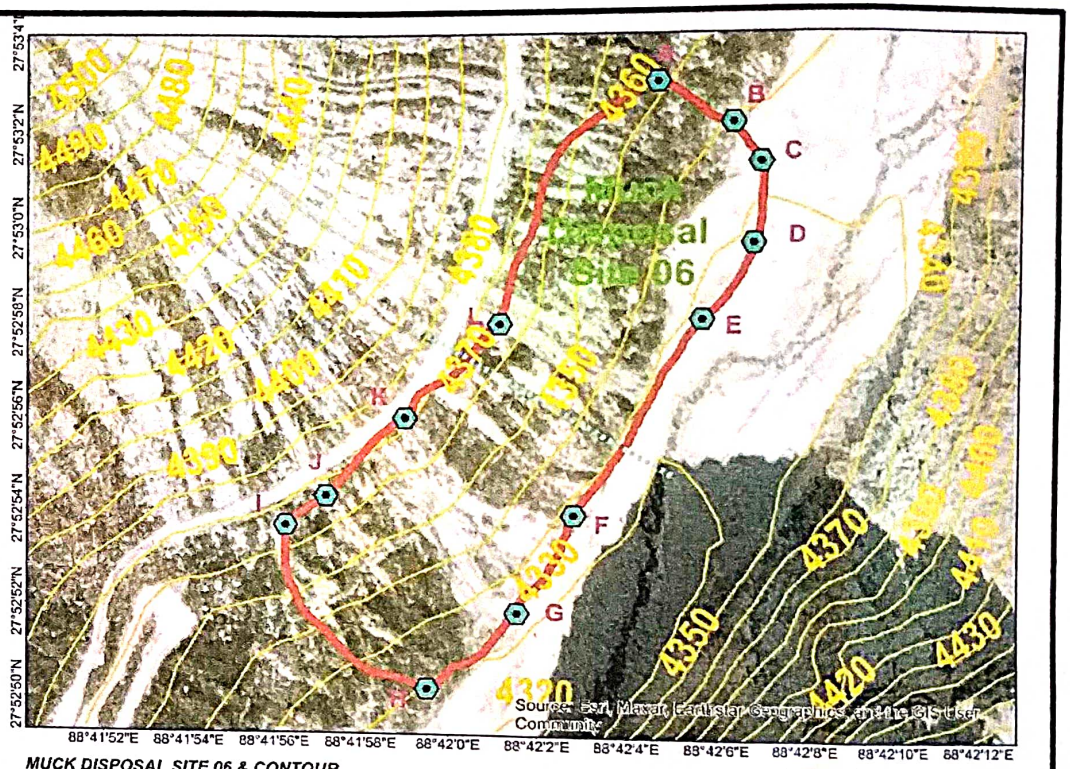
(Mr. Som Prakash Mitra)
(Environmental Expert)

Lt Col
Officer Commanding
86 RCC (GREF)

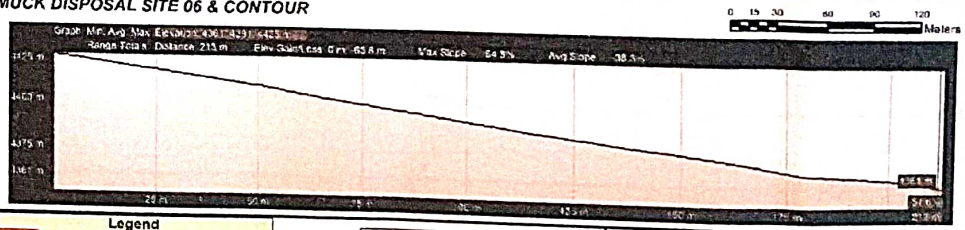



PRoW and Muck Disposal Site 06

| Muck Disposal Site | | |
|---|---|---|
| | | Site no. 06 |
| Area | 5.0196 ha | |
| Perimeter | 1040.2187 m | |
| GPS location no. | Longitude | Latitude |
| A | 88° 42' 04.60" E | 27° 53' 03.59" N |
| B | 88° 42' 06.28" E | 27° 53' 02.81" N |
| C | 88° 42' 06.93" E | 27° 53' 02.01" N |
| D | 88° 42' 06.83" E | 27° 53' 00.31" N |
| E | 88° 42' 05.79" E | 27° 52' 58.64" N |
| F | 88° 42' 03.09" E | 27° 52' 54.40" N |
| G | 88° 42' 01.97" E | 27° 52' 52.31" N |
| H | 88° 42' 00.03" E | 27° 52' 50.62" N |
| I | 88° 41' 56.62" E | 27° 52' 53.95" N |
| J | 88° 41' 57.53" E | 27° 52' 54.64" N |
| K | 88° 41' 59.28" E | 27° 52' 56.37" N |
| L | 88° 42' 01.34" E | 27° 52' 58.36" N |




MUCK DISPOSAL SITE 06 & CONTOUR



**SIKKIM**
PKG-6: Yumthang to Yume Sangdang Road From 52+808 km to 84+160 km
Client: Border Roads Organization

Legend
- Muck Disposal Site 06
- Proposed Right of Way (P-6)
- Muck Disposal Site 06 Contour Line

Som Prakash Mitra
Environmental Expert

| | |
|---|---|
| Muck Disposal Site 06 | |
| Drawn By: | SOM PRAKASH MITRA |
| Sheet No. SKZTW 20220711-M6-4.5 | Designation: ENVIRONMENTAL EXPERT |
| | Date: 11-07-2022 |



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(Environmental Expert)

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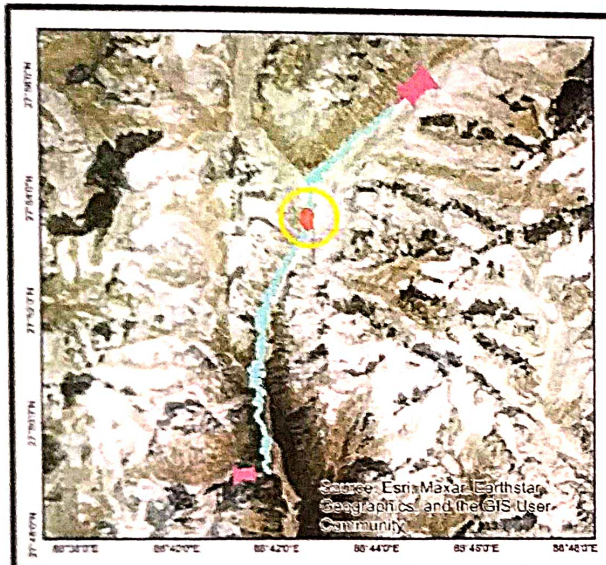
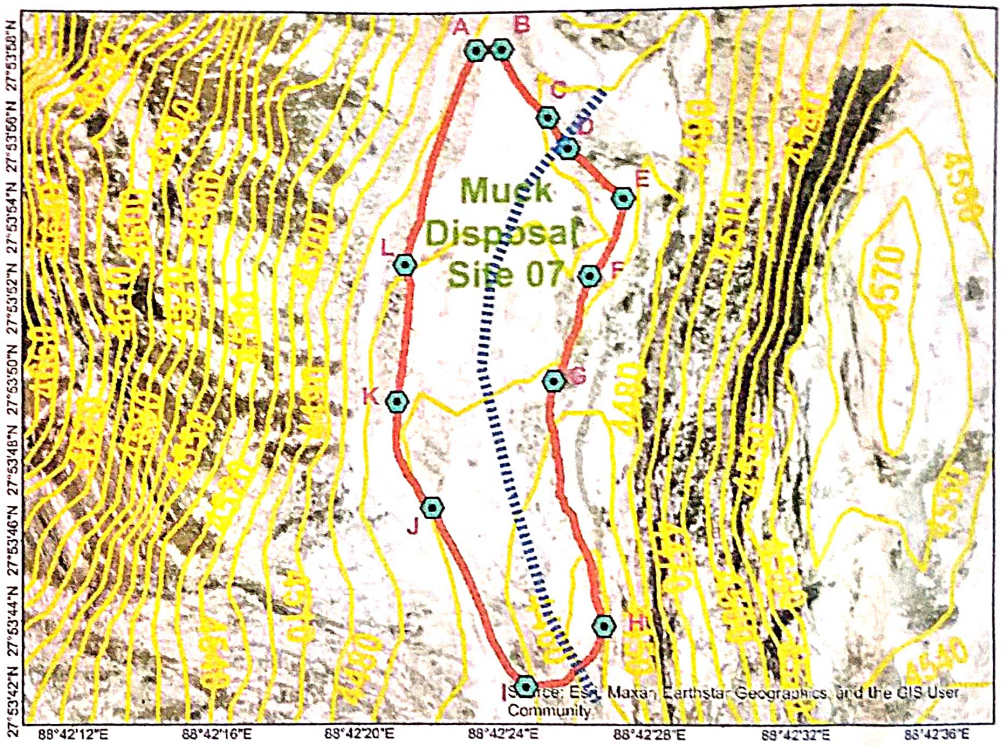
86 RCC (GREF)

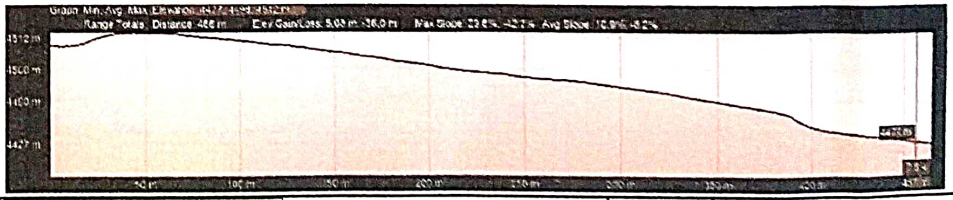



*PRoW and Muck Disposal Site 07*

| Muck Disposal Site | | |
|---|---|---|
| | | Site no. 07 |
| Area | 5.0830 ha | |
| Perimeter | 1157.2079 m | |
| GPS location no. | Longitude | Latitude |
| A | 88° 42' 23.20" E | 27° 53' 56.58" N |
| B | 88° 42' 23.91" E | 27° 53' 56.61" N |
| C | 88° 42' 25.21" E | 27° 53' 56.98" N |
| D | 88° 42' 25.89" E | 27° 53' 56.19" N |
| E | 88° 42' 27.35" E | 27° 53' 55.01" N |
| F | 88° 42' 26.55" E | 27° 53' 53.05" N |
| G | 88° 42' 25.67" E | 27° 53' 50.45" N |
| H | 88° 42' 27.21" E | 27° 53' 44.42" N |
| I | 88° 42' 25.17" E | 27° 53' 42.83" N |
| J | 88° 42' 22.45" E | 27° 53' 47.20" N |
| K | 88° 42' 21.35" E | 27° 53' 49.80" N |
| L | 88° 42' 21.47" E | 27° 53' 53.21" N |




*MUCK DISPOSAL SITE 07 & CONTOUR*



**SIKKIM**
PKG-6: Yumthang to Yume
Sangdang Road From 52+808 km
to 84+160 km
Client: Border Roads Organization

Legend
- Muck Disposal Site 07
- Proposed Right of Way (P-6)
- Muck Disposal Site 07
- Contour Line

Som Prakash Mitra
Environmental Expert

| Muck Disposal Site 07 | |
|---|---|
| Drawn By: | SOM PRAKASH MITRA |
| Designation: | ENVIRONMENTAL EXPERT |
| Date: | 12-07-2022 |



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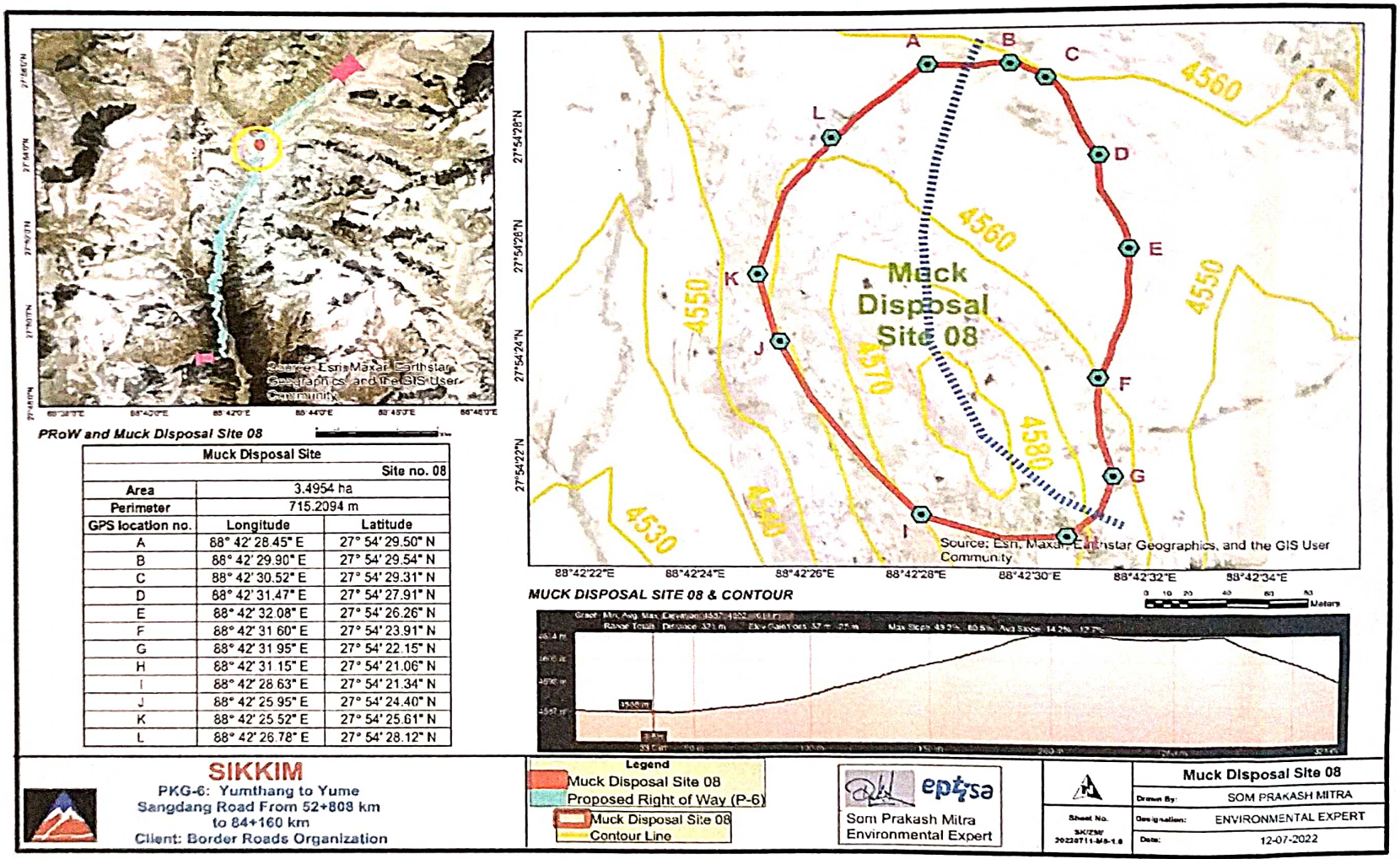
Officer Commanding
86 RCC (GREF)

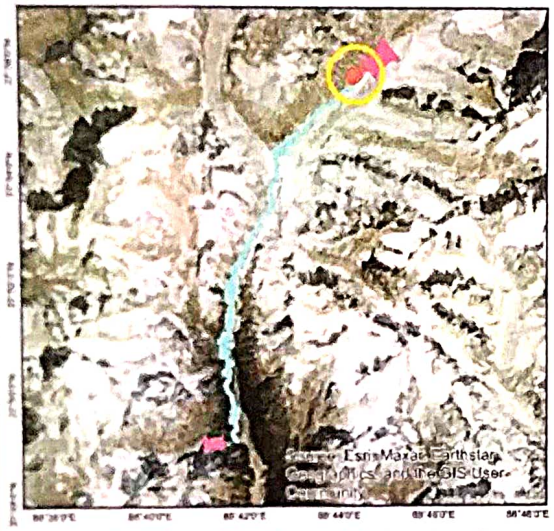



| Muck Disposal Site | | |
|---|---|---|
| | | Site no. 08 |
| Area | 3.4954 ha | |
| Perimeter | 715.2094 m | |
| GPS location no. | Longitude | Latitude |
| A | 88° 42' 28.45" E | 27° 54' 29.50" N |
| B | 88° 42' 29.90" E | 27° 54' 29.54" N |
| C | 88° 42' 30.52" E | 27° 54' 29.31" N |
| D | 88° 42' 31.47" E | 27° 54' 27.91" N |
| E | 88° 42' 32.08" E | 27° 54' 26.26" N |
| F | 88° 42' 31.60" E | 27° 54' 23.91" N |
| G | 88° 42' 31.95" E | 27° 54' 22.15" N |
| H | 88° 42' 31.15" E | 27° 54' 21.06" N |
| I | 88° 42' 28.63" E | 27° 54' 21.34" N |
| J | 88° 42' 25.95" E | 27° 54' 24.40" N |
| K | 88° 42' 25.52" E | 27° 54' 25.61" N |
| L | 88° 42' 26.78" E | 27° 54' 28.12" N |



(Mr. Som Prakash Mitra)
(Environmental Expert)

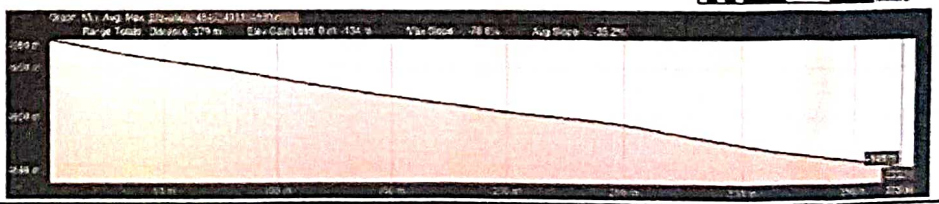
Lt Col
Officer Commanding
86 RCC (GREF)




PRoW and Muck Disposal Site 09

| Muck Disposal Site | | |
|---|---|---|
| | | Site no. 09 |
| Area | 7.2841 ha | |
| Perimeter | 1050.8415 m | |
| GPS location no. | Longitude | Latitude |
| A | 88° 43' 58.50" E | 27° 56' 04.44" N |
| B | 88° 44' 04.80" E | 27° 56' 04.22" N |
| C | 88° 44' 07.34" E | 27° 56' 01.96" N |
| D | 88° 44' 07.84" E | 27° 56' 01.00" N |
| E | 88° 44' 06.86" E | 27° 55' 59.60" N |
| F | 88° 44' 05.04" E | 27° 55' 58.21" N |
| G | 88° 44' 03.35" E | 27° 55' 56.21" N |
| H | 88° 43' 59.17" E | 27° 55' 53.44" N |
| I | 88° 43' 56.70" E | 27° 55' 57.70" N |
| J | 88° 43' 55.62" E | 27° 56' 00.52" N |
| K | 88° 43' 55.85" E | 27° 56' 01.72" N |
| L | 88° 43' 57.99" E | 27° 56' 03.44" N |


MUCK DISPOSAL SITE 09 & CONTOUR



SIKKIM
PKG-6: Yumthang to Yume
Sangdang Road From 52+808 km
to 84+160 km
Client: Border Roads Organization

Legend
Muck Disposal Site 09
Proposed Right of Way (P-6)
Muck Disposal Site 09 Contour Line

Som Prakash Mitra
Environmental Expert

| Muck Disposal Site 09 | |
|---|---|
| Drawn By: | SOM PRAKASH MITRA |
| Designation: | ENVIRONMENTAL EXPERT |
| Sheet No. | |
| Date: | 12-07-2022 |



(Mr. Som Prakash Mitra)
(Environmental Expert)

Lt Col
Officer Commanding
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## 1.6 REHABILITATION OF DUMPING SITES

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 project authorities would ensure that the dumping yards' blend with the natural landscape to develop the sites with gentle slopes, bunds, terraces, water ponds, 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. 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 basic aim and objectives of the muck management plan are to:

a. protect these areas from soil erosion
b. develop these areas by afforestation
c. develop them into parks, gardens etc.
d. utilize the maximum quantity of muck for development of infrastructure of the project
e. develop these areas in harmony with the landscape of the project area.

Various activities proposed as a part of the management plan are given as below:

i. Land acquisition for muck dumping sites
ii. Civil works (construction of retaining walls, boulder crate walls etc.)
iii. Dumping of muck
iv. Levelling of the area, terracing and implementation of various engineering
v. control measures e.g., boulder, crate wall, masonry wall, catchwater drain.
vi. Spreading of soil
vii. Application of fertilizers to facilitate vegetation growth over disposal sites.

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

### 1.6.1 ENGINEERING MEASURES

#### 1.6.1.1 Retaining Wall

For stacking of dumped material retaining wall is proposed to be built before dumping of any material on to the sites. 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 National Highway 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



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

To minimise 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 of nala bed. In addition, stone/concrete work on the downstream area will also be provided at vulnerable places to minimize erosion

### 1.6.1.2 Compaction & Levelling

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 50 cm 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.

### 1.6.1.3 Fencing

Fencing is a bio-engineering measure. After rehabilitation of muck the dumping areas need protection for some time from disturbing by human and domestic animals.

### 1.6.1.4 Catch water Drain

a. Catch water drains are provided to collect excessive rainwater in heavy rainfall regions i.e. in case of hill roads.
b. These drains are useful to avoid large water flow reaching to hill road surface.
c. It helps to avoid landslides in hill roads.

## 1.6.2 BIOLOGICAL MEASURES

Muck generally lacks nutrients and therefore, are difficult to re-vegetate. However, if no attempts to vegetate the slopes are made, the muck could slide lower down during rain and may eventually wash off the check dams also. Since, top soils are not available in large quantities in Himalayas, it may not be possible to apply a thin layer of soil over the muck. Bio-fertiliser technique developed by National Environmental Engineering Research Institute (NEERI) can be adopted in the proposed project. NHPC has successfully used this technique in Uri hydroelectric project. Similar approach can be utilized in the proposed project as well. In this process, the unused excavated material is piled and stacked with proper slopes at the designated muck disposal sites. The slopes are broken up by creating benches across them. This is done to provide stability to the slopes and also to provide ample space for planting of trees that would further help in holding and consolidating biotechnological approach. The traditional methods of afforestation of these areas would be supplemented with the use of fungus, i.e. Vesicular Arbuscular Mycorrizae (VAM) and nitrogen fixing bacteria that form partnership with plant roots. These grow on plant roots and provide water and nutrition especially phosphorus to plants at faster rate. The seeding of plants would be inoculated with VAM and nitrogen fixing bacteria before planting. It has been found that plants inoculated with bio-fertilizers grow at faster rate especially in the medium where the soil/rock is devoid of nutrients.

Top surfaces and slopes of all dumping areas would be left. These areas 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. In order to implement the biological measures in dumping areas the following activities would be taken into account. The biological measures include the following:

### 1.6.2.1 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. The work plan will be formulated for re-vegetation of the dumping sites through Integrated Biotechnological Approach.



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### 1.6.2.2 Plantation

Muck generally lacks nutrients and therefore, are difficult to re-vegetate. However, if no attempts to vegetate the slopes are made, the muck could slide lower down during rain and may eventually wash off the check dams also. Since, top soils are not available in large quantities in Himalayas, it may not be possible to apply a thin layer of soil over the muck. Bio-fertiliser technique developed by *National Environmental Engineering Research Institute* (NEERI) can be adopted in the proposed project. NHPC has successfully used this technique in Uri hydroelectric project. Similar approach can be utilized in the proposed project as well. In this process, the unused excavated material is piled and stacked with proper slopes at the designated muck disposal sites. The slopes are broken up by creating benches across them. This is done to provide stability to the slopes and also to provide ample space for planting of trees that would further help in holding and consolidating biotechnological approach. The traditional methods of afforestation of these areas would be supplemented with the use of fungus, i.e. Vesicular Arbuscular Mycorrizae (VAM) and nitrogen fixing bacteria that form partnership with plant roots. These grow on plant roots and provide water and nutrition especially phosphorus to plants at faster rate. The seeding of plants would be inoculated with VAM and nitrogen fixing bacteria before planting. It has been found that plants inoculated with bio-fertilizers grow at faster rate especially in the medium where the soil/rock is devoid of
nutrients.

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.

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:

a. Plantation of suitable tree species and soil binding using bio-fertilizer technology.
b. Turfing of the exposed area and improvement of environment with ornamental species.
c. Protection with mechanical support.
d. 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:

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

The afforestation with suitable plant species shall be done. About 1000-1200 trees/ha shall be planted. The tentative list of plant species suggested for afforestation is as follows:

6.6.2.2. Botanical Name

**Trees**

- *Alnus nepalensis*
- *Leucaena leucocephala*
- *Myrica esculenta*
- *Grevillea robusta*
- *Pinus roxburghii*



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Shrubs

- *Jatropha carcus*
- *Berberis asiatica*
- *Berberis lyceum*
- *Desmodium elegan*

Grasses

- *Arundinella nepalensis*
- *Agrimonia pilosa*
- *Alexandrium folium*
- *Cynodon dactylon*
- *Geranium ocellatum*
- *Solanum nigrum*

### 1.6.3 PROPOSED MEASURES

i. 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.

ii. A retaining wall of 6 m/9 m has been proposed to hold the muck on the lower part of the dumping site and shall be constructed prior to dumping of muck. Loose muck would be compacted layer-wise. The height of Gabion Wall is proposed to be 6 m / 9 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.

iii. 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.

iv. Proper fencing of the entire area will be done. 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.

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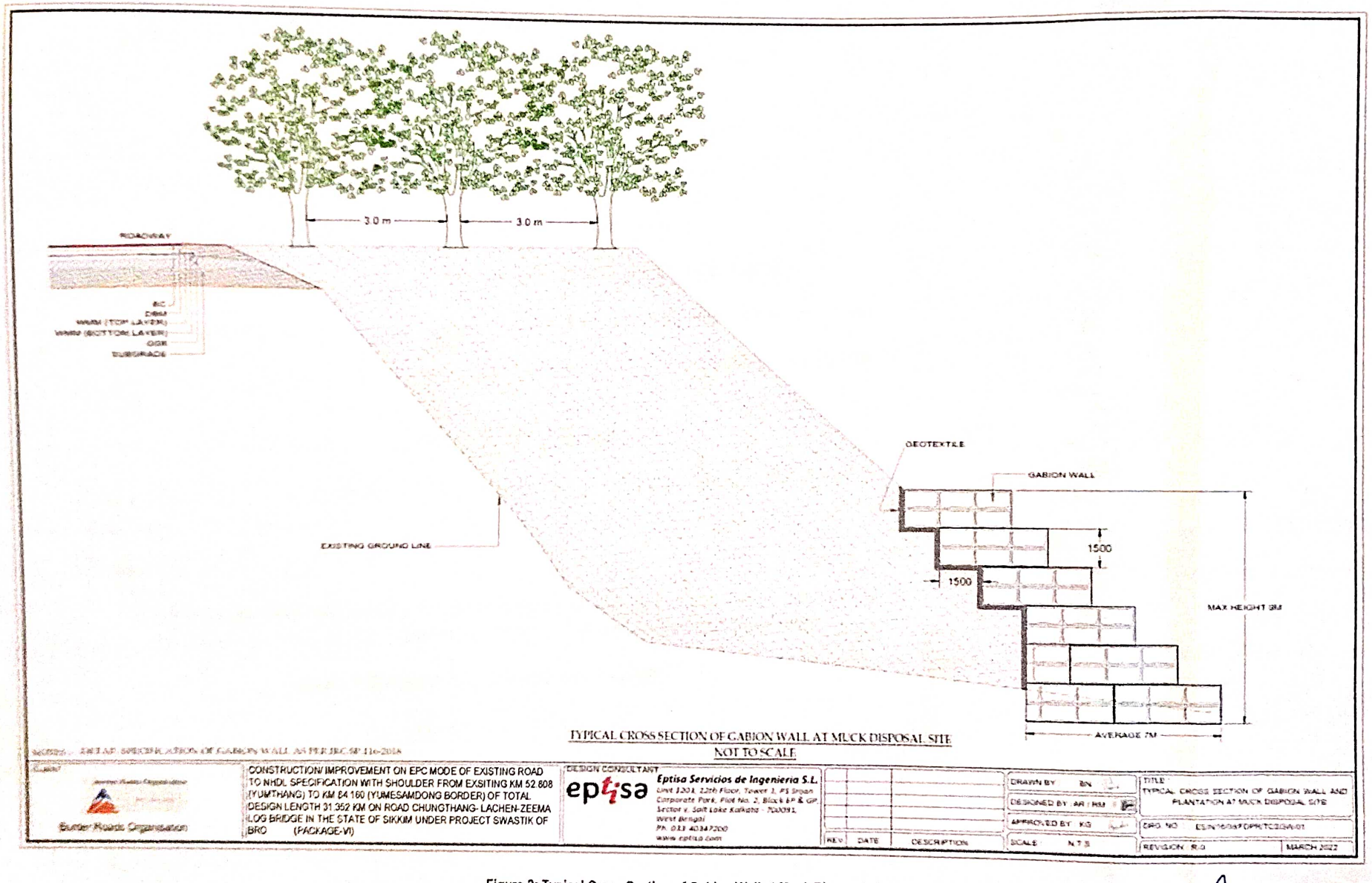


Figure 2: Typical Cross Section of Gabion Wall at Muck Disposal Site



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## 1.8 MONITORING & COMPLIANCES

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

a. Each layer shall be rolled compacted.

b. A layer of soil shall be spread on top of it to make it suitable for plantation.

c. Water testing facilities shall be set up for checking quality parameter of water.

d. Soil samples shall be regularly collected and tested for checking the level of contamination.

e. Prescribed norms and approvals will be sought from state pollution control board wherever necessary.

f. All norms of Forest department, SPCB and MoEF&CC and their acts related to muck disposal shall be complied with.

g. Design consultant shall be engaged for designing of retaining structures.

h. Plantation shall be done on the reclaimed land and native variety of plants and trees shall be planted.

## 1.9 BUDGET

A provision of Rs. 7,90,74,866.00/- has been earmarked for stabilization and restoration of muck disposal site. Gabbion Wall Cosntruction cost is included in Departmental Cost. The details are given in Table below:

**Table 1: Gabbion Wall Construction Budget**

| A. Gabbion Wall Construction | | | | |
|---|---|---|---|---|
| Dimensions of Units | | Total Area | Total Length (m) | Quantity (cum) |
| B | H | | | |
| 7 | 1.5 | 10.5 | 538 | 27,436 |
| 7 | 1.5 | 10.5 | | |
| 6 | 1.5 | 9 | | |
| 6 | 1.5 | 9 | | |
| 5 | 1.5 | 7.5 | | |
| 3 | 1.5 | 4.5 | | |
| | | 51 | 538 | 27,436 |
| Item | Quantity | Rate | Cost in Rs./- | Remarks |
| Gabian Structure for Retaining Earth (Providing and construction of a gabain structure for retaining earth with segments of wire crates of size 7 m x 3 m x 0.6 m each divided into 1.5 m compartments by cross netting, made from 4 mm galvanised steel wire @ 32 kg per 10 sqm having minimum tensile strength of 300 Mpa conforming to IS:280 and galvanizing coating conforming to IS:4826, woven into mesh with double twist, mesh size not exceeding 100 x 100 mm, filled with boulders with least dimension of 200 mm, all loose ends to be tied with 4 mm galvanised steel wire) (in Rs.) | 27,436 | 2569 | 7,04,83,084/- | Reference: Govt. of Sikkim SoR 2018 Sl. No. 15.12 |



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| | | | | |
|---|---|---|---|---|
| GEO TEXTILE | 4841.632 | 320 | 15,49,322.24 | Reference: Govt. of Sikkim SoR 2018 Sl. No. 15.06 |
| Total Cost for Gabion construction (A) in (Rs./-) | 7,20,32,406.00 | | | |

**Table 2: Biological Measure Cost Budget**

| B. Biological Measures Cost | | |
|---|---|---|
| Sl. No. | Name of the work | Cost in (Rs./-) |
| | MUCK DISPOSAL SITE (per site) | |
| 1 | Raising of Plantation (Creation Cost) | |
| | Survey/demarcation/plantation planning/site clearance | 7,350.00 |
| | Pit Digging/Soil working/Manuring & Planting | 13,500.00 |
| | Seedling cost | 27,472.50 |
| | Sub-Total (1) | 48,322.50 |
| 2 | Maintenance of Plantation Cost for 3 years | |
| | Tending Operation (1st Year Operation) | 6,872.25 |
| | Tending Operation (2nd Year Operation) | 15,000.00 |
| | Tending Operation (3rd Year Operation) | 10,050.00 |
| | 1 weeding (1 DLS per weeding for 100 plants) | 4,950.00 |
| | Sub-Total (2) | 36,872.25 |
| 3 | Fensing Cost | |
| | i. Erection of barbed wire fencing (1.2 m) cost | 1,92,988.95 |
| | ii. Maintenance of barbed wire fencing @5% of erection cost for 2nd and 3rd year | 1,93,000.00 |
| | Sub-Total (3) | 3,85,988.95 |
| | TOTAL MUCK DISPOSAL SITE | |
| | Cost for Sl. No. 1 to 3 (4= 1+2+3) | 4,71,183.70 |
| | Total cost for all Muck Disposal sites (5) | 42,40,653.30 |
| 4 | Grass carpeting cost for Total Muck area in ha Sub-Total (6) | 85,500.00 |
| | | 43,26,153.30 |
| | Total (7=5+6) | 2,16,307.67 |
| | Contingency @ 5% | 45,42,460.37 |
| | Sub-Total(6) | |
| | Wages for 2 persons for 5 years | 18,00,000.00 |
| | Consumables and Tool cost | 5,00,000.00 |
| | Miscellaneous expenditure | 2,00,000.00 |
| | Sub-Total (7) | 25,00,000.00 |
| | GRAND TOTAL (B=6+7) | 70,42,460.97 |



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| Sl. No. | Name of the work | Cost in (Rs./-) |
|---|---|---|
| A | Gabbion Wall Construction | 7,20,32,406.00 |
| B | Biological Measures Cost | 70,42,460.97 |
| **TOTAL COST stabilization and restoration of muck disposal site** | | 7,90,74,866.00 |
| (in words): *Rupees Seven Crore Ninety Lakh Seventy-Four Thousand And Eight Hundred Sixty-Six Only* | | |

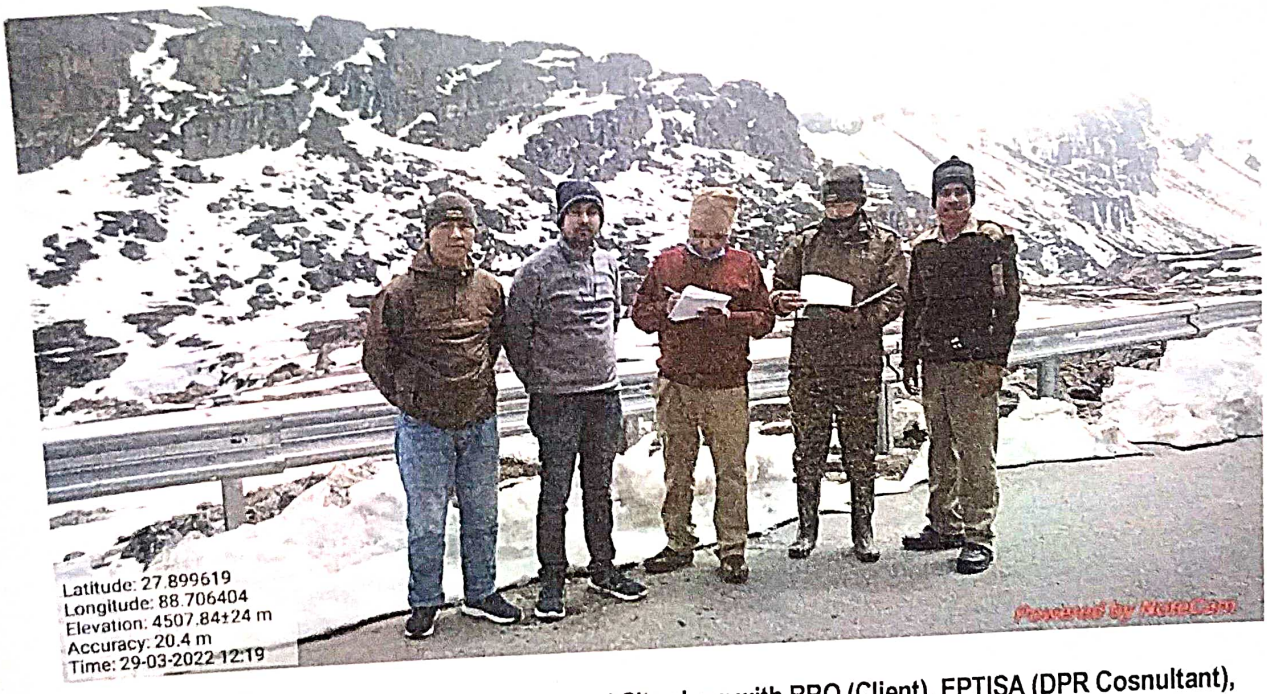


**Figure 3: Joint Site Inspection of Muck Disposal Site along with BRO (Client), EPTISA (DPR Cosnultant), State Forest Department of Sikkim & State Revenue Department of Sikkim**

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## Compliance for Essential Details Sought dated 21.06.2022 by Nodal Officer, FCA, Govt. of Sikkim

**COMPLIANCE FOR OBSERVATION No. 1:** Site Inspection Report

Site Inspection Report: Site Inspection Report was already being submitted and it is re-submitted which is jointly signed by the (vide Range Incharge, Lachung (Territorial) Range, Territorial Division, Mangan, Forest & Environment Department, Government of Sikkim vide letter no. 02/LTR dated 18.04.2022):

a. Sub-Division Magistrate, Land Revenue & Disasater Management Department, Chungthang, Government of Sikkim.
b. Divisional Forest Officer, North Territorial Forest Divsiion, Government of Sikkim
c. Range Officer In-Charge, Lachung Territorial Range, Forest and Environment Departmet, Government of Sikkim.
d. Assisstant Executive Engineer, Second-in-Commanding, 86 RCC(GREF), Ministry of Defence, Government of India.
e. Authorized representative of Eptisa India

**Requirement of any other Site Inspection Report can be received from the internal State Forest Department of Sikkim since all the documents are not shared with the User Agency by any office of the Forest Department / Comepetent Authority.**

**COMPLIANCE FOR OBSERVATION No. 2:** Muck Disposal Certificate and Plan

Muck Disposal Certificate and Plan **(copy Enclosed herewith as "ANNEXURE - I" & "ANNEXURE-II")** are submitted herewith. The Muck Disposal Site Inspection Report is already being signed by the:

a. Sub-Division Magistrate, Land Revenue & Disasater Management Department, Chungthang, Government of Sikkim.
b. Divisional Forest Officer, North Territorial Forest Divsiion, Government of Sikkim
c. Range Officer In-Charge, Lachung Territorial Range, Forest and Environment Departmet, Government of Sikkim.
d. Assisstant Executive Engineer, Second-in-Commanding, 86 RCC(GREF), Ministry of Defence, Government of India.
e. Authorized representative of Eptisa India

**COMPLIANCE FOR OBSERVATION No. 3:** Village-wise Forest land breakup

As per the Site Inspection Report submitted by the Range Incharge, Lachung (Territorial) Range, Territorial Division, Mangan, Forest & Environment Department, Government of Sikkim vide letter no. 02/LTR dated 18.04.2022 **(copy Enclosed herewith),** there are no village(s) present along the said PKG-6 proposed alignment (Yumthang to Yumesamdaong Border). **The subject stretch (PKG-6) falls**



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**under Reserved Forest under Lachung Territorial Range, Forest & Environment Department, Government of Sikkim.**

There is no revenue land found within said proposed road alignment is also confirmed by the Sub Divisional Magistrate, Sub Division Office, Chungthang, North Sikkim District, Govt. of Sikkim vide Memo no. 1049/SDO/GoS/C dated 16.02.2022 **(which was already being submitted and copy is re-enclosed herewith).**

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