



Government of West Bengal
Directorate of Forests

Office of the Principal Chief Conservator of Forests & Head of Forest Force
Aranya Bhawan, Block: LA-10A, Salt Lake City, Sector – III, Kolkata.: 700 106
Phone - Fax:: (033) 2335 8581/7751, e-mail : nfcawb@gmail.com
Visit us at: www.westbengalforest.gov.in



No- 331 / L & LT/2M-27/2021

Dated: 19.04.2021

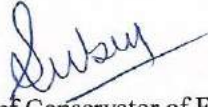
To Dr. Tandra Sarkar
Integrated Regional Office, MoEF & CC, Kolkata
IB-198, Broadway Rd, IB Block, Sector III,
Bidhannagar, Kolkata, West Bengal 700106

Sub.: Proposal No. **FP/WB/RAIL/47649/2020** for diversion of 13.512 ha of forest land in favour of North East Frontier Railway for construction of **Sivok-Rangpo New BG Rail Line** under Kurseong 0.5089 ha , Darjeeling 2.7945 ha and Kalimpong 10.2086 ha. Forest Division.

Ref.; (i) Your letter no..WB-SRBG-09/2021/FC/58 dt. 01.04.2021.
(ii) CCF, Hill Circle letter no. 447/C2-239/2021 dt. 13.04.2021.

With reference to the subject please find enclosed herewith the required additional informations along with Annexures submitted by the Divisional Forest Officers, Darjeeling, Kurseong and Kalimpong Forest division in connection with forest clearance proposal of 13.512 ha. (Phase-IV) for kind necessary actions at your end.

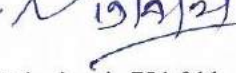
Encl.: As stated.

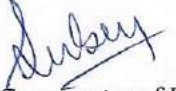

Addl. Principal Chief Conservator of Forests
&
Nodal officer Forest Conservation Act.

No- 332 / L & LT/2M-27/2021

Dated: 19.04.2021

Copy forwarded for information and necessary action to:

1. The Additional Chief Secretary, Department of Forests, West Bengal. 
2. The Chief Conservator of Forest, Hill Circle, West Bengal.
3. The Dy. Chief Engineer (Construction), North East Frontier Railway, New Jalpaiguri- 781 011.


Addl. Principal Chief Conservator of Forests
&
Nodal officer Forest Conservation Act.



Government of West Bengal
Directorate of Forests
Office of the Chief Conservator of Forests, Hill Circle, West Bengal
Shankar Villa, Ladenla Road, Darjeeling-734101
Phone : Office – 0354-2252277, Fax – 0354-2252845
e-mail : cefhwb@gmail.com; cefhe.frd-wb@bangla.gov.in



169

No. 447 /C2-239/2021

Dated, Darjeeling, the 13/04/2021.

To : The Addl. Principal Chief Conservator of Forests &
Nodal Officer, FCA
West Bengal

Sub : Proposal for diversion of additional 13.512 ha forest land for construction of SivokRangpo BG
Railway Line-reg.

Ref : APCCF/Nodal Officer letter no. 7452/L</2M-27/2021 dated 09.03.2021 and MoEF,
CC,Integrated Regional Office memo no. WB SRBG-09/2021/FC/58 dated 01.04.2021

Sir/Madame,

With reference to above, kindly find herewith the Sol Toposheet of all the forest land for diversion under Kurseong, Darjeeling and Kalimpong Forest Division submitted by IRCON for verification and signature by all concerned DFOs under Hill Circle as desired by you and enclosed herewith the correspondence made by all concerned DFOs of Hill Circle in this respect.

Encl: As above.


Chief Conservator of Forests
Hill Circle, West Bengal

No. 447 /C2-239/2021

Dated, Darjeeling, the 13/04/2021.

Copy forwarded for information to :-

1. The Divisional Forest Officer, Darjeeling Forest Division.
2. The Divisional Forest Officer, Kurseong Forest Division.
3. The Divisional Forest Officer, Kalimpong Forest Division.

Sd/- G. P. Chhetri, IFS.

Chief Conservator of Forests
Hill Circle, West Bengal

07/04/21

Office of the CCF
Hill Circle, W.B.,
Reg. No. 1286
Case No. C2-239
Date 07.04.21

72
170



Government of West Bengal
Directorate of Forests
Office of the Divisional Forest Officer
Kurseong Division, Darjeeling, Pin -734204



Phone No: 0354-2332200; Fax No: 0354-2332200; Email: dfokue-wb@nic.in

No 714 / 17-10

Dated, Dowhill the 05/04/2021.

To :: The Chief Conservator of Forests
Hill Circle, West Bengal

Sub :: Proposal for diversion of 13.512Ha - reg.

Ref :: MoEF,CC, Integrated Regional Office Memo no: WB-SRBG-09/2021/FC/58
dt. 01.04.2021

Sir,
With reference to above kindly find the following details pertaining to Kurseong Forest Division as desired.

Sl no	Subject	Remarks/Explanation
1	Hard copy of Sol map file showing 12 individual proposed areas for diversion along with GPS Coordinates duly signed/Seal by competent authorities.	Hard copy of Sol map pertaining to Kurseong Division is enclosed. Soft copy is also attached for the reference.
2	Soft copy of KML/Shape file showing proposed area for diversion and CA area along with GPS coordinates	KML files showing proposed area for diversion and CA area was already uploaded in Part-II and the 4nos of soft copies in CD was submitted along with the hard copies of Part-II. However soft copies of KML for Proposed area and CA is also attached herewith.
3	Map showing aerial distance from the proposed project sites to the nearby protected forest area or wildlife sanctuary with duly signed by competent authority.	The proposed area of diversion pertaining to Kurseong Division is adjacent (around 70Mt) to the Mahananda Wildlife Sanctuary. The certified Google Map is enclosed herewith for the reference.
4	The proposed area is very near to river bed a detail of muck dump should be provided with all the plans of gabion structures and terraces.	Not applicable.

Haris
(Dr. Harikrishnan P.J, IFS)
Divisional Forest Officer,
Kurseong Division.

No / Dated, Dowhill the , .2021.

Copy forwarded for information and necessary action to:

The Addl Principal Chief Conservator of Forests, CAMPA & Nodal Officer FCA'1980.

sdf
(Dr. Harikrishnan P.J, IFS)
Divisional Forest Officer,
Kurseong Division.

Sevoke-Rongpo BG Line

0.5089 Ha. Diversion Proposal of Sevoke-Rongpo BG Line under Kurseong Division

Legend



70 meters

MAHANANDA WILDLIFE SANCTUARY

Google Earth

©2021 Google
Image © 2021 Maxar Technologies



90 m

17L 17B

Hans

Divisional Forest Officer
Kurseong Division

172 74

REFER TO THIS MAP AS - 1:50,000
SHEET 78 B/5 SECOND EDITION

पश्चिमी बंगाल WEST BENGAL

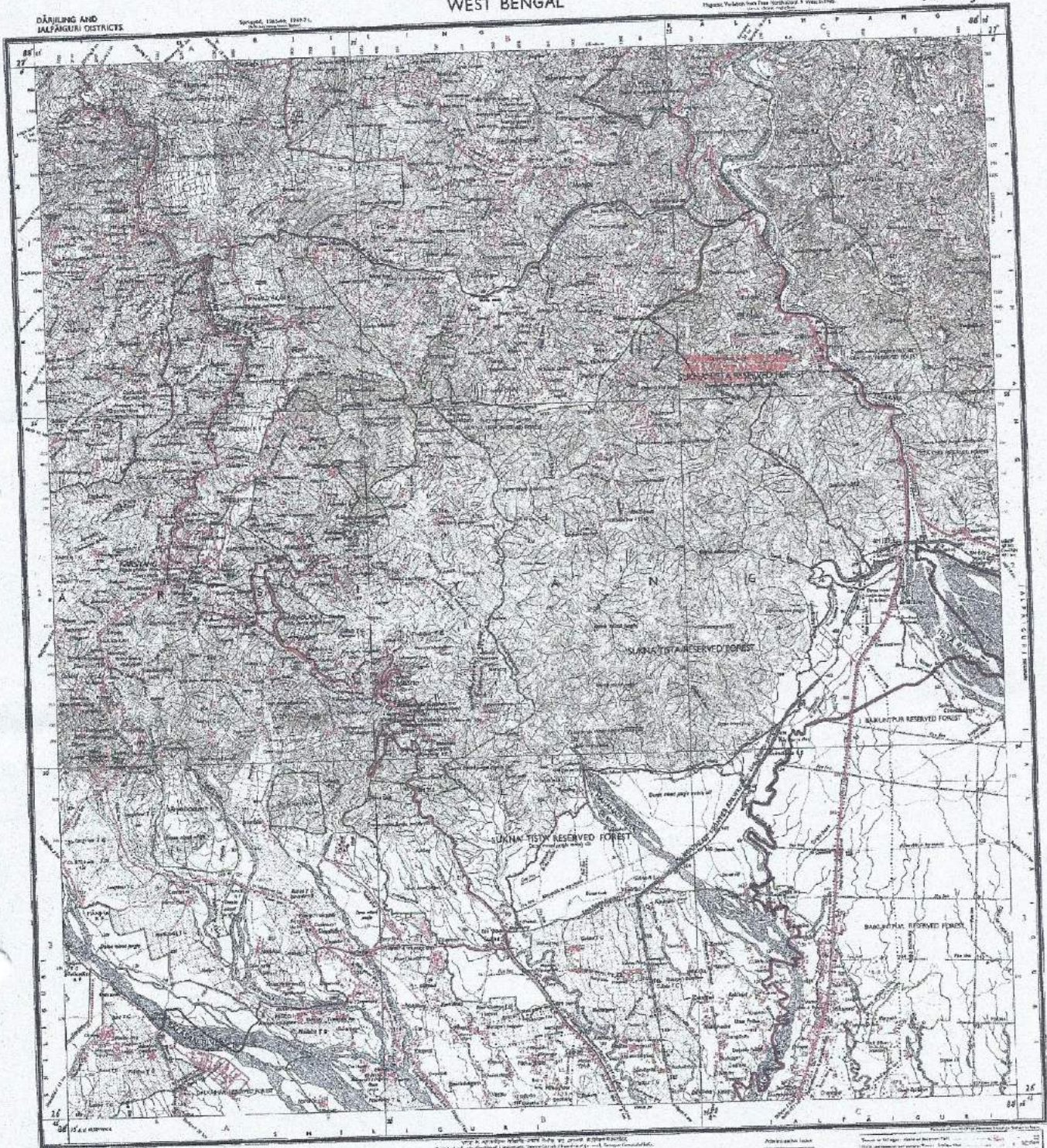
SECOND EDITION

No. 78 B

DARJILING AND
RALFARGUH DISTRICTS

Scale 1:50,000 (1947-51)

Figure 78(B) from the Survey of India Series 1:50,000



LEGEND

Boundaries of reserved forests are shown by a thick red line. Boundaries of other reserved forests are shown by a thin red line. Boundaries of other reserved forests are shown by a thin red line. Boundaries of other reserved forests are shown by a thin red line.



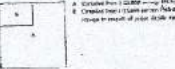
500 m Scale
1:50,000

HEIGHTS & CONTOURS IN METRES
EQUIVAL & INTERVAL IN METRES

Contour interval 20 metres. A 500m height is shown by a thick red line. A 100m height is shown by a thin red line. A 50m height is shown by a thin red line. A 20m height is shown by a thin red line.

SYMBOLS

As in Survey of India Series 1:50,000



RESTRICTED

Survey of India Series 1:50,000
No. 78 B/5
Second Edition

REFER TO THIS MAP AS - 1:50,000
SHEET 78 B/5 SECOND EDITION

Hani
Divisional Forest Officer
Kurseong Division

27/11/51
44/19/1/1/51
Deputy Chief Engineer/CCN
N.F. Railway, New Jalpaiguri

00
13/04/20

173

Office of the CDF
Hill Circle, W.B.,
Reg. No. 1349
Case No. C2-239
Date 13/04/20



Government of West Bengal
Directorate of Forests
Office of the Divisional Forest Officer
Kurseong Division, Darjeeling, Pin -734204



Phone No: 0354-2332200; Fax No: 0354-2332200; Email: dfokue-wb@nic.in

No 764 117-10

Dated, Dowhill the , 8-4-2020.

To :: The Chief Conservator of Forests
Hill Circle, West Bengal

Sub :: Sol Toposheet of 13.512Ha of Forest Land for diversion of IRCON project-reg.

Sir,

With reference to above, kindly find enclosed herewith the Sol Toposheet of all the forest land for diversion under Kurseong, Darjeeling and Kalimpong Division, submitted by IRCON for verification and signature by all concerned DFOs. The 0.5089Ha diversion under Kurseong Division has been marked correctly in the toposheet. The soft copy of map along with the pdf is also attached for your reference and necessary guidance.

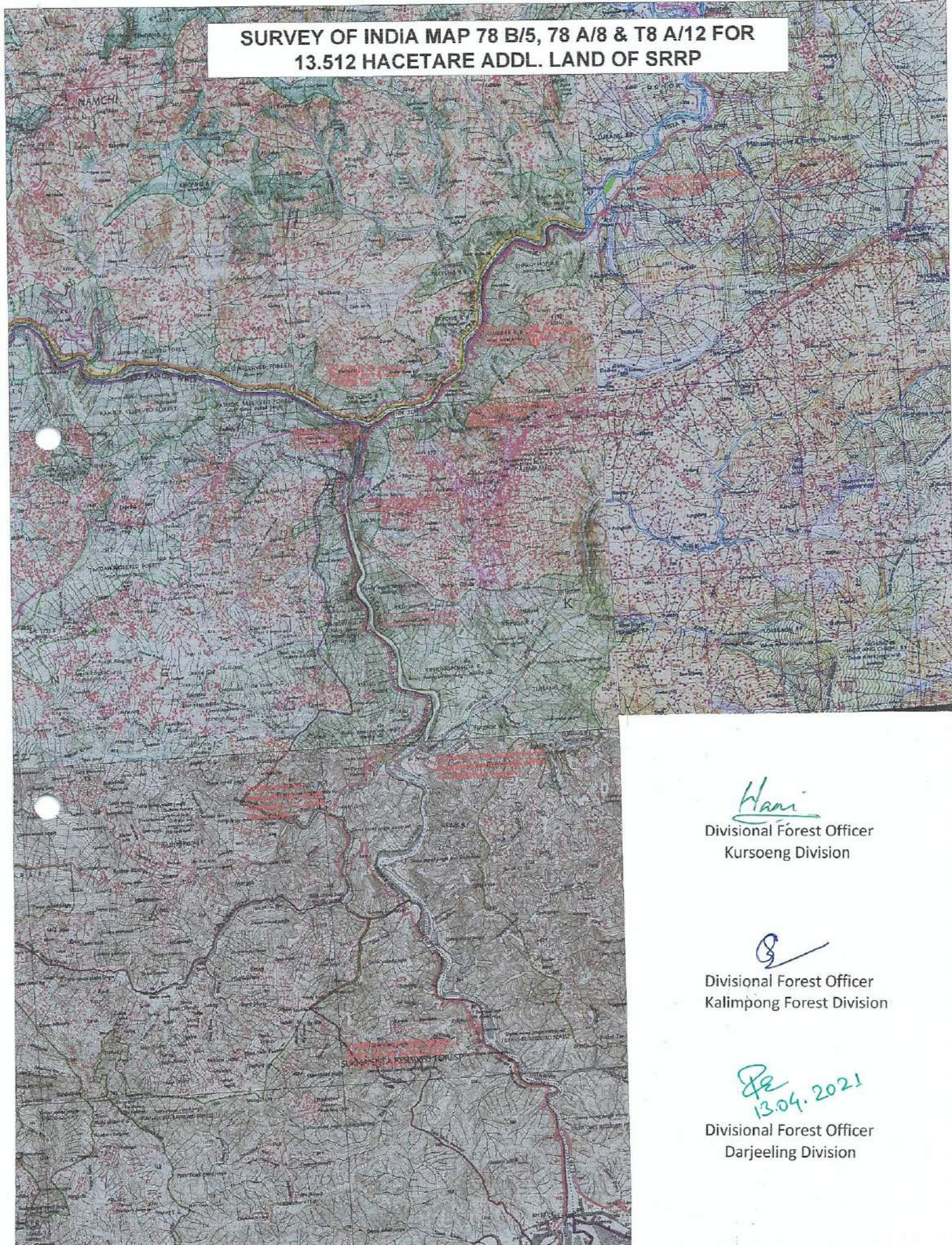
This is for your kind information and necessary action.

Encl:

Sol Toposheet in 1:50000

(Dr. Harikrishnan P.J, IFS)
Divisional Forest Officer,
Kurseong Division.

**SURVEY OF INDIA MAP 78 B/5, 78 A/8 & T8 A/12 FOR
13.512 HACETARE ADDL. LAND OF SRRP**



Hani

Divisional Forest Officer
Kursoeng Division

Divisional Forest Officer
Kalimpong Forest Division

Pe
13.04.2021

Divisional Forest Officer
Darjeeling Division

12/04/21



Government of West Bengal
Directorate of Forests
Office of the Divisional Forest Officer
Darjeeling Forest Division
Barakakjhora, D.B. Giri Road
Darjeeling 734101 West Bengal.

Telefax 03542252159. Email: dfodarj@gmail.com

Office of the CCF,
Hill Circle, W.B.,
Reg. No. 1347
Case No. 12-738
Date 13/04/21



Memo No. 680/8-72(b) Dated, Darjeeling the 13/04/2021

From : The Divisional Forest Officer
Darjeeling Forest Division.

To : The Chief Conservator of Forests
Hill Circle, West Bengal.

Sub : **Proposal for diversion of 13.512ha reg.**

Ref : **MoEF, CC Integrated Regional Office Memo no. WB-SRBG-09/2021/ FC/58
dt. 01.04.2021**

Sir

With reference to above kindly find the following details pertaining to Darjeeling Forest Division as desired.

Sl. No.	Subject	Remarks/Explanation
1.	Hard copy of Sol map file showing 12 individual proposed areas for diversion along with GPS coordinates duly signed/Seal by competent authorities	Hard copy of Sol map pertaining to Darjeeling Forest Division is enclosed. Soft copy is also attached for the reference. (Annexure-I)
2.	Soft copy of KML/Shape file showing proposed area for diversion and CA area along with GPS coordinates.	KML files showing proposed area for diversion and CA area was already uploaded in Part-II. However soft copies of KML for proposed area (4 patches - Mangwa-2 :: 0.32ha, Mangwa-4:: 0.29ha, Reang-3::1.060ha & Reang-3:: 1.1245ha) and CA is also attached herewith.
3.	Map showing aerial distance from the proposed project sites to the nearby protected forest area or wildlife sanctuary with duly signed by competent authority	The proposed area of diversion pertaining to the Darjeeling Forest Division is nearest (approx. 15Km of aerial distance) to the Senchal Wildlife Sanctuary. The certified Google Map is enclosed herewith for reference (Annexure-II)
4.	The proposed area is very near to river bed a detail of muck dump should be provided with all the plans of gabions structures and terraces.	Detail report on muck disposal site (1.1245ha) in respect of this Division as received from the user agency is enclosed herewith (Annexure-III) .

[Signature]

Divisional Forest Officer
Darjeeling Forest Division
Dated _____/_____/_____/

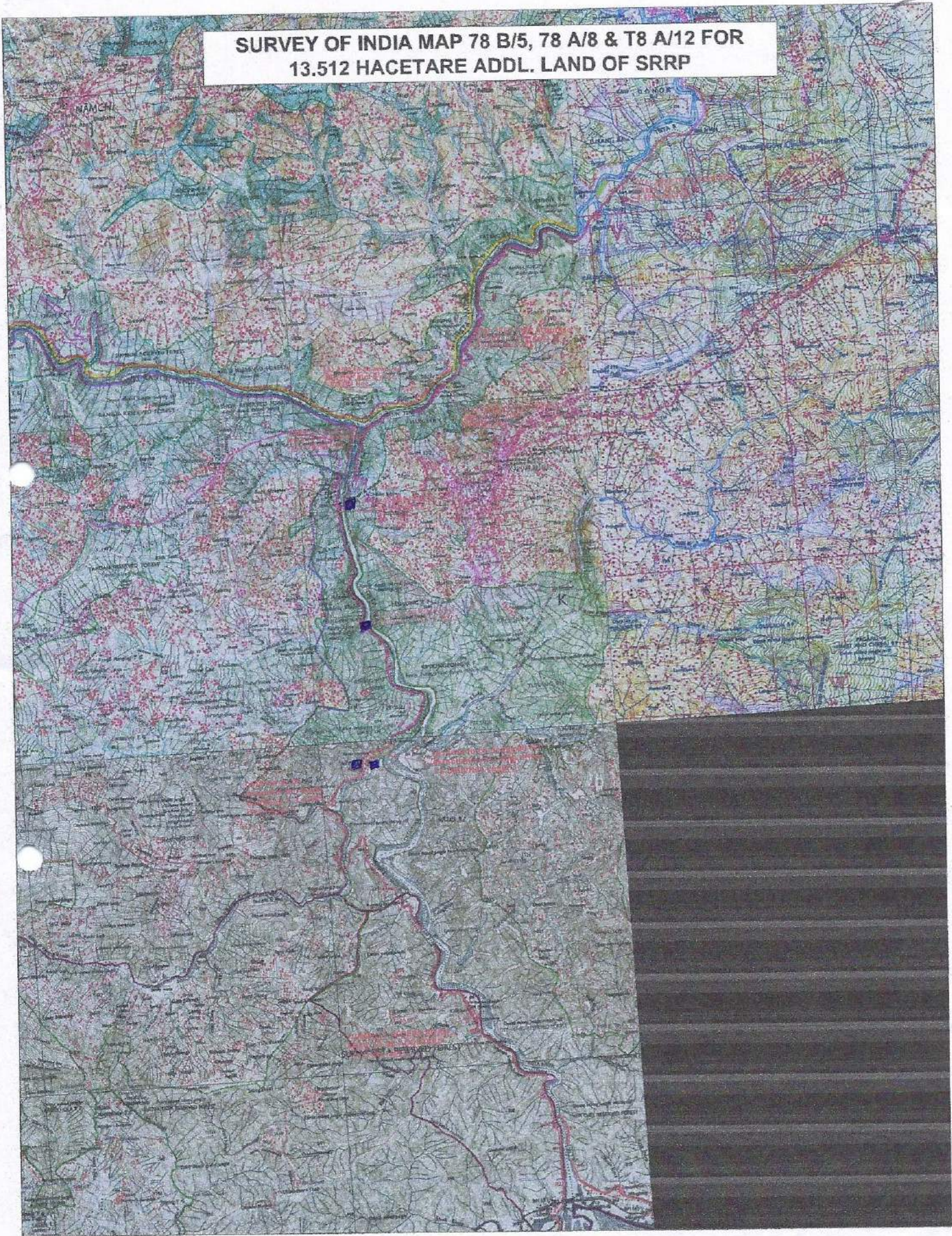
No. _____/_____/_____

Copy forwarded for information and necessary action to :

1) The Addl. Principal Chief Conservator of Forests, CAMPA & Nodal Officer, FCA 1980.

[Signature]
Divisional Forest Officer
Darjeeling Forest Division

**SURVEY OF INDIA MAP 78 B/5, 78 A/8 & T8 A/12 FOR
13.512 HACETARE ADDL. LAND OF SRRP**

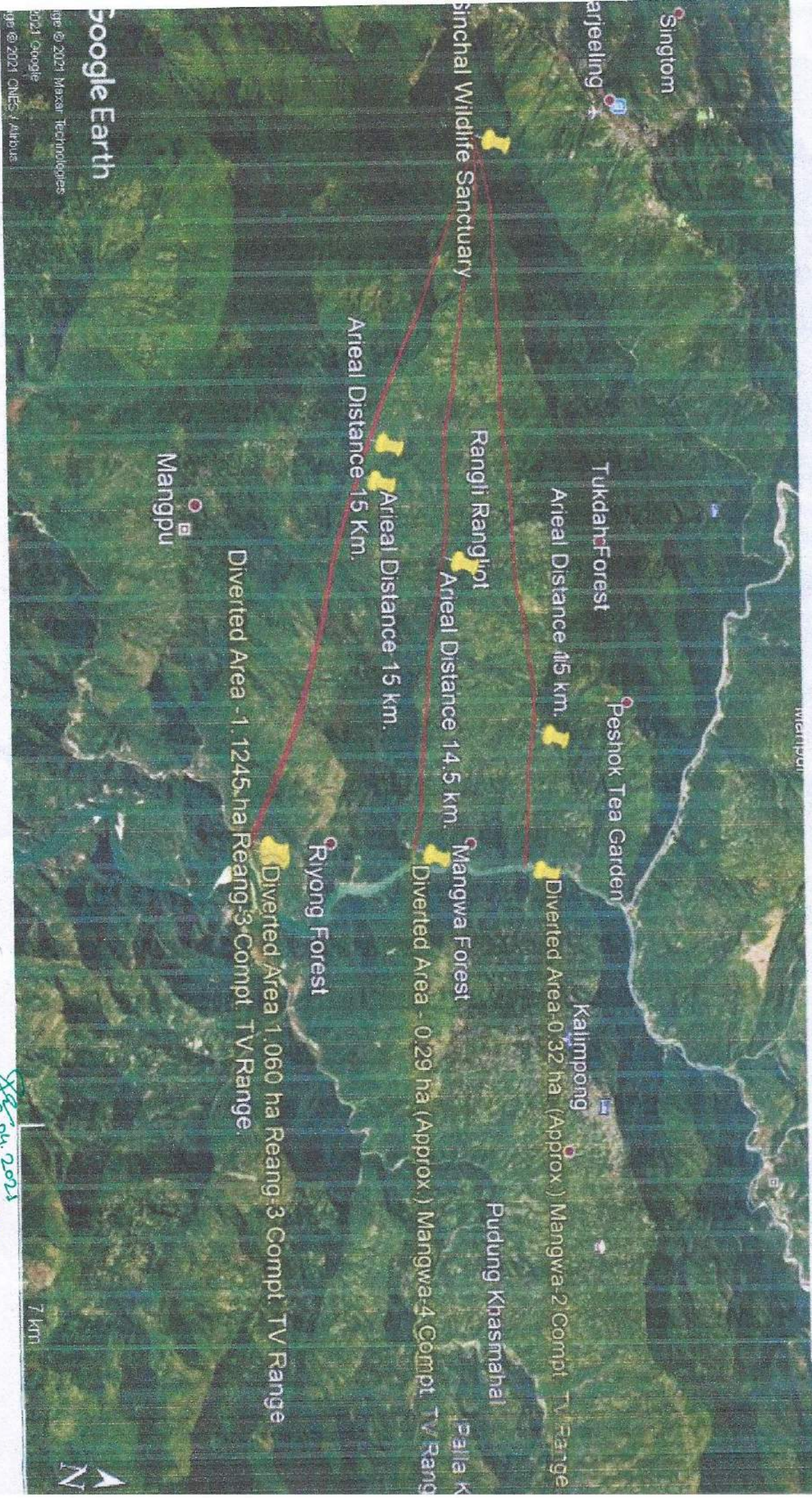


De
13.04.2021
Divisional Forest Officer
Darteeling Forest Division

71

ANNEXURE-II

Proposal for Diversion Sivok-Rangpo new BG Railway Line 2.7945 ha. under Darjeeling Division.



Legend

29.04.2023

Divisional Forest Officer
Darjeeling Forest Division

SEEN
 DFO: *Pa* 04.2021
 ABFO-I:
 ABFO-II:
 H.C.:

DIVISIONAL FOREST OFFICER
 Reg. No.
 File No.
 Date.

DIVISIONAL FOREST OFFICER
 Reg. No. 11245
 File No. 28 -
 Date. 6/04/2021
 Darjeeling Forest Division

The report enlightens the muck generation from the ongoing tunnel construction at T6 & T7 and its disposal methodology.

Report on muck disposal site (1.1245 Ha, under Darjeeling FD) near NHPC Gate, TLDP- III and its disposal methodology.

Sivok-Rangpo New BG Rail Line Project

Forwarded as received from user Agency

Pa
 13.04.2021

**Divisional Forest Officer
 Darjeeling Forest Division**

CONTENTS

179

Introduction	3
1.0 Muck disposal Site	3
1.1 Co-ordinates of disposal site	4
1.2 Estimated capacity of the muck to be disposed	4
2.0 Criteria for selection of dumping site	4
2.1 Muck disposal methodology	5
2.2 Geological report and bore/drill log data	6
3.0 Muck disposal management & mitigation techniques	7
3.1 Engineering measures	7
3.1.1 Levelling	7
3.1.2 Gabion Wall	8
3.2 Biological measures	12
3.2.1 Phytoremediation	12
3.2.2 Soil Treatment	12
3.2.3 Plantation technique	12
4.0 Conclusion	13

INTRODUCTION

180

Northeast Frontier Railway (NFR) has begun construction of the Sivok-Rangpo New BG Railway Project a 44.96km stretch of rail line that will mostly pass through tunnels dug in the hills. This rail project will bring Sikkim on the rail route map and have connectivity with rest of the country. The line will be broad gauge and has a proposed 100 km/hr. speed limit. Once operational, it will be for the first time that Sikkim will be connected to the main Indian rail network and it is expected to boost local tourism and the region's economy. The rail link will pass through the steep terrain of the Kanchenjunga mountain range foothills and the Teesta river valley. 85% of the route will pass through tunnels.

The New Austrian tunnelling method (NATM), also known as the sequential excavation method (SEM) or sprayed concrete lining method (SCL), is a method of modern tunnel design and construction employing sophisticated monitoring to optimize various wall reinforcement techniques based on the type of rock encountered as tunnelling progresses.

Stage -I forest clearance has been accorded for diversion of 86.6225 Ha, 0.9294 Ha, 12.3786 Ha for construction of main tunnels, bridges, access road to tunnel portals, dumping yards, station yards etc. A total of 4 forest land diversion proposals had been initiated by IRCON out of which 3 proposals already received Stage-1 approval and one having 13.512 Ha (including Kurseong, Darjeeling, Kalimpong) had been applied recently and is under process.

Forest Land Area (Ha)	Status	Stage-1 approved?	Issued by
86.6225	Applied earlier	YES	DM Darjeeling & DM Kalimpong
0.9294	Applied earlier	YES	DM Darjeeling
12.3786	Applied earlier	YES	DM Darjeeling & DM Kalimpong
13.512	Applied recently	NO	-

The concerned, designated dumping site has an area of 1.1245 Ha located near NHPC Gate, TLDP- IV in-between NH-10 & Rambh Jhora, which falls under Darjeeling forest division.

13.512 Ha		
Kurseong	Darjeeling	Kalimpong
0.5089 Ha	2.7945 Ha	10.2086 Ha
<ul style="list-style-type: none">T3P1 Alt access road	<ul style="list-style-type: none">0.29 Ha T7P1 Access road0.32 Ha T7P2/NH 10 protection.1.1245 Ha TLDP Gate- 4, Dumping Yard (B1).1.06 Ha TLDP Gate- 4, Camp Setup.	<ul style="list-style-type: none">0.9278 Ha Lobar Kote1.4156 Ha Melli Staff Qtr. Two Patches.1.3093 Ha Bhalu Khola two patches, Dumping Yard (B2).6.5559 Ha Tarkhola Dumping Yard (B3).

1.0 MUCK DISPOSAL SITE:

The selection of muck disposal sites was carried out considering the quantity of the muck, landscape, cost effectiveness, nearness to source of generation, absence of ground and surface water, relief and scope for afforestation works. Designated location (1.1245 Ha) is free from trees and plantations and disposal of muck in turn, can imply positive impact on slope stabilisation of NH-10.

All the dumping locations shall be well supported at base by suitable retaining structures, preferably gabion or stone crate walls. Subsequently, the muck disposed will be levelled and graded to a certain extent to carry on further land rehabilitation processes. All the spoil tips at the muck disposal site will be developed by taking up plantation through bio-technological methods to generate a thick forest canopy over them.

1.1 Table:1 Co-ordinates of the designated disposal site are as follows:

B1= 1.1245 Ha		
SL No.	Easting	Northing
1	641878.9999000	2986801.5323000
2	641872.8509000	2986845.8002000
3	641866.7467000	2986889.7456000
4	641860.4684000	2986934.9443000
5	641854.0336000	2986981.2700000
6	641896.6749000	2986988.3769000
7	641913.9705000	2986938.2134000
8	641933.5957000	2986881.3177000
9	641988.3789000	2986854.0342000
10	641957.3078000	2986839.1201000
11	641924.8054000	2986823.5189000

1.2 Table:2 Estimated Capacity of muck likely to be disposed at designated site, generated from T6 & T7 tunnels, adits etc.

Estimated Capacity (Considering approx. 10 M height of filling along with providing approx. 3m height gabion wall around the periphery of the disposal sites.)
Approx. 73,000-75,000 m3

2.0 Criteria for selection of muck disposal site

The muck disposal site had been carefully selected and taken after careful consideration of availability of suitable area along with minimizing distance from muck generation sites and neutralizing hazardous impact on the surrounding environment.

The following points were considered and followed as guidelines for finalization of the area to be used as a muck disposal site.

The Sivok-Rangpo New BG Rail Line Project being a Green project, it has been considered that wildlife habitation area should not be affected or utilized for selecting dumping site.

1. The concerned dumping site is more or less located near the project site thus haulage of muck to a long distance is avoided, this in turn reduces the air pollution due to short vehicular movement.
2. All the mentioned dumping site is free from any landslides or creep and care should be taken to protect toe erosion and slope instability.
3. There are no active channel or stream flowing through the above-mentioned dumping site.
4. The above-mentioned dumping site is situated at a suitable distance from the human settlements along NH10.

2.1 Muck disposal methodology.

Disposal of muck may create problem if not done properly. It is susceptible to scattering unless the muck disposal yards are supported with engineering measures such as gabions. The dumping site needs proper handling to avoid spilling of muck into the river water while dumping and in post dumping stages. The concerned disposal site has to be developed from the ground level either by providing stone masonry or by gabion structure. In this muck dumping site, the muck brought in dumpers shall be dumped along the sloperolled and graded in such a way that slope is always maintained at 1(H):2(V).

Generated muck should be disposed in such a way that it does not contaminate the adjacent water body (i.e., Teesta River) and other rivulets if present. Gabion walls (approx. height – 3m) shall be erected at the base/toe of the designated site to keep the muck within the boundaries.

Dumpers of suitable capacity shall be used to transport the muck generated at sites. The stock piles of muck shall be levelled with the movement of dozer etc. Zoning of the dump shall be done judiciously and ensure stability of side slopes of NH-10.

The nature of excavated muck may vary significantly from the natural soils in some cases; therefore, its unsound disposal is considered to contaminate not only the water quality, air quality but soils and vegetation of surrounding areas. Before execution of the proposed work, a proper geological report and bore/drill log data had been prepared and some of those are enclosed for reference where lithological condition of the sub-strata is clearly defined.

2.2 Geological report and bore/drill log data of T7:

183

Constell Consultants Pvt. Ltd.		FIELD BORE / DRILL LOG														
Project: Geotechnical Investigation including drilling of boreholes, setting of sample etc. for construction of Stack - Rangeo New BG Rail Line Project										Bore Hole No.: BH-22		Location: TP1				
Location: N 2990228 E 641420										Ground Elevation: -222.6m		Date of Boring / Drilling: Hs / Ns				
Method of Boring / Drilling: Auger / Rotary										Water Level: 0.50m b.g.l.		Date: From: 21.05.11 To: 16.06.11				
Boring / Drilling Equipment: G-O-12										Dia of Boring / Drilling: Hs / Ns						
Casing Lowered: Hs 1.27m, Ns 16.55m																
Date (dd / mm)	Elevation (m)	Depth: RUN (m)		Length (m)	Nature of Sampling	SPT No. of blows					Time Taken (min)	Total length of core (m)	Core Recovery (%)	R.C.D. (%)	Description	
		From	To			15-15 cm	15-30 cm	30-45 cm	45-60 cm	N Value						
21-05	-222.6	0.00														
		0.40			D											Over sand mixed with gravel, pebbles and fragmented rock pieces
		0.54	0.54	0.04	SD	86					100					-do-
		0.54	1.00	0.46	C						50	0.06	31			Gravel pebbles etc.
		1.00	2.00	1.00	C						75	0.18	18			Highly weathered greenish grey coloured medium grained phyllite, slightly foliated, possessing phyllitic structure by parallel arrangement of silty minerals like mica, chloritic mineral, covered by quartz, feldspar (felsic) bands etc. while darker bands composed of biotite etc. highly fractured from top to bottom of the run due to presence of close spaced fractures, one set non-stained joint dipping 60°c axis present, cores are broken into pieces.
22-05		2.00	3.00	1.00	C						90	0.35	35			-do-
23-05		1.00	4.00	1.00	C						110	0.71	71			-do- a band of quartzite (0.10m thick) occurs at depth 3-90m
NOTES: 1. Abbreviation Used: U-Undisturbed Sample C-Core Sample D-Disturbed Sample F-Standard Penetration Test V-Vane Shear Test 2. Level at which Artesian Condition experienced and its pressure, if any 3. Water Loss with depth, if any Partial water loss from 1.70m to 5.50m depth 4. Colour of water during drilling Greenish grey																
Site Engineer: S. Dhara		Driller: Sk. Anand		Job No.: CCPL118M64												

Constell Consultants Pvt. Ltd.		FIELD BORE / DRILL LOG														
Project: Geotechnical Investigation including drilling of boreholes, setting of sample etc. for construction of Stack - Rangeo New BG Rail Line Project										Bore Hole No.: BH-22		Location: TP1				
Location: N 2990228 E 641420										Ground Elevation: -222.6m		Date of Boring / Drilling: Hs / Ns				
Method of Boring / Drilling: Auger / Rotary										Water Level: 0.50m b.g.l.		Date: From: 21.05.11 To: 16.06.11				
Boring / Drilling Equipment: G-O-12										Dia of Boring / Drilling: Hs / Ns						
Casing Lowered: Hs 1.27m, Ns 16.55m																
Date (dd / mm)	Elevation (m)	Depth: RUN (m)		Length (m)	Nature of Sampling	SPT No. of blows					Time Taken (min)	Total length of core (m)	Core Recovery (%)	R.C.D. (%)	Description	
		From	To			15-15 cm	15-30 cm	30-45 cm	45-60 cm	N Value						
		4.00	5.00	1.00	C							125	0.46	46		-do- highly fractured from top to bottom of the run due to presence of close spaced fractures, one set non-stained joint dipping 60°c axis present a band (0.10m) of quartzite occurs at depth 4.20m, cores are broken into pieces
24-05		5.00	6.00	1.00	C							140	0.41	41		-do-
		6.00	7.00	1.00	C							150	0.67	67		Moderately weathered greenish grey coloured medium grained phyllite, highly foliated, possessing phyllitic structure, highly fractured from top to bottom of the run due to presence of close spaced two sets non-stained joint, joints are (i) 60°c axis, (ii) sub-vertical joint, joint planes rough and waxy, cores are broken into pieces
25-05		7.00	8.00	1.00	C							230	0.82	82		-do-
26-05		8.00	9.00	1.00	C							300	0.73	73		-do-
NOTES: 1. Abbreviation Used: U-Undisturbed Sample C-Core Sample D-Disturbed Sample F-Standard Penetration Test V-Vane Shear Test 2. Level at which Artesian Condition experienced and its pressure, if any 3. Water Loss with depth, if any Partial water loss from 1.70m to 5.50m depth 4. Colour of water during drilling Greenish grey																
Site Engineer: S. Dhara		Driller: Sk. Anand		Job No.: CCPL118M64												

Constell Consultants Pvt. Ltd.		FIELD BORE / DRILL LOG														
Project: Geotechnical Investigation including drilling of boreholes, setting of sample etc. for construction of Stack - Rangeo New BG Rail Line Project										Bore Hole No.: BH-22		Location: TP1				
Location: N 2990228 E 641420										Ground Elevation: -222.6m		Date of Boring / Drilling: Hs / Ns				
Method of Boring / Drilling: Auger / Rotary										Water Level: 0.50m b.g.l.		Date: From: 21.05.11 To: 16.06.11				
Boring / Drilling Equipment: G-O-12										Dia of Boring / Drilling: Hs / Ns						
Casing Lowered: Hs 1.27m, Ns 16.55m																
Date (dd / mm)	Elevation (m)	Depth: RUN (m)		Length (m)	Nature of Sampling	SPT No. of blows					Time Taken (min)	Total length of core (m)	Core Recovery (%)	R.C.D. (%)	Description	
		From	To			15-15 cm	15-30 cm	30-45 cm	45-60 cm	N Value						
		9.00	10.00	1.00	C							320	0.30	30		Highly weathered greenish grey coloured medium grained phyllite, slightly foliated, possessing phyllitic structure, highly fractured from top to bottom of the run due to presence of two sets non-stained joint, joints are (i) 90°-vertical joint dipping 40°c axis (ii) 60°c axis, joint planes rough and waxy, cores are broken into pieces
27-05		10.00	11.00	1.00	C							95	0.21	21		-do-
		11.00	12.00	1.00	C							85	0.11	11		-do-
		12.00	13.00	1.00	C							90	0.30	30		-do-
		13.00	14.00	1.00	C							105	0.36	36		Highly weathered grey coloured, medium to coarse grained quartzite, highly fractured, cores are broken into pieces
28-05		14.00	15.00	1.00	C							185	0.71	71		Moderately weathered hard and compact light grey coloured medium to coarse grained quartzite, highly fractured from top to bottom of the run due to presence of two sets close spaced non-stained joint, joints are (i) 60°c axis with spacing 0.05-0.10m (ii) sub-vertical joint with spacing 0.10m - 0.20m
		15.00	16.00	1.00	C							180	0.54	54		-do-
29-05		16.00	17.00	1.00	C							175	0.43	43		-do-
NOTES: 1. Abbreviation Used: U-Undisturbed Sample C-Core Sample D-Disturbed Sample F-Standard Penetration Test V-Vane Shear Test 2. Level at which Artesian Condition experienced and its pressure, if any 3. Water Loss with depth, if any Partial water loss from 1.70m to 5.50m depth																
Site Engineer: S. Dhara		Driller: Sk. Anand		Job No.: CCPL118M64												

Constell Consultants Pvt. Ltd.		FIELD BORE / DRILL LOG														
Project: Geotechnical Investigation including drilling of boreholes, setting of sample etc. for construction of Stack - Rangeo New BG Rail Line Project										Bore Hole No.: BH-22		Location: TP1				
Location: N 2990228 E 641420										Ground Elevation: -222.6m		Date of Boring / Drilling: Hs / Ns				
Method of Boring / Drilling: Auger / Rotary										Water Level: 0.50m b.g.l.		Date: From: 21.05.11 To: 16.06.11				
Boring / Drilling Equipment: G-O-12										Dia of Boring / Drilling: Hs / Ns						
Casing Lowered: Hs 1.27m, Ns 16.55m																
Date (dd / mm)	Elevation (m)	Depth: RUN (m)		Length (m)	Nature of Sampling	SPT No. of blows					Time Taken (min)	Total length of core (m)	Core Recovery (%)	R.C.D. (%)	Description	
		From	To			15-15 cm	15-30 cm	30-45 cm	45-60 cm	N Value						
		17.00	18.00	1.00	C							150	0.80	80		Moderately weathered hard greenish grey coloured medium grained phyllite, slightly foliated, possessing phyllitic structure, highly fractured from top to bottom of the run due to presence of two sets close spaced non-stained joint, joints are (i) 60°c axis with spacing 0.05-0.10m (ii) sub-vertical joint with spacing 0.10m - 0.20m
30-05		18.00	19.00	1.00	C							140	0.46	46		Highly weathered greenish grey coloured medium grained phyllite, slightly foliated, possessing phyllitic structure by parallel arrangement of silty minerals like mica, chloritic mineral, highly fractured from top to bottom of the run due to presence of two sets close spaced non-stained joint, joints are (i) 60°c axis with spacing 0.05-0.10m (ii) sub-vertical joint with spacing 0.10m - 0.20m, cores are broken into pieces
		19.00	20.00	1.00	C							130	0.43	43		-do-
		20.00	21.00	1.00	C							135	0.43	43		-do-
		21.00	22.00	1.00	C							140	0.18	18		-do-
01-06		22.00	23.00	1.00	C							220	0.49	49		-do-
02-06		23.00	24.00	1.00	C							140	0.52	52		Highly weathered grey coloured fine grained quartzite, hard, highly fractured, cores are broken into pieces
NOTES: 1. Abbreviation Used: U-Undisturbed Sample C-Core Sample D-Disturbed Sample F-Standard Penetration Test V-Vane Shear Test 2. Level at which Artesian Condition experienced and its pressure, if any 3. Water Loss with depth, if any Partial water loss from 1.70m to 5.50m depth																
Site Engineer: S. Dhara		Driller: Sk. Anand		Job No.: CCPL118M64												

184

From the borehole data of different tunnels along the route, it can be seen that the sub-strata mainly consist of fine to medium sand mixed soil along with grey, yellowish to earthy brown colored clayey soil, gravels, pebbles can be found in the initial strata and in the mid strata quartzite phyllite rock can be seen and when we bore further down, we get silty highly weathered grey colored quartzite phyllite rock along with stone and boulder fragments. These are natural sub geo-strata found generally in hilly terrains and are completely environment friendly. Hence, the muck generated from the sites does not contain any toxic chemicals or any deleterious substances that may affect the geological strata of the proposed dumping site in future.

A muck disposal plan would take into calculation of muck to be generated, swelling factors, reutilization of muck, dumping areas and their characteristics, mitigation measures including engineering and biological measures stated below.

Muck reuse is always an environmental benefit, since it reduces both disposal in landfills and raw material extraction, whatever the type of civil work concerned. In case of tunnel projects, since spoil has however to be removed from construction site, recovery is more convenient than the landfill disposal, mainly because of the following reasons: immediate availability and excellent ability to control the required characteristics in case of reuse within the production site.

Spoil reuse as by-product has proved to be an environmental benefit, as well as a technological advantage during tunneling projects. But in this case, reusability of spoil is not suitable for construction activities with a view to maintain certain standard and quality of proposed, work but in turn its disposal is completely environment friendly and are free from deleterious substances.

3.0 MUCK DISPOSAL MANAGEMENT & MITIGATION TECHNIQUES

During the muck disposal, the following site criteria to be adopted before utilizing the site. They are as follows:

- The dumping site is located within a short distance from the tunnel portals which in turn will minimize the haulage of muck and eventually help in reducing the air pollution.
- The site is free from active landslides or creeps and thus there shall not be any possibility of toe erosion /slope failure.
- There are no natural channel or streams flowing through the designated dumping yard, thus there will not be any possibility of contact between the muck and the stream.
- Advance methodology and engineering technique will be applied during dumping and the muck will be kept confined within the protective walls so that themuck does not pollute the surrounding environment.

3.1 Engineering measures

3.1.1 Levelling

The levelling of the dumping piles is to be done using dozer layer by layer and which in turn reduces the volume of muck considerably. The levelling also makes it suitable for the plantation and other biological measures. Top surface would be levelled and graded to make the alternative use.

All precautionary measures will be followed during the dumping of muck. All dumpers must be well maintained so that loose soil could be well protected during haulage and transportation. All routes should be wetted prior to the dumping. Dumping would be avoided during the high-speed wind, so that

suspended particulate matters (SPM) level could be maintained and care should be taken so that the loose soil could not be leached out in the nearby water body if present.

3.1.2 Gabion wall/ Protection wall

Gabion wall is a cage, carefully packed rock toe of 3 m height with side slope of 1:1.5 is enough to withstand the stress caused by the muck. However, the ground terrain of this dumping site has a flat area followed by a gentle to moderately steep slope thus, by providing only gabion or stone crate wall at the base periphery will reduce the chance of spillage and will prevent further contamination.



Figure- 1: Erected Gabion wall surrounding the periphery of muck disposal site near T4



Figure- 2: Erected Gabion wall surrounding the periphery of muck disposal site near T5

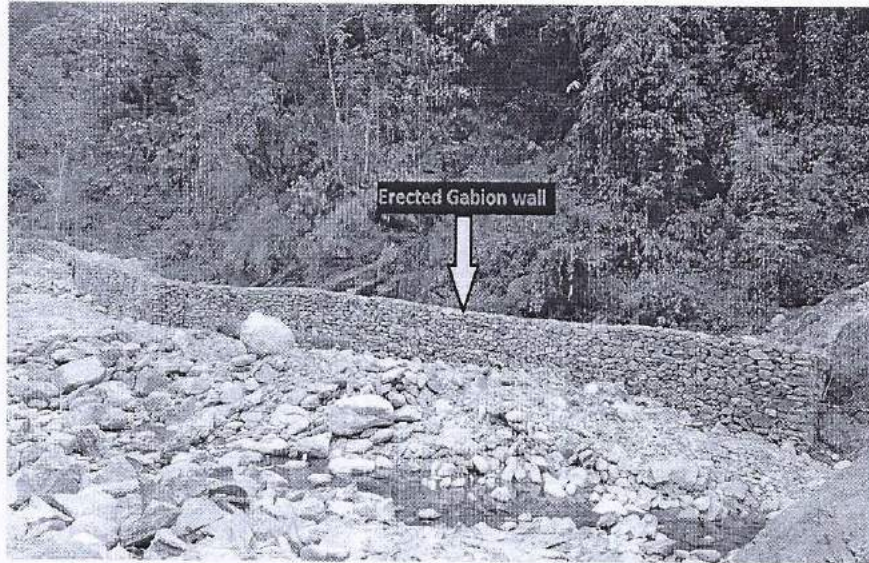


Figure- 3: Erected Gabion wall surrounding the periphery of muck disposal site near T6



Figure- 4: Erected Gabion wall surrounding the periphery of muck disposal site at A14 for muck generating from T9 & T10

Figure- 1, 2, 3& 4 depicts the proposed typical gabion wall/protection wall, erected around the periphery of the aforementioned sites (i.e. near T4, T5, T9 & T10). Similar type of muck retaining structures are to be constructed for this disposal site as well.

189

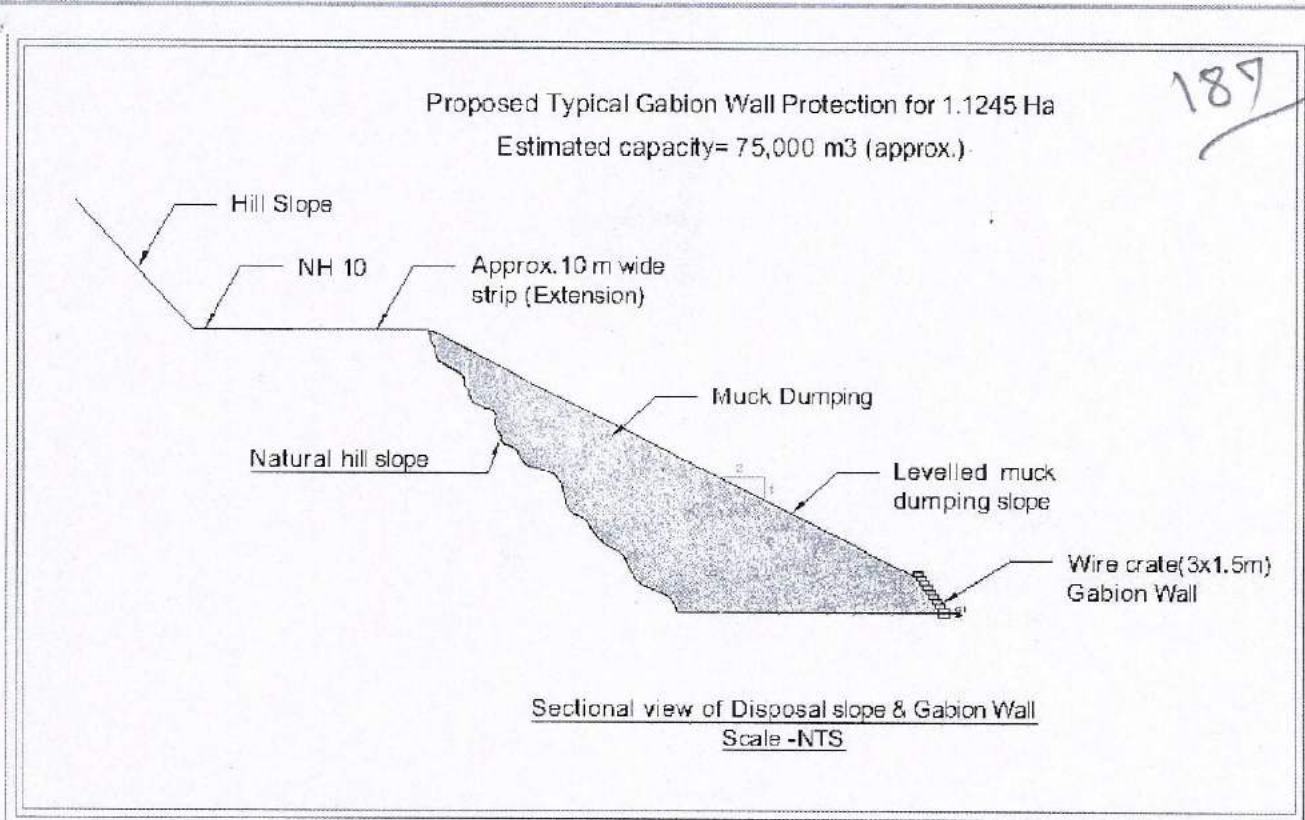


Figure- 5: Typical Gabion Wall Cross-section

Figure- 5, depicts a typical cross-section of a proposed wire crate gabion wall of dimension (3x1.5m) of a typical dumping site, erected around the base periphery, with a stabilized muck disposal slope of 1(V):2(H).



Figure- 6: Muck Disposal Yard KML



Figure- 7: Showing barren stature of the designated land

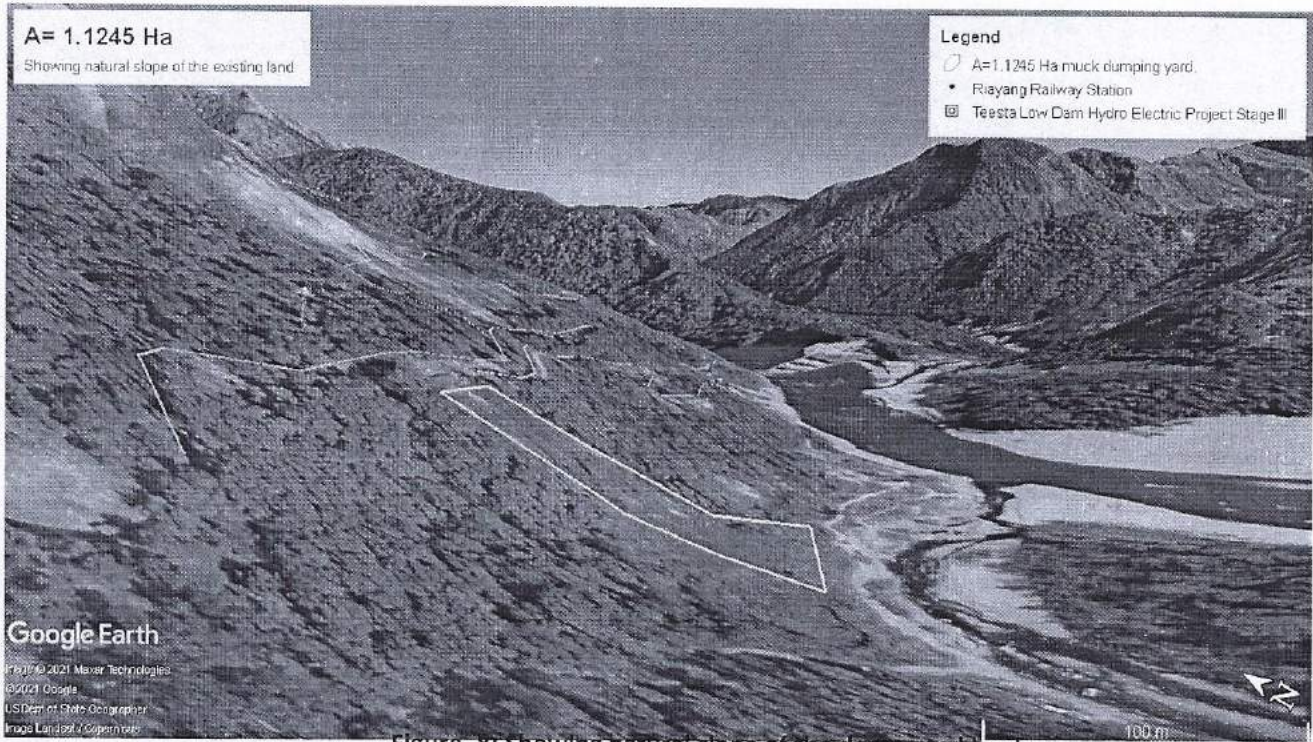


Figure- 8: Showing natural slope of the designated land

3.2 Biological measures

SPECIES FOR PLANTATION:

189

Afforestation with suitable plant species of high ecological and economic value and adaptable to local conditions will be undertaken in coordination with forest department.

3.2.1 Phytoremediation

Special care and efforts are required to take up biological measures at dumping site as the disposed muck will be devoid of nutrients and soil contents to support vegetation. The selection of soil for spreading over such an area and over hill slope would require nutrient profiling of soil for different base elements. Suitable mixture of nutrients would be done before placing the soil on the top surface of muck disposal areas to have administered growth of trees.

On completion of muck dumping, the base area shall be levelled and the slope would be levelled at 1(V):2(H) for further stabilization. An area of 2 m to 4 m width strip all along the periphery of the land fill shall be used for development of plantation so that vegetation cover could control the mechanical and hydrological effects on the slopes and would give the permanent stability to the muck. Plant saplings are to be considered based on the consultation with the forest department and the concerned DFO. Plants are the most important component of soil bio-engineering. Bio-engineering is used to accelerate site recovery by mimicking what would happen naturally. Use of native species and dense mixed plantation can be preferred for soil stabilization and peripheral protection. The success of stabilizing peripheral area depends on great extent with the native species. Survival of the plants depends on selection of the right plant for site.

3.2.2 Soil treatment

- Analysis of dumped material for their physical and chemical properties to assess the nutrient status to support vegetation.
- Formulation of appropriate blends of organic waste and soil to enhance the nutrient status of rhizo sphere.
- Isolation and screening of specialized strains of mycorrhiza fungi, rhizobium, azotobacter.
- Phosphate solubilizers (bio fertilizers inoculum) suitable for the dumped material.
- Mass culture of plant specific bio fertilizer and mycorrhiza fungi.
- Use of locally available manure and compost.

3.2.3 PLANTATION TECHNIQUE:

Planting of trees would be done in pits of 0.60 m x 0.60 m x 0.60 m size. Soil mixture would be used while filling the pits. Balance dug up soil/ muck will be stacked on downhill side of the pit for trapping the rain water and allowing it to percolate in the pit. It is proposed to use soil mixture in the pits & patches consisting of soil imported from nearby areas mixed with compost or vermin-compost manually. The ratio for the mix would be 5 parts: Compost/manure 2 parts: Sand 2 part: and humus or vermincompost 1 part. This will make nutrients available for the plants in the preliminary stages and also help increase soil aeration, porosity & permeability and improved moisture available for the plants.

The diagrammatic representation is given below:

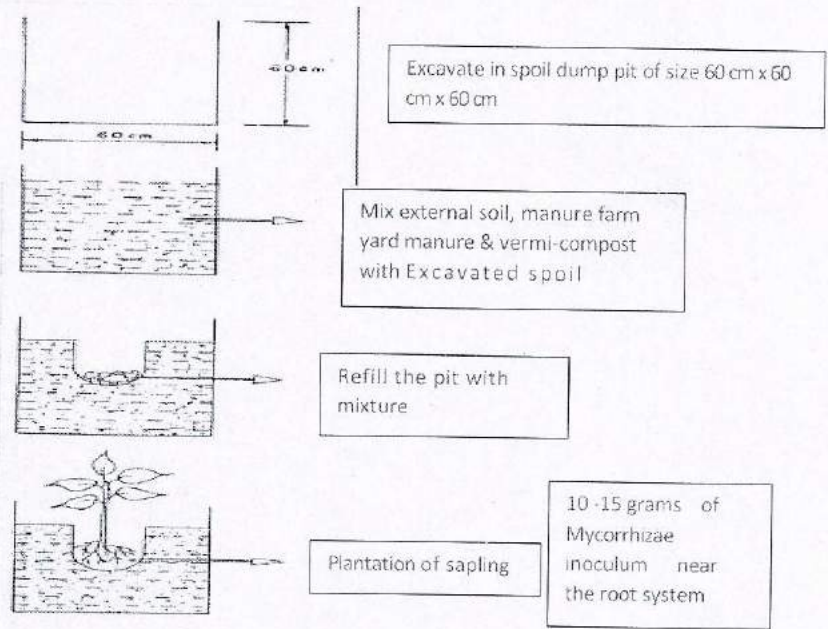


Figure-9

4.0 CONCLUSION

The muck will be material generated when we go for a tunnel construction and thus considered safe for disposal as we can analyse from the geological log of drill hole data. The present section gives emphasis on the muck disposal techniques. As the proposed tunnels passes through several forest divisions and wildlife sanctuaries, therefore it becomes a part and parcel to review the impacts caused by construction activity on the wild flora and fauna. All mitigation measures for flora and fauna to be considered. Also, the muck is dumped in such a way that it should not give rise to any unwanted environmental consequences. All precautionary measures will be taken during the muck dumping procedure. The concerned muck will be kept confined within boundary/protection wall which will prevent it from leaching outside. The muck will be levelled along the existing hill slope and kept suitable for further development.



Government of West Bengal
Directorate of Forests

Office of the Divisional Forest Officer, Kalimpong Forest Division
Ringkingpong Road, Kalimpong:: 734301

Phone - Fax:: (03552) 255496. Email Id-dfokpgdiv@gmail.com/dfokalse-wb@nic.in

191
Office of the CCF,
Hill Circle, W.B.,
Reg. No. 1348
Case No. C2-240
Date 13/04/21

13/04/21

Memo No: 791/19-39.

Dated, Kalimpong, 13/04/2021.

To,
The Chief Conservator of Forests,
Hill Circle, West Bengal.


Sub: Proposal for Diversion of 13.512 Ha. - Reg.

Ref: MoE, CC, integrated Regional Office Memo no: WB-SRBG-09/2021/FC/58 dt.01.04.2021

Sir,

With reference to above kindly find the following details pertaining to Kalimpong Forest Division as desired.

Sl no	Subject	Remarks/Explanation
1	Hard copy of Sol map file showing 12 individual proposed areas for diversion along with GPS coordinates duly signed/seal by competent authorities.	Hard Copy of Sol map pertaining to Kalimpong Division is enclosed. Soft copy is also attached for the reference.
2	Soft copy of KML/Shape file showing proposed area for diversion and CA area along with GPS coordinates.	KML files showing proposed area for diversion and CA area was already uploaded in Part-II. Soft copies of KML for Proposed area and CA is enclosed herewith for the reference.
3	Map showing aerial distance from the proposed project sites to the nearby protected forest area or wildlife sanctuary with duly signed by competent authority	The proposed area of diversion pertaining to Kalimpong Division is adjacent (around 23.8 KM) to the Mahananda Wildlife sanctuary. The Certificated Google Map is enclosed herewith for the reference.
4	The proposed area is very near to river bed a detail of muck dump should be provided with all the plan of gabion structures and terraces.	The Muck Disposal Plan under Kalimpong Forest Division is enclosed herewith for the reference.


Divisional Forest Officer,
Kalimpong Forest Division

Memo No: /

Dated, Kalimpong, / /2021.

Copy forwarded for kind information to

- The Addl. Principal Chief Conservator of Forests, CAMPA & Nodal Officer FCA'1980.

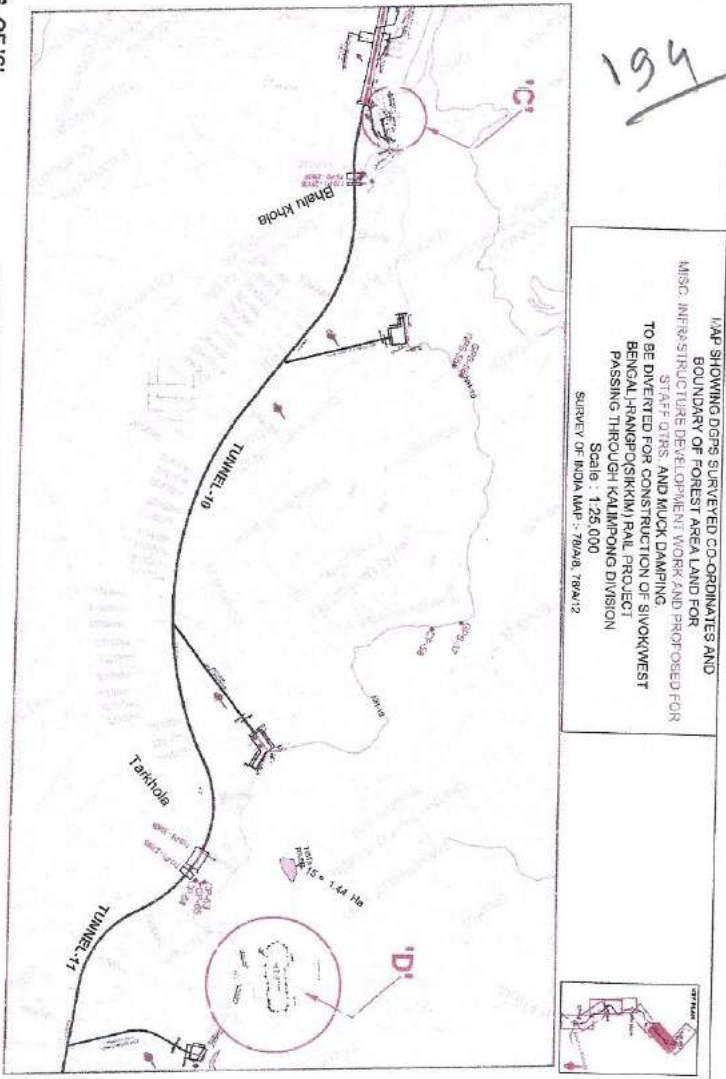
Sd/-C.Bhattacharya-IFS

Divisional Forest Officer,
Kalimpong Forest Division

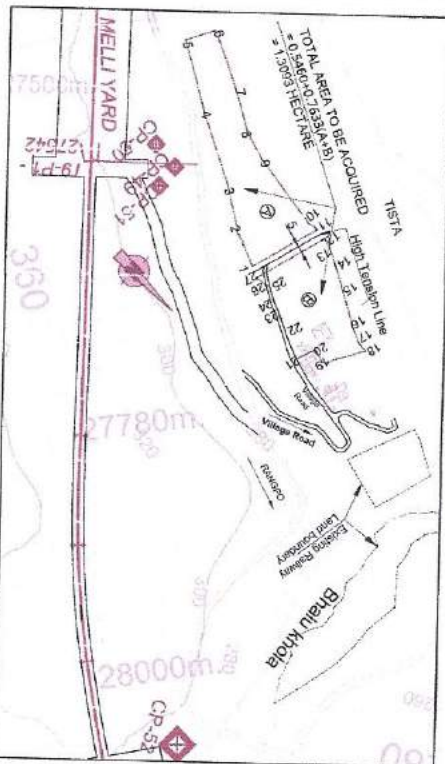
Co-ordinates of Land for muck damping
(Details of C)

Sl.No.	Eastng	Northing	Latitude(North)	Longitude(East)
1	644870.2502	2997488.5173	27.09215256	88.4612618
2	644858.3290	2997453.8070	27.0918857	88.4611381
3	644805.6624	2997558.5723	27.0910317	88.4605972
4	644749.6580	2997316.4820	27.0905442	88.4602705
5	644733.1008	2997365.5650	27.0910382	88.4602683
6	644739.4169	2997424.6269	27.0916285	88.4605405
7	644807.0105	2997500.9317	27.0923154	88.4602661
8	644808.8780	2997491.5180	27.0922113	88.4605438
9	644808.8780	2997500.9317	27.0923154	88.4602661
10	644808.8780	2997500.9317	27.0923154	88.4602661
11	644808.8780	2997500.9317	27.0923154	88.4602661
12	644808.8780	2997500.9317	27.0923154	88.4602661
13	644808.8780	2997500.9317	27.0923154	88.4602661
14	644808.8780	2997500.9317	27.0923154	88.4602661
15	644808.8780	2997500.9317	27.0923154	88.4602661
16	644808.8780	2997500.9317	27.0923154	88.4602661
17	644808.8780	2997500.9317	27.0923154	88.4602661
18	644808.8780	2997500.9317	27.0923154	88.4602661
19	644808.8780	2997500.9317	27.0923154	88.4602661
20	644808.8780	2997500.9317	27.0923154	88.4602661
21	644808.8780	2997500.9317	27.0923154	88.4602661
22	644808.8780	2997500.9317	27.0923154	88.4602661
23	644808.8780	2997500.9317	27.0923154	88.4602661
24	644808.8780	2997500.9317	27.0923154	88.4602661
25	644808.8780	2997500.9317	27.0923154	88.4602661
26	644808.8780	2997500.9317	27.0923154	88.4602661
27	644808.8780	2997500.9317	27.0923154	88.4602661
28	644808.8780	2997500.9317	27.0923154	88.4602661

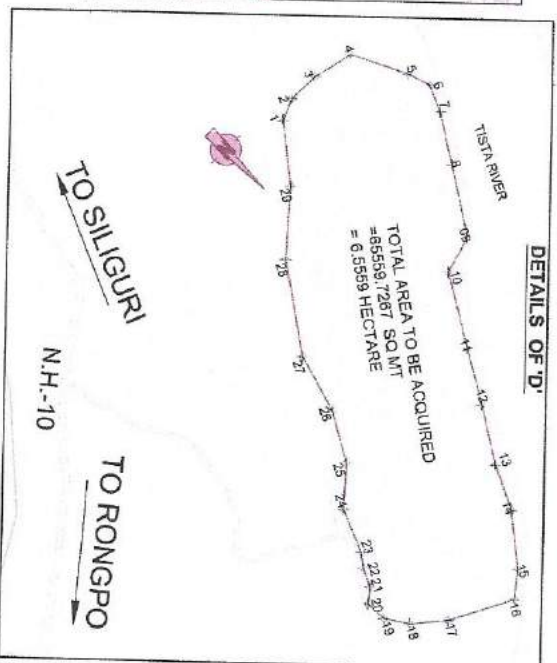
DETAILS OF C.



MAP SHOWING DGPS SURVEYED CO-ORDINATES AND BOUNDARY OF FOREST AREA LAND FOR MUCK DAMPING AND MUCK DAMPING STRUCTURE DEVELOPMENT WORK AND PROPOSED FOR STAFF PITS AND MUCK DAMPING TO BE DIVERTED FOR CONSTRUCTION OF SIPOKWEST BENGAL-RANGPO(SIKKIM) RAIL PROJECT PASSING THROUGH KALIMPONG DIVISION
Scale - 1:25,000
SURVEY OF INDIA MAP-77094, 794/2



TOTAL LAND TO BE ACQUIRED
= 1.3093+6.5559=7.8652 HECTARE



DETAILS OF D.
TOTAL AREA TO BE ACQUIRED
= 65559.1287 SQ MT
= 6.5559 HECTARE

LEGEND
- - - - - ACQUIRED LAND
- - - - - EXISTING LAND
- - - - - BOUNDARY OF FOREST AREA
- - - - - RAILWAY LINE
- - - - - ROAD

Co-ordinates of Land to be acquired (Details of D)

Sl. No.	Eastng	Northing	Latitude(North)	Longitude(East)
1	649000.19700	3001954.50350	27.131885852076	88.50345479238
2	648982.34980	3001926.32450	27.13181316654	88.50326367402
3	648954.14200	3001926.60700	27.13181876332	88.50297916455
4	648918.58790	3001934.54380	27.13189423352	88.50262147394
5	648894.44400	3001982.11500	27.13206184885	88.50283866365
6	648888.59350	3002001.96880	27.13250600009	88.50232704239
7	648898.92390	3002075.10420	27.13271369201	88.50243404157
8	648923.62700	3002064.81700	27.13306944512	88.50288802655
9	648958.91300	3002119.38700	27.13355814549	88.50305055222
10	648991.65600	3002129.01600	27.13364515135	88.50338202184
11	649006.31200	3002187.24600	27.13416130394	88.50373869923
12	649050.08400	3002231.42680	27.134659227480	88.50400072619
13	649068.89400	3002276.98900	27.13496629736	88.50430000440
14	649098.76300	3002314.74900	27.135308629413	88.50449491410
15	649131.13000	3002355.89550	27.13567409371	88.50481639642
16	649151.48200	3002372.16600	27.13586312489	88.50502366908
17	649205.63600	3002344.49300	27.13556612489	88.50556651408
18	649231.34000	3002373.59500	27.13597135582	88.50585115061
19	649243.70110	3002304.75740	27.13520037961	88.50594579911
20	649244.99880	3002285.43380	27.13502584944	88.50595549365
21	649233.66600	3002276.63580	27.13494766030	88.50587624045
22	649226.34270	3002260.66490	27.13480043048	88.50581132348
23	649217.64710	3002249.07650	27.13467006622	88.50576537018
24	649201.80050	3002211.38680	27.13446211641	88.50551828800
25	649171.79750	3002184.91880	27.13412658044	88.50525058617
26	649148.47200	3002144.39700	27.13379638192	88.50496577775
27	649133.36300	3002093.23800	27.13349648922	88.50480705579
28	649084.55700	3002022.09600	27.13296486822	88.50430624945
29	649036.91100	3001980.26500	27.13259410109	88.50382056934

Co-ordinate DGPS observation point

CONTROL POINT	UTM Co-ordinate	Geographic Co-ordinate		
	NORTHING	EASTING	Latitude(North)	Longitude(East)
CP-49	2997375.829	644857.743	27.09182007	88.461123013
CP-50	2997350.564	644855.750	27.090954190	88.461089964
CP-51	2997377.306	644878.744	27.091193945	88.461334975
CP-52	2997332.630	645208.817	27.094366472	88.464706327
CP-53	2997744.796	645248.820	27.094471050	88.465059322
CP-54	2997816.949	645191.246	27.093128357	88.4648537442
GPS-55	2999241.887	645468.279	27.108014108	88.467499926
GPS-56	2999336.459	645457.062	27.108813647	88.467498081
GPS-57	3000803.307	646495.842	27.113943804	88.478047810
CP-58	3000721.204	646666.137	27.1120279884	88.480083854
CP-59	3000638.309	648132.772	27.120196717	88.495239415
GPS-60	3000692.922	648202.308	27.120196717	88.495239415
CP-61	3000700.929	648206.166	27.120337167	88.504310715
CP-62	3001283.027	649095.048	27.125092499	88.504310715
CP-63	3001281.834	649108.097	27.125892858	88.50454280
CP-64	3001234.523	649153.757	27.125507026	88.504909127
CP-65	3001279.765	649143.237	27.125960386	88.504808479
CP-66	3002336.234	649923.566	27.135410501	88.512828057
CP-67	3002465.818	649973.156	27.138574862	88.513323880

CLIENT: NORTH EAST FRONTIER RAILWAY

ENGINEERS: IIGM Icon International Ltd.

PROJECT TITLE: PLAN SHOWING THE LAND FOR MISC. INFRASTRUCTURE DEVELOPMENT WORK AND DAMPING TO BE ACQUIRED PERMANENTLY IN FOREST AREA FOR THE CONSTRUCTION OF NEW BROAD GAUGE RAIL LINK BETWEEN SIPOK AND RANGPO

SM/ICOM/RRP

CGM/ICOM/RRP

DY CEE CON / N/P M.F.A.L.Y.

Divisional Forest Officer Kalimping Forest Division

DWG NO.: Addl Land/IKP/G/02

SCALE: AS SHOWN

DATE: 14/07/2014

REV. 0

PREPARED BY: RAJESH K D CHA

Co-ordinates of Land (Details of A)

Sl. No.	UTM Co-ordinate Easting	UTM Co-ordinate Northing	Geographic Co-ordinate Latitude(North)	Geographic Co-ordinate Longitude(East)
1	642478.4265	2996212.9405	27.080993361	88.436995959
2	642434.7176	2996189.0016	27.08072205	88.43655251
3	642380.7154	2996162.3470	27.08048704	88.43600493
4	642360.4321	2996192.5184	27.08076144	88.43580389
5	642411.7121	2996227.1484	27.08108872	88.43632494
6	642448.5721	2996249.1904	27.08126395	88.43669914
7	642480.3689	2996271.5828	27.08146269	88.43702233
8	642533.9344	2996288.0508	27.08160683	88.43746851
9	642560.9450	2996306.3650	27.08176881	88.43789888
10	642573.4963	2996277.1856	27.08150367	88.437962
11	642555.8927	2996256.4097	27.08130002	88.43758044
12	642507.0649	2996234.7328	27.08112734	88.43728227
13	642478.4265	2996212.9405	27.080993361	88.436995959

Co-ordinate DGPS observation point

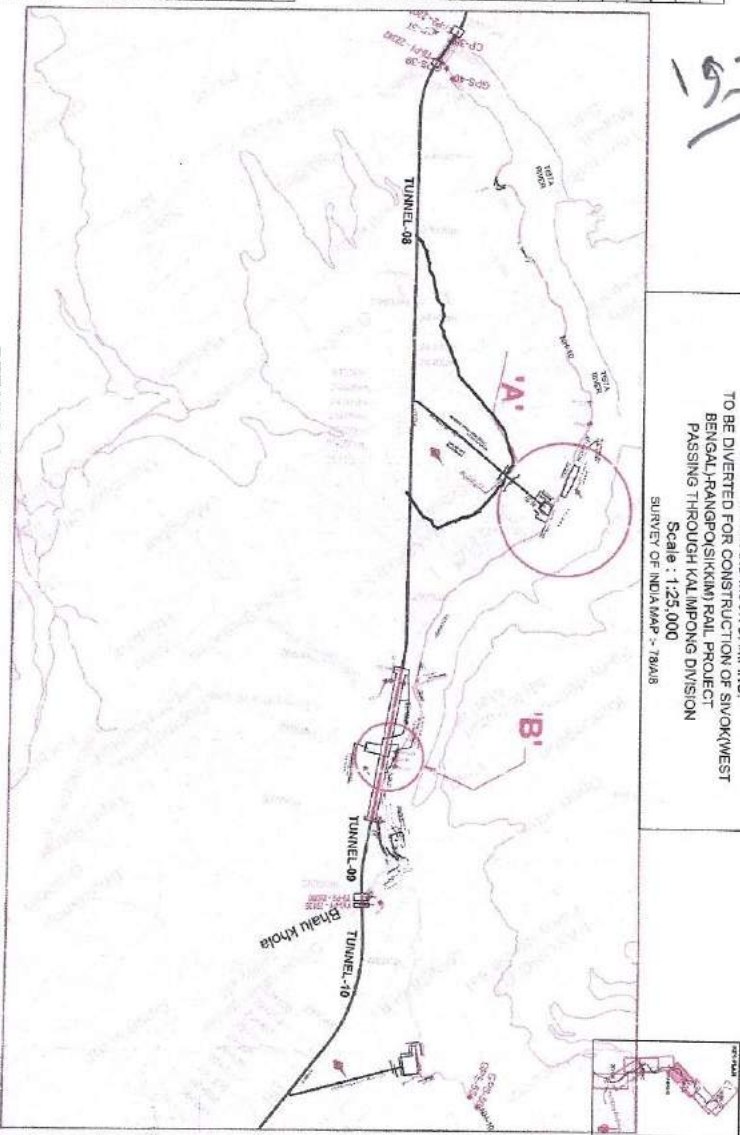
CONTROL POINT	UTM Co-ordinate NORTHING	EASTING	Geographic Co-ordinate Latitude(North)	Geographic Co-ordinate Longitude(East)
GPS-41	2995877.082	642045.487	27.077546819	88.432592039
GPS-42	2995994.491	642130.019	27.078997826	88.433457853
CP-43	2996613.286	644283.431	27.084359272	88.455242716
CP-44	2996631.716	644248.911	27.084529669	88.454896786
CP-45	2996693.367	644150.401	27.085110258	88.454314224
GPS-46	2997052.493	644503.405	27.088300831	88.457512110
CP-47	2997081.472	644543.138	27.088558222	88.457916143

Co-ordinate DGPS observation point

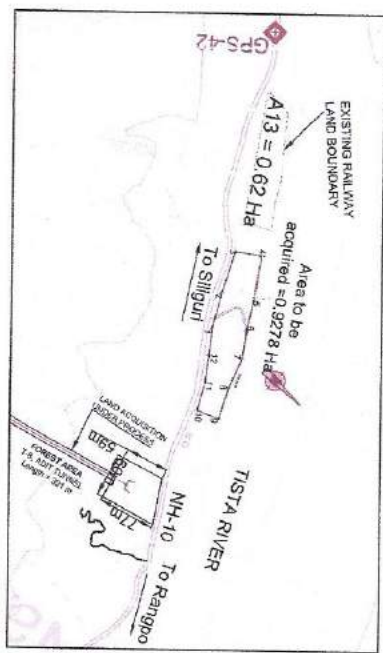
CONTROL POINT	UTM Co-ordinate NORTHING	EASTING	Geographic Co-ordinate Latitude(North)	Geographic Co-ordinate Longitude(East)
GPS-48	2997119.979	644569.136	27.08899052	88.458182801
CP-49	2997375.829	644857.743	27.091182007	88.461123013
CP-50	2997550.564	644855.750	27.090954190	88.461099964
CP-51	2997977.396	644878.744	27.091133945	88.461334975
CP-52	2997732.630	645208.817	27.093855472	88.464705127
CP-53	2997744.736	645243.820	27.094471050	88.465059522

5/1

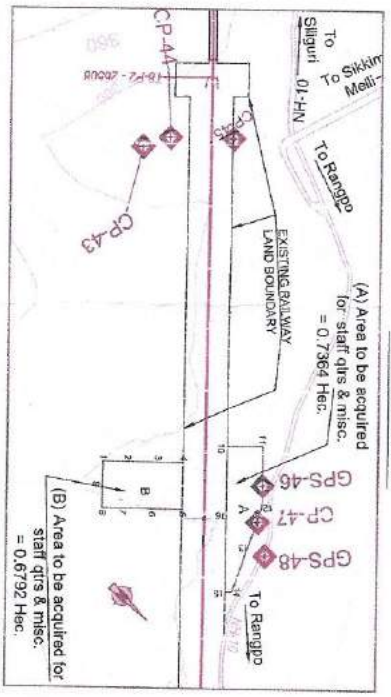
MAP SHOWING DGPS SURVEYED CO-ORDINATES AND BOUNDARY OF FOREST AREA LAND FOR MISCELLANEOUS DEVELOPMENT WORK AND PROPOSED FOR STAFF QUARTERS AND MUCK DAMPING TO BE DIVERTED FOR CONSTRUCTION OF SIVOK WEST BENGAL-RANGPO-SIVOK RAIL PROJECT PASSING THROUGH KALIMPONG DIVISION
Scale : 1:25,000
SURVEY OF INDIA MAP - 78A/8



DETAILS OF 'A'



DETAILS OF 'B'



TOTAL LAND TO BE ACQUIRED = 0.9278+0.7364+0.6792=2.3434 HECTARE

Co-ordinates of Land for Staff Qtrs at Melli Yard (Details of B)

Sl. No.	UTM Co-ordinate Easting	UTM Co-ordinate Northing	Geographic Co-ordinate Latitude(North)	Geographic Co-ordinate Longitude(East)
1	644629.6534	2996872.9973	27.08666757	88.45876417
2	644606.8883	2996897.5291	27.08689137	88.45853758
3	644578.0501	2996928.6297	27.08717509	88.45825033
4	644555.7973	2996952.6201	27.08739394	88.45802874
5	644602.5764	2996996.2653	27.08778297	88.45850555
6	644630.4406	2996966.2318	27.08750898	88.45878301
7	644657.5363	2996937.0267	27.08724255	88.45905282
8	644676.4410	2996916.6503	27.08705677	88.45924106
9	644653.9275	2996895.6347	27.08686935	88.45901159
10	644497.7816	2996980.5214	27.08765183	88.45744699
11	644463.7791	2997015.5400	27.08797145	88.45710821
12	644524.0414	2997071.7927	27.08847286	88.45772245
13	644586.1881	2997099.7961	27.0887191	88.4583524
14	644634.7618	2997121.9834	27.08891157	88.45884475
15	644641.3762	2997114.5976	27.08884692	88.45891063
16	644656.4663	2997044.6363	27.08822332	88.45814708



CLIENT: **NORTHEAST FRONTIER RAILWAY**

ENGINEERS: **ICON** (Icon International Ltd)

PROJECT TITLE: **PLAN SHOWING THE LAND FOR MISCELLANEOUS DEVELOPMENT WORK AND PROPOSED FOR STAFF QTRS. AND MUCK DAMPING TO BE ACQUIRED PERMANENTLY IN FOREST AREA FOR THE CONSTRUCTION OF NEW BROAD GAUGE RAIL LINK BETWEEN SIVOK AND RANGPO**

GM/ICONS/HRP, CGM/ICONS/RRP, DY/CE/CON./NJP, NFR/LY

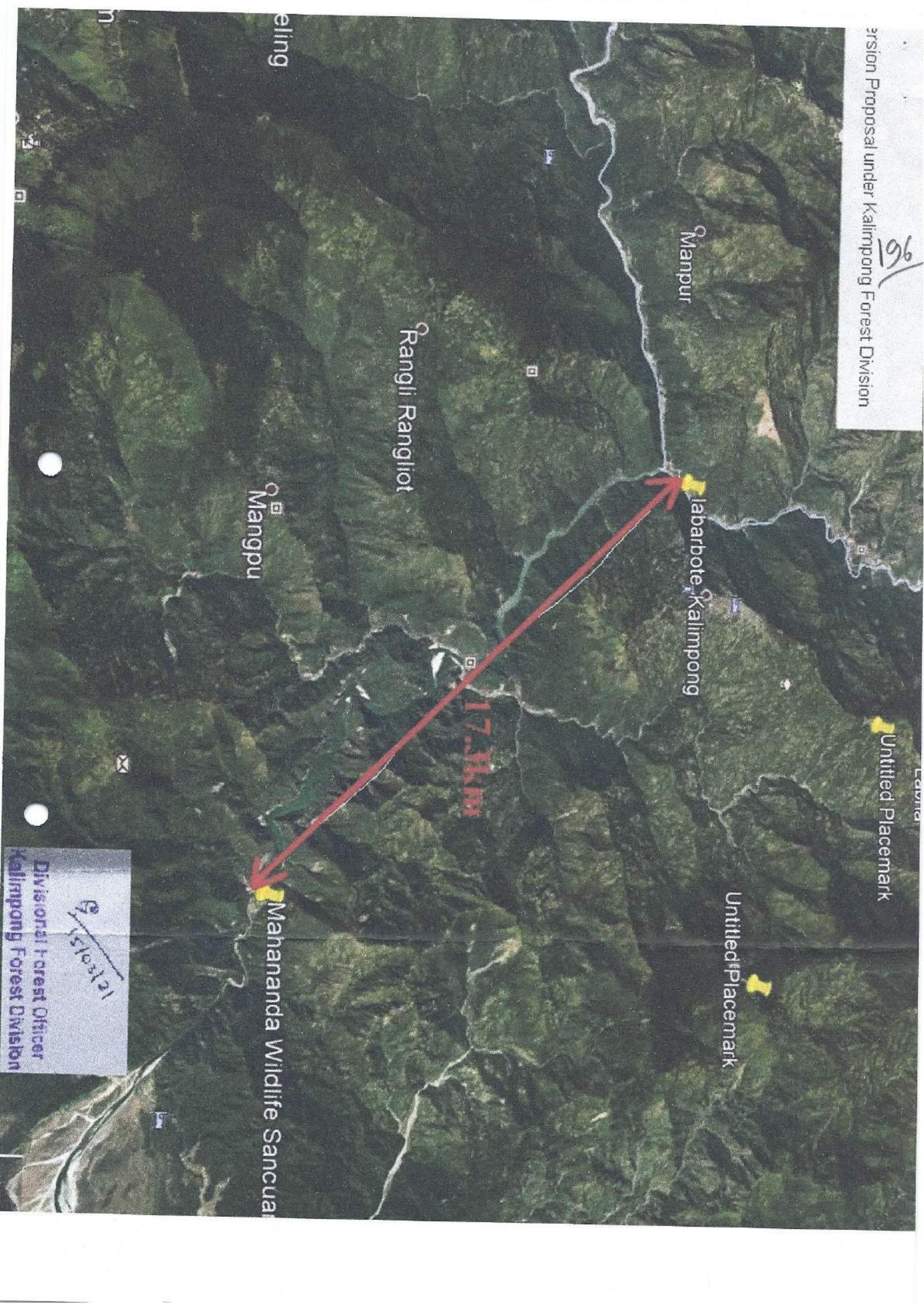
DWG NO: Addl Land/RG/01

SCALE: AS SHOWN

DATE: 01.07.2020

REV: 0

PREPARED BY: SALESHTES OJHA



Manpur

Rangli Rangliot

Mangpu

Labarbote, Kalimpong

17.3 km

Mahananda Wildlife Sanctuary

Untitled Placemark

Untitled Placemark

Divisional Forest Officer
Kalimpong Forest Division
12/07/21

197
Division under Kalimpong Forest Division
Tea Garden



Manpur

Tuktah Forest

Pesnok Tea Garden

Rangli Rangliot

Mangwa Forest

Riyong Forest

Mangpu

Mellie

KalimpongDungra-Khasmahal

Pudum

18.2 Km

Mahananda Wildlife S

Divisional Forest Officer
Kalimpong Forest Division

Division Kallimpong Forest Division

158

ar Forest

Mangpu

Rangli Rangliot

Tukdah Forest

Peshok Tea Garden

Mangwa Forest

Riyong Forest

Sittong Forest

Mahananda Wildlife Sanctuary

18.7km

Bhalukhop

Dungra Khasmahal

Maring

Untitled Placemark

Untitled Placemark

Untitled Plac

Mang

Divisional Forest Officer
Kallimpong Forest Division
15/03/21

109

Sittong Forest

Mahananda Wildlife Sanctuary

23.8 KM

Untitled Placem

Untitled Placem
Labha

Divisional Forest Officer
Kalimpong Forest Division
12/10/15



The report enlightens the muck generation from the on-going tunnel project at Sivok and its disposal methodology.

Report on Muck disposal sites and its disposal management plan under DFO Kalimpong.

Sivok-Rangpo new BG Rail Line Project

CONTENTS

Introduction.....	3
1.0 Muck disposal Site.....	3
1.1 Details of all muck dumping yards in West Bengal.....	4
1.2 Estimated Capacity of yards and likely generated muck.....	5
2.0 Criteria for selection of dumping site.....	5
2.1 Muck disposal methodology.....	5
2.2 Geological report and bore/drill log data.....	6
3.0 Muck disposal management & mitigation techniques.....	8
3.1 Engineering measures.....	8
3 1.1 Levelling.....	8
3 1.2 Gabion Wall.....	9
3.2 Biological measures.....	11
3 2.1 Phytoremediation.....	11
3 2.2 Soil Treatment.....	11
3 2.3 Plantation technique.....	12
4.0 Conclusion.....	12

INTRODUCTION

Northeast Frontier Railway (NFR) has begun construction of the Sivok-Rangpo New BG Railway Project a 44.96 km stretch of rail line that will mostly pass through tunnels dug in the hills. This rail project will bring Sikkim on the rail route map and have connectivity with rest of the country. The line will be broad gauge and has a proposed 100 km/hr. speed limit. Once operational, it will be for the first time that Sikkim will be connected to the main Indian rail network and it is expected to boost local tourism and the region's economy. The rail link will pass through the steep terrain of the Kanchenjunga mountain range foothills and the Teesta river valley. 85% of the route will pass through tunnels.

The New Austrian tunnelling method (NATM), also known as the sequential excavation method (SEM) or sprayed concrete lining method (SCL), is a method of modern tunnel design and construction employing sophisticated monitoring to optimize various wall reinforcement techniques based on the type of rock encountered as tunnelling progresses.

Stage -I forest clearance has been accorded for diversion of 86.6225 Ha of forest land for construction of main tunnels, bridges, access road to tunnel portals, dumping yards, station yards etc. Out of 86 Ha of Forest area only 19.678 Ha area at three forest division excluding Mahananda wildlife in small patches has been demarcated and diverted for disposal of muck generated from main tunnels and other construction activities. Division wise forest land for muck dumping purpose under 19.678 Ha is as follows:

District	Forest Division	Area (Ha)
Darjeeling	Kurseong Forest Div.	3.074
	Darjeeling Forest Div.	0.931
Kalimpong	Kalimpong Forest Div.	15.673
TOTAL		19.678

1.0 MUCK DISPOSAL SITE:

The selection of muck disposal sites was carried out considering the quantity of the muck, landscape, cost effectiveness, nearness to source of generation, absence of ground and surface water, relief and scope for afforestation works. All the dumping locations shall be well supported at base by suitable retaining structures. Subsequently all the spoil tips (muck disposal sites) will be developed by taking up plantation through bio-technological methods to generate a thick forest canopy over them. Below mentioned muck dumping sites have been identified matching the criteria and has been diverted for the said purpose.


 Divisional Forest Officer
 Kalimpong Forest Division

1.1 The details of dumping sites along with their area and few coordinates for identifying the same at site are enumerated as follows:

Co-ordinates of Land for muck dumping
(Details of C)

Sl.No.	UTM Co-ordinate		Geographic Co-ordinate	
	Easting	Northing	Latitude(North)	Longitude(East)
1	644870.2502	2997483.5173	27.0921526	88.4612618
2	644858.3290	2997453.8070	27.0918857	88.4611381
3	644836.8110	2997420.5090	27.0915875	88.4609172
4	644805.6624	2997358.5723	27.0910317	88.4605958
5	644774.0360	2997304.1900	27.0905442	88.4602705
6	644749.6580	2997316.4820	27.0906577	88.4600261
7	644773.1008	2997365.5650	27.0910982	88.4602683
8	644792.2276	2997399.0956	27.0913989	88.4604651
9	644799.4169	2997424.6269	27.0916285	88.4605406
10	644808.8780	2997491.5180	27.0922313	88.4606438
11	644807.0105	2997500.9317	27.0923164	88.4606261
12	644808.2542	2997510.9614	27.0924068	88.4606398
13	644812.2310	2997521.8660	27.0925048	88.4606812
14	644818.1030	2997533.7370	27.0926114	88.4607418
15	644828.1850	2997552.1280	27.0927763	88.4608456
16	644845.4130	2997582.2510	27.0930464	88.4610229
17	644851.4910	2997596.7370	27.0931765	88.4610858
18	644851.9890	2997604.6240	27.0932476	88.4610918
19	644885.7998	2997585.8359	27.0930745	88.4614305
20	644882.1274	2997573.5599	27.0929641	88.4613921
21	644899.1873	2997567.1634	27.0929046	88.4615634
22	644890.5480	2997545.7000	27.0927117	88.4614737
23	644881.6420	2997526.9810	27.0925437	88.4613817
24	644879.0690	2997519.8900	27.0924800	88.4613549
25	644871.0740	2997504.9980	27.0923464	88.4612726
26	644873.4320	2997503.8860	27.0923361	88.4612962
27	644874.2691	2997492.9239	27.0922371	88.4613034

Bhalu khola (2patches) (1.3093 Ha)

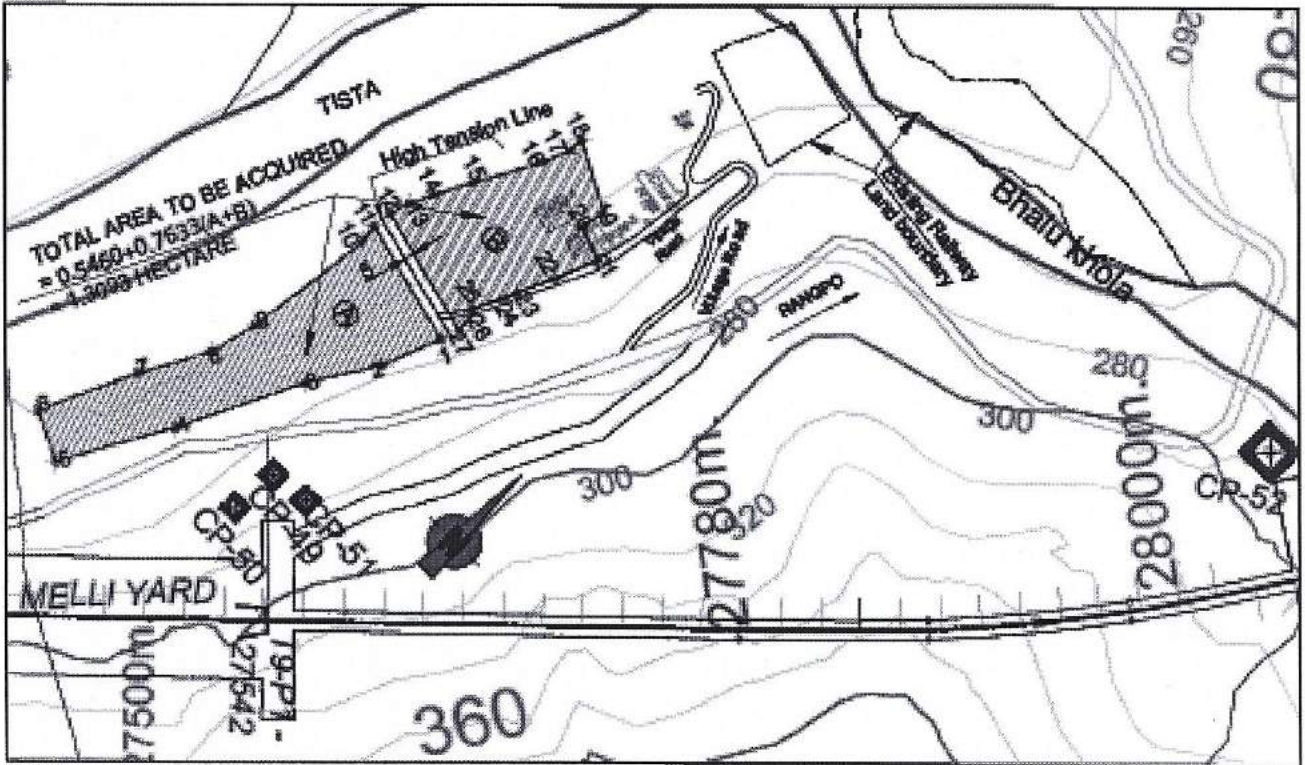
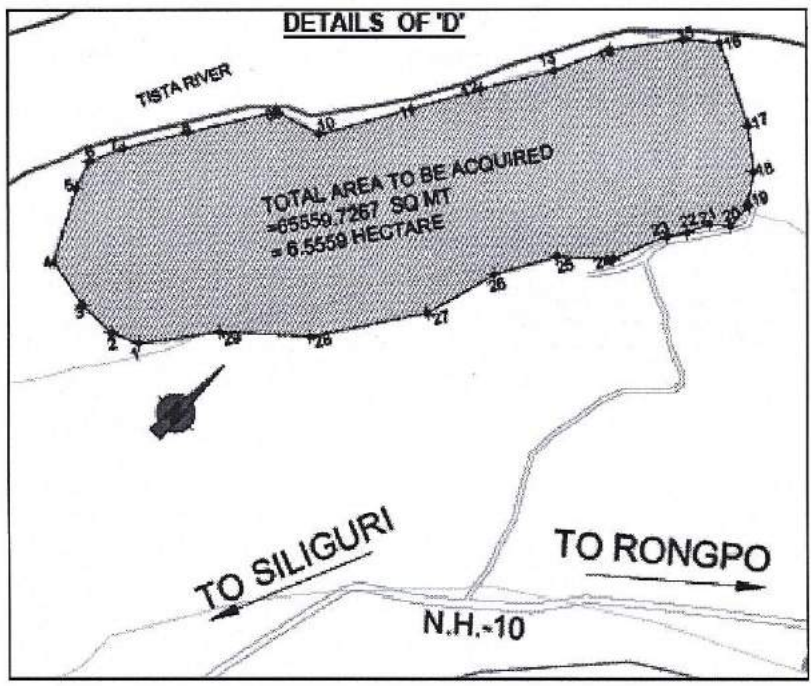
209

Co-ordinates of Land to be acquired(Details of D)				
Sr. No.	UTM Co-ordinate		Geographic Co-ordinate	
	Easting	Northing	Latitude(North)	Longitude(East)
1	649001.19700	3001934.60350	27.13188585076	88.50345479298
2	648982.34980	3001926.32450	27.13181316614	88.50326367402
3	648954.14200	3001926.60700	27.13181876232	88.50297916455
4	648918.58790	3001934.54380	27.13189423352	88.50262147354
5	648894.44400	3001982.11500	27.13232618485	88.50238366365
6	648888.59350	3002001.96880	27.13250600309	88.50232704239
7	648898.92390	3002025.10420	27.13271369201	88.50243404157
8	648923.62700	3002064.81700	27.13306944512	88.50268802655
9	648958.91300	3002119.38700	27.13355814549	88.50305056222
10	648991.65600	3002129.01600	27.13364151335	88.50338202194
11	649026.31200	3002187.24500	27.13416330334	88.50373864923
12	649052.06040	3002231.42680	27.13455927480	88.50400372619
13	649080.89410	3002276.98090	27.13496729756	88.50430009440
14	649098.76300	3002314.74900	27.13530623413	88.50448491410
15	649131.13000	3002355.89550	27.13567409371	88.50481639642
16	649151.48200	3002372.16600	27.13581873875	88.50502366908
17	649205.62600	3002344.49300	27.13556312489	88.50556651408
18	649231.31400	3002323.55300	27.13537135582	88.50582311506
19	649243.70110	3002304.75740	27.13520037961	88.50594579911
20	649244.89380	3002285.43380	27.13502584944	88.50595549336
21	649233.66260	3002276.63580	27.13494766030	88.50584113248
22	649226.34370	3002260.66430	27.13480430482	88.50576537018
23	649217.64710	3002249.07650	27.13470066252	88.50567624045
24	649201.80050	3002211.38680	27.13436221641	88.50551182800
25	649171.79750	3002184.91880	27.13412658044	88.50520696917
26	649148.47200	3002144.39700	27.13376338192	88.50496577275
27	649133.36300	3002092.23800	27.13329426529	88.50480705579
28	649084.55700	3002022.09600	27.13266648922	88.50430624945
29	649036.91100	3001980.26500	27.13229410109	88.50382056934

Tar Khola Dumping Yard (6.5559 Ha)


 Divisional Forest Officer
 Kalimpong Forest Division

205



TOTAL LAND TO BE ACQUIRED
= 1.3093 + 6.5559 = 7.8652 HECTARE


Divisional Forest Officer
Kalimpong Forest Division

1.2 Table:2 Estimated Capacity of dumping yards & quantity of muck likely to be generated from tunnels, adit etc.

Estimated Capacity (Considering approx. 10 M height of filling along with providing approx. 3-4m height gabion wall around the periphery of the disposal sites.)	Appr. Qnty of Muck from generated from tunnels and adits
5,11,239 m3	4,39,239 m3

2.0 Criteria for selection of muck dumping yards

The muck disposal sites had been carefully selected and taken after careful consideration of availability of suitable area along with minimizing distance from muck generation sites and neutralizing hazardous impact on the surrounding environment.

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

The Sivok-Rangpo New BG Rail Line Project being a Green project, it has been considered that wildlife habitation area should not be affected or utilized for making dumping site.

1. All the dumping sites are more or less located near the project site thus haulage of muck to a long distance is avoided, this in turn reduces the air pollution due to short vehicular movement.
2. All the mentioned dumping sites are free from any landslides or creep and care should be taken to protect toe erosion and slope instability.
3. There are no active channel or stream flowing through the above-mentioned dumping sites.
4. The above-mentioned dumping sites are situated at a suitable distance from the human settlements along NH 31 and NH10.

2.1 Muck disposal methodology.

Disposal of muck may create problem if not done properly. It is susceptible to scattering unless the muck disposal yards are supported with engineering measures such as gabions. All the dumping sites need proper handling to avoid spilling of muck into the river water while dumping and in the post dumping stages. All the muck disposal sites have to be developed from the ground level either by providing stone masonry or by

207

gabion structure. In all the muck dump sites, the muck brought in dumpers shall be dumped and spread behind the crates and roller compacted in such a manner that rock mass is properly stacked behind the crates with minimum of voids.

Generated muck should be disposed in such a way that it does not contaminate the adjacent water bodies if present. Gabion walls shall be erected along the sides of the designated site to keep the muck within the boundaries.

Dumpers of suitable capacity shall be used to transport the muck generated at sites. The stock piles of muck shall be levelled with the movement of dozer etc. Zoning of the dump shall be done judiciously and ensure stability of side slopes.

The nature of excavated muck varies significantly from the natural soils; therefore, its unsound disposal is considered to contaminate not only the water quality, air quality but soils and vegetation of surrounding areas.

2.3 Geological report and bore/drill log data:

From the geological and geotechnical investigation carried out around this area for the proposed tunnels and bridges indicate that mainly phyllite, quartzite and schist type of rocks will be excavated for tunneling work and the same will be dumped in muck dumping areas. These are quite natural in such Himalayan region and are not harmful to either the environment or the water bodies. Even laboratory tests of the rocks have been performed, which also indicate that the rocks are devoid of any harmful chemicals, etc. Some of the borehole logs from geotechnical investigation reports of different tunnels and adits from Teesta Bazar (Tunnel T8) to Rangpo (Tunnel T13) have been given below:

208

GEOLOGICAL LOG OF DRILL HOLE												HOLE NO: DFB-8		SHEET NO: 1 of 4	
PROJECT: SROK-BANKPOINER RAILWAY LINE PROJECT			COORDINATES: NANG559 502 E02528845			ANGLE WITH HORIZONTAL: 90°			BEARING OF HOLE: 270°			DEPTH OF HOLE: 40.0m			
LOCATION: BURELA LAKOLA			PERIOD OF EXECUTION: 30.10.2018 - 12.11.2018			TYPE OF CORE BARREL: DOHRMANN/TORRE HOLE			LOGGED BY: AKUMAR						
STRUCTURE: T-13 / P-1															
CLIENT: IRCON INTERNATIONAL LTD.															
DRILLING AGENCY: ARJUNANT DRILLINGS PVT.LTD.															
GROUND ELEVATION: 418.2m															
COLLECTOR: 418.2m															
DEPTH (m)	LITHOLOGY		SIZE OF CORE PIECES	STRUCTURAL CONDITIONS	% OF CORE RECOVERY	ROQ'S	FRACTURE INDEX	SIZE OF CASING	SIZE OF PIPE	DEPTH OF GWT OR	DELL WATER LOSS	PERMEABILITY	SPECIAL OBSERVATIONS AND INTERPRETATIONS		
	FROM	TO												DESCRIPTION	LOG
418.24	3.00	6.50	Grey color of sand mixed with pebbles and gravel. Quartzite, Phyllite and granite.												
418.24	0.50	1.00	Grey coloured Pebbles of granite and Quartzite.	OVERBURDEN	OVERBURDEN	36						2.27			
418.24	1.00	2.00				36								2.08	
418.24	3.00	5.00				36								2.78	
418.24	4.00	5.00				36								2.86	1497
418.24	4.00	5.00				36								2.91	
418.24	4.00	5.00				36								2.83	
418.24	5.00	6.00				36								2.75	090
418.24	6.00	7.00				36								2.63	
418.24	7.00	8.00				36								2.50	
418.24	8.00	9.00				36								2.38	047
418.24	9.00	10.00	36								2.24				
418.24	10.00	11.00	36								2.27				
418.24	11.00	12.00	Grey coloured fine grained Quartzite. Phyllite, slightly weathered, very intensely fractured, medium strength.									2.36	Rock mass tested from 11m		
418.24	12.00	13.00	Grey colored, fine grained Quartzite. Fine to medium strong, intensely fractured, locally blocky, some natural.									2.94			
418.24	13.00	14.00	Grey colored, Quartzite. Phyllite, slightly weathered, medium strong, intensely fractured.									1.89			
418.24	14.00	15.00	Grey colored, fine grained Quartzite. Fine to medium strong, intensely fractured.									1.82	1710; 9.67		
418.24	15.00	16.00	Grey colored Quartzite and phyllite. Slightly weathered, medium strong, intensely fractured.									1.72			
418.24	16.00	17.00	White colored medium of Quartzite, strong, with some phyllite and grey colored Phyllite-Quartzite, intensely fractured.									1.79			
418.24	17.00	18.00	Grey colored fine grained Quartzite, fine strong, intensely fractured.									1.82			
418.24	18.00	19.00	Quartzite and Phyllite-Quartzite									1.83			
418.24	20.00	21.00										1.67			
418.24	21.00	22.00	Grey colored Quartzite, fresh, strong, intensely fractured.									1.72	19.42; 9.82		
418.24	22.00	23.00										1.83			
418.24	23.00	24.00										1.72			
418.24	24.00	25.00	Light grey colored Quartzite, medium strong, intensely fractured.									1.92			
418.24	25.00	26.00	Dark grey Quartzite. Phyllite, medium strong, intensely fractured.									1.80			
418.24	26.00	27.00	Dark grey Quartzite, strong, fresh, intensely fractured.									1.73			
418.24	27.00	28.00										1.79			
418.24	28.00	29.00	Greenish grey Quartzite, Phyllite and Quartzite.									1.64			
418.24	29.00	30.00	Greenish grey Quartzite, Phyllite and Quartzite. Decomposed phyllite, weak to medium strong.									1.61			
418.24	30.00	31.00	Light grey decomposed Phyllite.									1.58			
418.24	31.00	32.00	Light grey Quartzite, medium strong, intensely fractured, weak to medium strong.									1.67			
418.24	32.00	33.00	Quartzite and Quartzite, Phyllite, fresh, weak to medium strong, intensely fractured.									1.72	31.34; 11.44		
418.24	33.00	34.00										1.54			
418.24	34.00	35.00	Greenish grey, fine grained Phyllite, quartzite, fresh, medium strong, very intensely fractured.									1.67			
418.24	35.00	36.00										1.61			
418.24	36.00	37.00	Greenish grey, fine grained quartzite, medium strong to strong, fresh, intensely fractured.									1.54			
418.24	37.00	38.00										1.55			
418.24	38.00	39.00										1.61			
418.24	39.00	40.00										1.67			

Notation:

	Overburden		Shear joint		Fault/line/joint		GWT - Ground Water Table		SPT - Standard Penetration Test
	Phyllite/Quartzite/Phyllite		Quartzite/Phyllite/Quartzite		Other joint		Core length		R - Range

Slightly fractured: Core recovered mostly in lengths from 30 to 100 cm with few scattered lengths less than 30 cm or greater than 100 cm.
 Moderately fractured: Core recovered mostly in lengths from 10 to 30 cm with few scattered lengths above 30 cm.
 Very intensely fractured: Core recovered mostly in scabs and fragments with a few scattered short core lengths.
 Intensely fractured: Lengths average from 3 to 10 cm with frequent intervals. Core recovered mostly in lengths less than 10 cm.

Divisional Forest Officer
Kalimping Forest Division

GEOLOGICAL LOG OF DRILL HOLE						ROLENO. NR-26 A
PROJECT	SIVOK-RANGPO NW RG RAIL LINE PROJECT	COORDINATES	N2997699.718, E648265.718	ANGLE WITH HORIZONTAL	90°	
LOCATION	T-9, P-2 (BHALU KHOLA)	GROUND EL.	299.847m	BEARING OF HOLE	VERTICAL	
STRUCTURE	TUNNEL	COLLAR EL.	11CMm	DEPTH OF HOLE	27.00mtr	
CLIENT	IRCON INTERNATIONAL LTD.	DRILLING AGENCY	ARIHANT DRILLINGS PVT LTD.	PERIOD OF EXECUTION	09/11/19 - 13/11/19	
		CORE BARREL TYPE	DOUBLE TRIPLE TUBE	LOGGED BY	JATINDER SINGH	

ELEVATION (m)	DEPTH (m)	LITHOLOGY		SIZE OF CORE PIECES	Structural Condition	Percentage of core recovery				TYPE OF BIT	R-Q-D	FRACTURE INDEX	SIZE OF HOLE	CASING	DEPTH OF WATER TABLE	DRILL WATER LOSS		PENETRATION RATE (mm/min)	Permeability		Special Observations and Interpretation			
		Description	LOG			20	40	60	80							100	In figure		PARTIAL	COMPLETE		Test Section (m)	Lugeon Value	
299.35	0.50	Pebbles, size fragments with topsoil of Quartzite, & Phyllite.		<10mm	OVERBURDEN STRATA	20	40	60	80	100	40	IMP (NX CASING) DIAMOND CORE BIT	NA	NA	NX	13.5			42		SPT: 1.50-1.58M = 100Blows, NV>100, Refusal/Double Hammering			
298.35	1.50			>10		20	40	60	80	100	20									56		SPT: 1.50-1.54M = 100Blows, NV>100, Refusal/Double Hammering		
296.05	3.00			0		20	40	60	80	100	10									71		SPT: 1.50-1.54M = 100Blows, NV>100, Refusal/Double Hammering		
295.05	4.50			0		20	40	60	80	100	14									65		SPT: 4.50-4.553M = 100Blows, NV>100, Refusal/Double Hammering		
294.05	6.00			0		20	40	60	80	100	12									58		SPT: 6.00-6.45M 15/26, 15/21, 15/19 N =E2		
292.35	7.50			0		20	40	60	80	100	28									71		SPT 7.50-7.95M 15/25, 15/28, 15/24, N =E2		
290.05	9.00			>10		20	40	60	80	100	24									50		SPT: 10.50-10.57M = 100Blows, NV>100, Refusal/Double Hammering		
288.35	10.50			>10		20	40	60	80	100	30									31				
288.35	11.00			Angular, Sub-Angular, Sub-Rounded, Boulder & Pebbles size fragments with topsoil of Quartzite, Gneiss & Phyllite.			>10	OVERBURDEN STRATA	20	40	60	80	100	24	IMP (NX CASING) DIAMOND CORE BIT	NA	NA	NX	13.5			27		SPT: 12.00-12.06M = 100Blows, NV>100, Refusal/Double Hammering
287.89	12.00			>10		20	40		60	80	100	24									43			
286.05	13.00	>10	20	40	60	80	100		24									45						
280.05	13.50	>20	20	40	60	80	100		34									28		SPT: 13.50-13.55M = 100Blows, NV>100, Refusal/Double Hammering				
284.05	15.00	MODERATE TO HIGHLY weathered, light greyish in color, moderately fractured, fine grained, moderately strong Phyllite with interbedded quartzitic phyllite.		>10	FJ-20°-45 /Un/Sm	20	40		60	80	100	80	IMP (NX CASING) DIAMOND CORE BIT							28		ROCK ENCOUNTERED AT DEPTH OF 13.50M		
283.25	16.50	>10	20	40		60	80		100	91									26					
281.65	18.00	>10	20	40		60	80		100	96									24		ROCK IS nil			
280.35	19.50	>10	20	40		60	80		100	100									23					
278.05	21.00	>10	20	40		60	80		100	100									24					
276.05	23.00	>10	20	40		60	80		100	100									24					
275.38	24.50	MODERATE weathered, light greyish in color, moderately fractured, fine grained, moderately strong Phyllite with quartz veins		>10		FJ-20°-45 /Un/Sm	20	40	60	80	100	100	UNCASING							26		core recovery varies from 10 to 100%		
273.05	26.00	>10	20	40			60	80	100	100									27					
272.05	27.00	>10	20	40			60	80	100	100									24					

INDEX		ABBREVIATIONS			
OVERBURDEN		RED	SM	SMOOTH	FJ FOLIATED JOINT
PHYLITE / PHYLITIC SCHIST		ROCK	UN	UNDULATING	SPT STANDARD PENETRATION TEST

Divisional Forest Officer
Kalimpong Forest Division

211

GEOLOGICAL LOG OF DRILL HOLE

HOLE NO. NB 29 A

SHEET 2 OF 2

PROJECT	STVOK-RANGPO NEW BG RAIL LINE PROJECT	COORDINATES	N299737.906, E644924.604	ANGLE WITH HORIZONTAL	90°
LOCATION	T-9, P-1(BHALU KHOLA)	GROUND EL.	307.789	BEARING OF HOLE	VERTICAL
STRUCTURE	TUNNEL	COLLAR EL.	18CM	DEPTH OF HOLE	36.00m
CLIENT	IRCON INTERNATIONAL LTD.	DRILLING AGENCY	ARIHANT DRILLINGS PVT LTD.	PERIOD OF EXECUTION	10-12-19 TO 17-12-19
		CORE BARREL TYPE	DOUBLE/TRIPLE TUBE	LOGGED BY	JATINDER SINGH

ELEVATION (m)	DEPTH (m)	LITHOLOGY Description	SIZE OF CORE PIECES				Structural Condition	Percentage of core recovery				TYPE OF BIT	R.Q.D	FRACTURE INDEX	SIZE OF HOLE	CASING	DEPTH OF WATER TABLE	DRILL WATER LOSS		PERMEABILITY	Special Observations and Interpretation	
			LONG	<10mm	10-25mm	25-75mm		75-150mm	>150mm	20	40							80	100			in figure
288.29	19.50																				SPT: 18.00-18.45 15/21, 15/20, 15/28, N=48	
287.29	20.50																					
286.29	21.50																				ROCK ENCOUNTERED AT THE DEPTH OF 20.50M	
285.29	22.50	slightly to moderately weathered, greyish coloured, moderately fractured, fine grained, weak phyllite and schistose phyllite with quartz veins.																				
284.29	23.50																					
284.29	24.50																					
281.29	25.50																					
281.29	26.50																					
280.29	27.50																					
279.29	28.50																					
278.29	29.50	slightly to moderately weathered, greyish coloured, moderately fractured, fine grained, weak phyllite with quartz veins.																				
277.289	30.50																					
276.289	31.50																					
275.289	32.50																					
274.289	33.50																					
273.289	34.50																					
272.289	35.50	Slightly to moderately weathered, greyish coloured, slightly fractured, fine grained, weak phyllite with quartz veins.																				
271.289	36.50																					
270.289	37.50																					
269.789	38.00																					

INDEX

OVER BURDEN STRATA		BED	SM	SMOOTH	FJ	FOLiated JOINT
PHYLLITE/PHYLLITIC SCHIST		ROCK	UN	UNDATING	SPT	STANDARD PERMEABILITY TEST

**Divisional Forest Officer
Kalimpong Forest Division**

212

GEOLOGICAL LOG OF DRILL HOLE										HOLE NO. NB 28 A										
PROJECT	SIYOK-RANGPO NEW BG RAIL LINE PROJECT			COORDINATES	E 645324.606, N2997786.974		ANGLE WITH HORIZONTAL	90°												
LOCATION	T-10, P-1 (BHALU KHOLA)			GROUND EL.	301.811		BEARING OF HOLE	VERTICAL												
STRUCTURE	TUNNEL			COLLAR EL.			DEPTH OF HOLE	28.00 MTR												
CLIENT	IRCON INTERNATIONAL LTD.			DRILLING AGENCY	ARIHANT DRILLINGS		PERIOD OF EXECUTION	26.11.19 - 02.12.19												
				CORE BARREL TYPE	DOUBLE/TRIPLE TUBE		LOGGED BY	JATINDER SINGH												
ELEVATION (m)	DEPTH (m)	LITHOLOGY	LOG	Structural Condition	Percentage of core recovery				TYPE OF BIT	R.O.P	FRACTURE INDEX	SIZE OF TROUBLE	CASING	DEPTH OF WATER TABLE	DRILL WATER LOSS		Permeability	Special Observations and interpretation		
					20	40	60	80							100	PARTIAL			COMPLETE	Penetration Rate (mm/min)
3063.1	0.50	Rounded to subrounded pebbles and cobbles of Quartzite, schist & phyllite within soil		OVER BURDEN STRATA	20	40	60	80	100	30	NA	NA	NX					SPT: 1.50-1.55 m = 100Blows, NV>100, Refusal/Double Hammering		
3062.6	1.50				20	40	60	80	100	18									SPT: 3.00-3.06 m = 100Blows, NV>100, Refusal/Double Hammering	
3061.1	3.00				20	40	60	80	100	16									SPT: 4.50, 00-4.57 m = 100Blows, NV>100, Refusal/Double Hammering	
3059.1	4.50				20	40	60	80	100	15									SPT: 6.00-6.05 m = 100Blows, NV>100, Refusal/Double Hammering	
3057.1	6.00				20	40	60	80	100	21										SPT: 9.00-9.07 m = 100Blows, NV>100, Refusal/Double Hammering
3055.1	7.50	ROUNDED to subrounded pebbles and cobbles of Quartzite, schist & phyllite within soil		OVER BURDEN STRATA	20	40	60	80	100	12	NA	NA	NX					SPT: 9.00-9.07 m = 100Blows, NV>100, Refusal/Double Hammering		
3053.1	9.00				20	40	60	80	100	20									SPT: 10.50, 00-10.58 m = 100Blows, NV>100, Refusal/Double Hammering	
3051.1	10.50				20	40	60	80	100	16									*SPT: 12.00-12.06 m = 100Blows, NV>100, Refusal/Double Hammering	
3049.1	12.00				20	40	60	80	100	26									SPT: 12.00-12.06 m = 100Blows, NV>100, Refusal/Double Hammering	
3047.1	13.50				20	40	60	80	100	14										*SPT: 13.500-13.95M 15/21, 15/18, 15/23 N =43
3045.1	15.00	Rounded to subrounded pebbles and cobbles of Quartzite, schist & phyllite within soil		OVER BURDEN STRATA	20	40	60	80	100	22	NA	NA	NX					SPT: 12.00 TO 12.45M 15/18, 15/23, 15/24 N=50		
3043.1	16.50				20	40	60	80	100	11									*SPT: 13.500-13.95M 15/21, 15/18, 15/23 N =43	
3041.1	18.00				20	40	60	80	100	19									SPT: 15.00-15.05m 15/21, 15/2, 15/3 IN= 58	
3039.1	19.50				20	40	60	80	100	18										*SPT: 16.500-16.95M 15/23, 15/28, 15/23 N =61
3037.1	21.00				20	40	60	80	100	25										ROCK ENCOUNTERED
3035.1	22.00	Rock encounter is between 22 and 23 mtr.		OVER BURDEN STRATA	20	40	60	80	100	42	IMP (NX SIZE) DIAMOND CORE BIT	NA	NA	NX					Permeability test section	
3033.1	23.00				20	40	60	80	100	95									23.00 to 26.00 M	
3031.1	24.00				20	40	60	80	100	90										23.00 to 26.00 M
3029.1	25.00				20	40	60	80	100	180										23.00 to 26.00 M
3027.1	26.00				20	40	60	80	100	100										
3025.1	27.00	slightly to moderately weathered, greyish coloured, slightly fractured, fine grained, weak phyllite and schistose phyllite with quartz veins		OVER BURDEN STRATA	20	40	60	80	100	100	IMP (NX SIZE) DIAMOND CORE BIT	NA	NA	NX						
3023.1	28.00				20	40	60	80	100	100										

INDEX

OVERBURDEN	
PHYLLITE / PHYLLITIC SCHIST	

BED	SM	SMOOTH	FJ	FOLIATED JOINT
ROCK	UN	UNDULATING	SPT	STANDARD PENETRATION TEST

Divisional Forest Officer
Kalinpong Forest Division

GEOLOGICAL LOG OF DRILL HOLE

HOLE NO: DFE3
SHEET NO: 11 of 11

PROJECT	: SIVOK RANG TO NEW 3G RAILWAY LINE PROJECT	COORDINATES	: NS002514015, E650719.453
LOCATION	: TUM LONG KHOLA	ANGLE WITH HORIZONTAL	: 90°
STRUCTURE	: 111 / E2	BEARING OF HOLE	: Vertical
CLIENT	: IRCON INTERNATIONAL LTD.	DEPTH OF HOLE	: 35.00m
DRILLING AGENCY	: ARHANI DRILLINGS PVT.LTD.	PERIOD OF EXECUTION	: 10.06.2017 - 22.06.2017
GROUND ELEVATION	: 371.11m	TYPE OF CORE BARREL	: DOUBLE/TRIPLE TUBE
CORNER ELEVATION	: 371.21m	LOGGED BY	: AK, JORGE

ELEVATION (m)	DEPTH (m)		LITHOLOGY	STRUCTURAL CONDITIONS	% OF CORE RECOVERY	FRACURE INDEX	SIZE OF CASING	SIZE OF HOLE	SIZE OF BIT	DEPTH (m)	DRILL WATER LOSS		PERMEABILITY	SPECIAL OBSERVATIONS AND INTERPRETATIONS
	FROM	TO									PACKAL	COMPLETE		
370.61	0.00	0.50	Light brownish coloured top soil									3.33		
370.11	0.50	1.00										2.50		
369.61	1.00	1.50										2.50		
369.11	1.50	2.00	Pebbles and granules of Light grey coloured phyllite and phyllitic quartzite.	OVERBURDEN								2.27		Constant test could not done due to complete water loss
368.61	2.00	2.50										1.72		
368.11	2.50	3.00										1.92		SPT: 00.3.08m-000199
367.61	3.00	3.50										2.63		
366.88	3.50	4.25										1.70		
366.11	4.25	5.00										1.63		Rock started from 4.25m
365.36	5.00	5.75										1.36		
364.61	5.75	6.50										1.32		
363.61	6.50	7.50	Grey coloured, fine grained Phyllite with bands of Phyllitic Quartzite, intensely to very intensely fractured. Weak to medium strong, moderately to highly weathered.									1.32		
362.61	7.50	8.50										1.67		
361.61	8.50	9.50										1.43		
360.61	9.50	10.50										1.79		
360.11	10.50	11.00										0.65		
359.11	11.00	12.00										1.64		
358.11	12.00	13.00										2.00		
357.61	13.00	13.50										2.00		
356.01	13.50	18.50	Grey coloured, fine grained Phyllite Quartzite, intensely fractured, medium strong to strong, fresh to slightly weathered.									1.49		
355.61	14.50	15.50										1.33		
354.61	15.50	16.50	Grey coloured, fine grained Phyllite with bands of Phyllitic Quartzite, intensely to very intensely fractured. Weak to medium strong, slightly to moderately weathered.									1.67		
353.61	16.50	17.50										1.52		
352.61	17.50	18.50	Grey coloured, fine grained Phyllite Quartzite, intensely to very intensely fractured, weak to medium strong, slightly to moderately weathered.									1.64		
351.61	18.50	19.50										1.79		
350.61	19.50	20.50										1.67		
349.61	20.50	21.50										1.59		
348.61	21.50	22.50	Sheared rock mass of Phyllite with some quartzite fragments	Sheared rock mass								1.82		Almost rock mass is laboratory to very intensely fractured and RQD is min to 25 %.
347.61	22.50	23.50										1.67		
346.61	23.50	24.50	Grey coloured, fine grained Phyllite Quartzite, intensely fractured, weak to medium strong, slightly weathered.									1.43		
345.61	24.50	25.50										1.67		
344.61	25.50	26.50										1.43		
343.11	26.50	27.00										2.00		
343.11	27.00	28.00	Grey coloured, fine grained Phyllite with bands of Quartzite, intensely to very intensely fractured, weak to medium strong, highly weathered.									1.82		
342.11	28.00	29.00										1.75		
341.11	29.00	30.00										2.60		
340.11	30.00	31.00										1.52		
339.61	31.00	31.50	Grey coloured, fine grained Quartzite, intensely to very intensely fractured, medium strong to strong, moderately weathered.									1.82		
338.61	31.50	32.50										1.67		
337.61	32.50	33.50										1.79		32.35 500
336.11	33.50	34.00	Grey coloured, fine grained Phyllite with bands of Quartzite, intensely to very intensely fractured, weak to medium strong, slightly to moderately weathered.									1.82		
336.11	34.00	35.00										1.82		

	Overburden		Shear seam	FJ-Foliation joint	GWT-Ground Water Table	SPT-Standard Penetration Test
	Phyllite		Phyllitic Quartzite/Quartzite	J-Other Joint	Sm-Smooth	R-Rough
<p>Notation</p> <p>Slightly fractured: Core recovered mostly in lengths from 30 to 100cm with few scattered lengths less than 30 cm or greater than 100cm.</p> <p>Moderately fractured: Core recovered mostly in lengths from 10 to 30cm with most lengths about 20 cm.</p> <p>Intensely fractured: Lengths average from 3 to 10 cm with fragmented intervals. Core recovered mostly in lengths less than 10 cm.</p>						

Divisional Forest Officer
Kalimpong Forest Division

GEOLOGICAL LOG OF DRILL HOLE

HOLE NO: DR-48
SHEET NO: 1 of 1

PROJECT: SIVOK-RANGPO NEW BG RAILWAY LINE PROJECT
 LOCATION: TAR KHOLA
 STRUCTURE: F-11-P-1
 CLIENT: IRCON INTERNATIONAL LTD.
 DRILLING AGENCY: ARBHANT DRILLINGS PVT. LTD.
 GROUND ELEVATION: 323.54 m.
 COLLAR ELEVATION: 323.68 m.

CO-ORDINATE: N 3001150.566 E 649130.881
 ANGLE WITH HORIZONTAL: 90°
 BEARING OF HOLE: Vertical
 DEPTH OF HOLE: 25.00m
 PERIOD OF EXECUTION: 22.01.2017-05.12.2017
 TYPE OF CORE BARREL: DOUBBLE/TRIPLE TUBE
 LOGGED BY: JAK-Tomar

ELEVATION (m)	DEPTH (m)		LITHOLOGY	STRUCTURAL CONDITIONS	% OF CORE RECOVERY	REACTURE INDEX	SIZE OF CASING	SIZE OF HOLE	DEPTH OF BIT (m)	DRILL WATER LOSS	PERMEABILITY		SPECIAL OBSERVATIONS AND INTERPRETATIONS
	FROM	TO									PERCENTAGE	FLUXION VALUE	
			DESCRIPTION	DESCRIPTION	3-20 20-40 40-60 60-80 80-100 N/A					PARTIAL CORRECTION	PERCENTAGE	FLUXION VALUE	
323.54	0.00	0.30											
322.54	0.50	1.00											
321.54	1.00	1.50											
321.54	1.50	2.00											
321.04	2.00	2.50											
320.54	2.50	3.00	Overburden material consists of coarse sand with cobbles, pebbles and granules of quartzite, gneiss and quartzite phyllite.										
319.04	3.00	3.50											
319.54	3.50	4.00											
319.04	4.00	4.50											
318.54	4.50	5.00											
318.04	5.00	5.50											
317.54	5.50	6.00	Coarse sand with Cobbed Pebbles and granules of quartzite, gneiss and quartzite phyllite.										
317.04	6.00	6.50											
316.54	6.50	7.00											
316.04	7.00	7.50											
315.54	7.50	8.00											
315.04	8.00	8.50	Grey to greenish grey coloured, pebbles and granules of Quartzite and gneiss, phyllite quartzite										
314.54	8.50	9.00											
313.79	9.00	9.75											
312.79	9.75	10.50	Greyish white coloured cobbles and pebbles of phyllite quartzite and quartzite gneissic rock core.										
312.54	10.50	11.00											
312.04	11.00	11.50											
311.54	11.50	12.00											
311.04	12.00	12.50											
310.54	12.50	13.00											
310.04	13.00	13.50	Overburden material consists of cobbles, pebbles and granules of Quartzite, phyllite, Quartzite, Quartzite gneiss.										
309.54	13.50	14.00											
309.04	14.00	14.50											
308.54	14.50	15.00											
308.04	15.00	15.50											
307.54	15.50	16.00	Fine grained, dark greyish. Color Quartzite Gneiss, fresh to slightly weathered, intensely to moderately fractured, rock strength is Strong.										
307.04	16.00	16.50											
306.04	16.50	17.50											
305.54	17.50	18.00											
305.04	18.00	18.50	Medium grained phyllite quartzite with quartz intrusion, moderately weathered, iron staining, Moderately fractured, High strong.										
304.04	18.50	19.50											
303.54	19.50	20.00											
302.54	20.00	21.00											
302.04	21.00	21.50											
301.54	21.50	22.00	Fine grained, Greyish. Color phyllite quartzite, iron staining along foliation, Slightly weathered, Medium Strong, Intensely fractured, Quartz intrusion in foliation.										
300.54	22.00	23.00											
299.54	23.00	24.00											
298.54	24.00	25.00											

Overburden: Sheared mass Other joint
 Phyllite Phyllitic Quartzite Quartzitic gneiss
 FJ-Foliation joint R-Rough N-Null-No infillings
 SPT-Standard Penetration Test
 GWT-Ground Water Table
 Note: Slightly fractured: Core recovered mostly in lengths from 30 to 100 cm with few scattered lengths less than 30 cm or greater than 100 cm.
 Moderately fractured: Core recovered mostly in lengths from 10 to 30 cm with most lengths about 20 cm.
 Intensely fractured: Lengths average from 3 to 10 cm with fragmented intervals. Core recovered mostly in lengths less than 10 cm.
 Very intensely fractured: Core recovered mostly as chips and fragments with a few scattered short core lengths.

Divisional Forest Officer
Kalimpong Forest Division

215

GEOLOGICAL LOG OF DRILL HOLE

HOLE NO: DRH-13
SHEET NO: 1 of 1

PROJECT	: SYOK-RANGPO NEW BG RAILWAY LINE PROJECT	COORDINATE	: N299368.151, E641561374
LOCATION	: JESITA	ANGLE WITH HORIZONTAL	: 32°
STRUCTURE	: T.S / F.A	BEARING OF HOLE	: Vertical
CLIENT	: IRCON INTERNATIONAL LTD	DEPTH OF HOLE	: 32.00m
DRILLING AGENCY	: ARIHANT DRILLINGS PVT.LTD.	PERIOD OF EXECUTION	: 17.01.2018 - 27.01.2018
GROUND ELEVATION	: 223.72m	TYPE OF CORE BARREL	: DOUBLE TRIPLE TUBE
COLLER ELEVATION	: 223.92m	LOGGED BY	: AK.Toyat

ELEVATION (m)	DEPTH (m)		LITHOLOGY	SIZE OF CORE PIECES	STRUCTURAL CONDITIONS	% OF CORE RECOVERY	FRACURE INDEX	SIZE OF CASING	SIZE OF HOLE	SIZE OF BIT	DEPTH OF GWT (m)	DRILL WATER LOSS		PERMEABILITY	SPECIAL OBSERVATIONS AND INTERPRETATIONS
	FROM	TO										DESCRIPTION	LOG		
223.27	0.00	0.50	Brown colour Top Soil	> 10mm		46									
222.77	0.50	1.00	Angular to subangular pebbles & gravels of quartzite & phyllite intermixed within soil	10 to 25 mm		54									
222.27	1.00	1.50		25 to 75 mm		44									SPT: 1.50 - 1.57m = 55 blows
221.77	1.50	2.00		75 to 150 mm		64									
221.27	2.00	2.50		> 150 mm		68									
220.77	2.50	3.00				65								3	1464
220.27	3.00	4.00	Gray and earthy brown colored, Cobble and pebbles of Phyllite and Quartzite.			75									
220.77	4.00	5.00				70								6	918
220.27	5.00	6.00				73									
220.27	6.00	7.50													
220.27	7.50	8.50	Greenish grey colored, Phyllite with alternate thin bands of white to gray quartzite, weak to medium strong, fresh to slightly weathered, intensely to very intensely fractured, fresh to slightly weathered			72	Nil	>10							Rock started from 7.50m
220.27	8.50	9.50				75	37	5							
220.27	9.50	10.50			J-35-40°/sm / Uq/ Iron stained	64	20	7							
220.27	10.50	11.50				91	55	3							
220.27	11.50	12.50				80	28	4							
220.27	12.50	13.50				76	54	2						12.15	5.31
220.27	13.50	14.50				80	40	>5							
220.27	14.50	15.50				80	30	>10							
220.27	15.50	16.50				85	67	4							
220.27	16.50	17.50				84	21	6							
220.27	17.50	18.50			FJ-40.50°/sm/ua	80	30	4							
220.27	18.50	19.50	Greenish grey colored, Phyllite with alternate thin bands of white to gray quartzite, weak to medium strong, fresh to slightly weathered, intensely to very intensely fractured, fresh to slightly weathered			86	22	4							
220.27	19.50	21.00				85	16	11							
220.27	21.00	22.50				88	36	6						20.23	5.18
220.27	22.50	24.00				90	41	7							
220.27	24.00	25.00				92	22	11							
220.27	25.00	26.00				93	59	9							
220.27	26.00	27.00				87	10	7							
220.27	27.00	28.00				88	30	6							
220.27	28.00	29.00				87	51	5						27.30	5.50
220.27	29.00	30.00				90	33	4							
220.27	30.00	31.00			J-20°/sm/ua/day filled	95	22	8							
220.27	31.00	32.00				96	39	5							

Notation:		Overburden		Shear seam	F-	Foliation joint	GWT-	Ground Water Table	SPT-	Standard Penetration Test
		Phyllite		Quartzitic Phyllite	F-	Other joint	Sm-	Smooth	R-	Rough
	Slightly fractured: Core recovered mostly in lengths from 30 to 100cm with few scattered lengths less than 30cm or greater than 100cm.									
	Moderately fractured: Core recovered mostly in lengths from 10 to 30cm with most lengths about 20cm					Very intensely fractured: Core recovered mostly as chips and fragments with a few scattered short core lengths.				
Intensely fractured: Lengths average from 3 to 10 cm with fragmented intervals. Core recovered mostly in lengths less than 10 cm.										

Divisional Forest Officer
Kalimpong Forest Division

From the borehole data of different tunnels along the route, it has been observed that the groundmass consists of boulder mix soil overburden underlain by quartzite, phyllite and schist rocks. The geotechnical investigation done along the entire route from Teesta Bazar to Rangpo depicts same type of groundmass to be encountered in each and every tunnel. These are natural sub geo-strata found generally in Himalayan region and are completely environment friendly. Hence, the muck generated from the sites does not contain any toxic chemicals or any deleterious substances that may affect the geological strata of the proposed dumping site in future.

A muck disposal plan would take into calculation of muck to be generated, swelling factors, reutilization of muck, dumping areas and their characteristics, mitigation measures including engineering and biological measures stated below.

Muck reuse is always an environmental benefit, since it reduces both disposal in landfills and raw material extraction, whatever the type of civil work concerned. In case of tunnel projects, since spoil has however to be removed from construction site, recovery is more convenient than the landfill disposal, mainly because of the following reasons: immediate availability and excellent ability to control the required characteristics in case of reuse within the production site.

Spoil reuse as by-product has proved to be an environmental benefit, as well as a technological advantage during tunneling projects. But in this case, reusability of spoil is not suitable for construction activities with a view to maintain certain standard and quality of proposed, work but in turn its disposal is completely environment friendly and are free from deleterious substances.

3.0 MUCK DISPOSAL MANAGEMENT & MITIGATION TECHNIQUES

During the muck disposal the following site criteria to be adopted before utilizing the site. They are as follows:

- All the dumping sites are located within a short distance from the tunnel portals which in turn will minimize the haulage of muck and eventually help in reducing the air pollution.
- These sites are free from active landslides or creeps and thus there shall not be any possibility of toe erosion /slope failure.
- There are no natural channel or streams flowing through the designated dumping yard, thus there will not be any possibility of contact between the muck and the stream.
- Advance methodology and engineering technique will be applied during dumping and the muck will be kept confined within the protective walls so that the muck does not pollute the surrounding environment.

3.1 Engineering measures

3.1.1 Levelling

The levelling of the dumping piles is to be done using dozer layer by layer and which in turn reduces the volume of muck considerably. The levelling also makes it suitable for the plantation and other biological measures. Top surface would be levelled and graded to make the alternative use.

All precautionary measures will be followed during the dumping of muck. All dumpers must be well maintained so that loose soil could be well protected during haulage and transportation. All routes should be wetted prior to the dumping. Dumping would be avoided during the high-speed wind, so that suspended particulate matters (SPM) level could be maintained and care should be taken so that the loose soil could not be leached out in the nearby water body if present.

3.1.2 Gabion wall/ Protection wall

Gabion wall is a cage, carefully packed rock toe of 3 m height with side slope of 1:1.5 is enough to withstand the stress caused by the muck. However, the natural ground terrain of most of the concerned dumping sites are plane hence, the chance of spillage is reduced considerably. Therefore, only provision of gabion walls around the periphery will suffice.

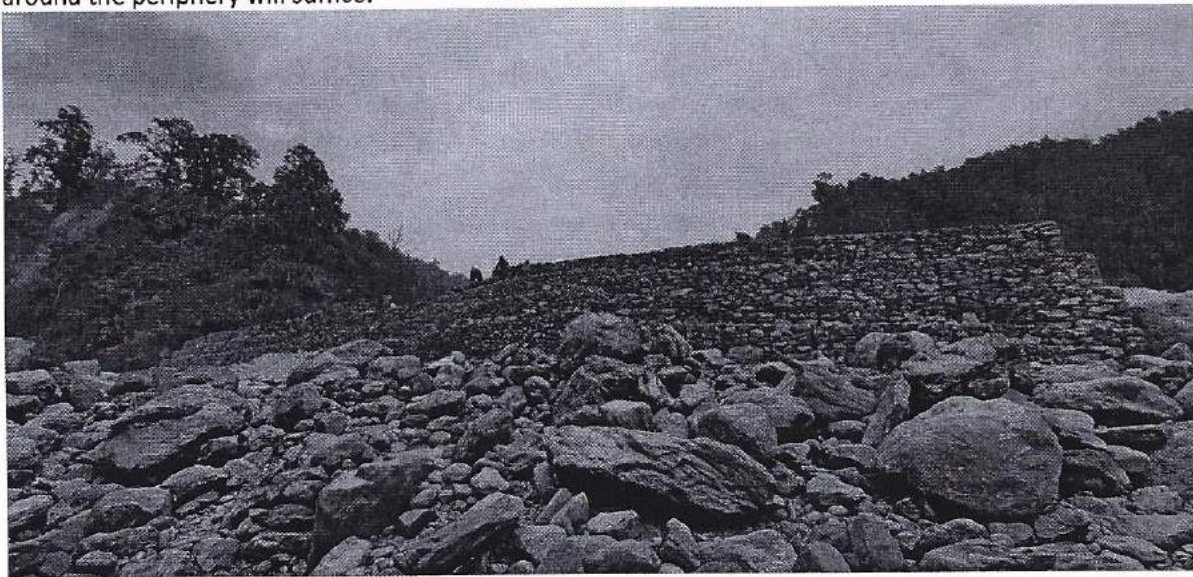


Figure- 1: Erected Gabion wall surrounding the periphery of muck disposal site


Divisional Forest Officer
Kalimpong Forest Division



Figure- 2: Erection of Gabion wall surrounding the periphery of muck disposal site along Teesta River



Figure- 3: Step-wise erection of Gabion wall surrounding the periphery of muck disposal site to provide the stability

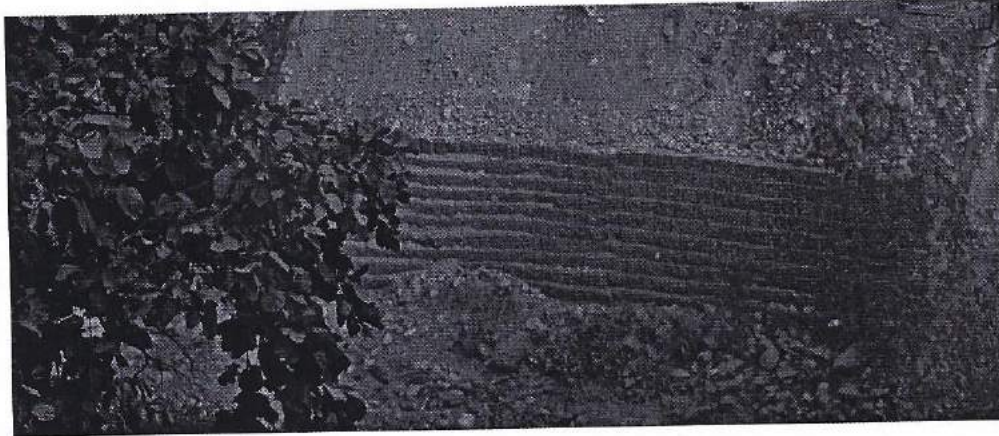


Figure- 4: Close view of erected Gabion wall surrounding the periphery of muck disposal site

Figure- 1, 2, 3 & 4 depicts the proposed typical gabion wall/protection wall, erected around the periphery of the aforementioned sites (i.e. near T8, T9 & T10). Similar type of muck retaining structures have been constructed for the rest of the muck disposal sites.

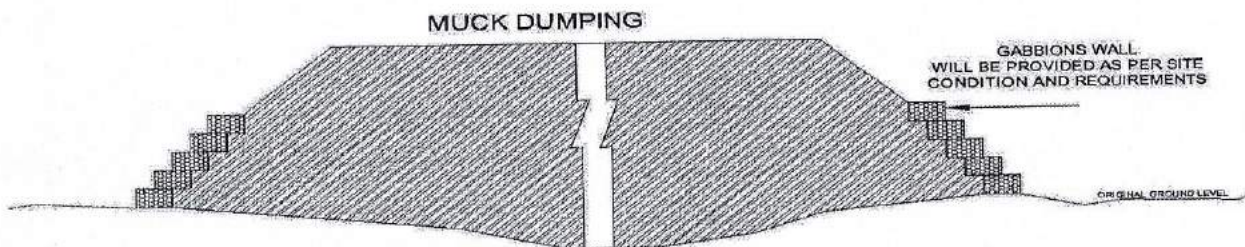


Figure- 5: Typical Gabion Wall Cross-section

Figure- 5, depicts a typical cross-section of a proposed wire crate gabion wall of dimension (3x1.5m) of a typical dumping site, erected around the periphery, with a stabilized muck disposal slope of 1(V):2(H).

3.2 Biological measures

SPECIES FOR PLANTATION:

Afforestation with suitable plant species of high ecological and economic value and adaptable to local conditions will be undertaken in coordination with forest department.

3.2.1 Phytoremediation

Special care and efforts are required to take up Biological measures at dumping site as the disposed muck will be devoid of nutrients and soil contents to support vegetation. The selection of soil for spreading over such an area would require nutrient profiling of soil for different base elements. Suitable mixture of nutrients would be done before placing the soil on the top surface of muck disposal areas to have administered growth of trees.

On completion of muck dumping, the area shall be levelled. An area of 2 m to 4 m width strip all along the periphery of the land fill shall be used for development of plantation so that vegetation cover could control the mechanical and hydrological effects on the slopes and would give the permanent stability to the muck. Plant saplings are to be considered based on the consultation with the forest department and the concerned DFO. Plants are the most important component of soil bio-engineering. Bio-engineering is used to accelerate site recovery by mimicking what would happen naturally. Use of native species and dense mixed plantation can be preferred for soil stabilization and peripheral protection. The success of stabilizing peripheral area depends on great extent with the native species. Survival of the plants depends on selection of the right plant for site.

3.2.2 Soil treatment

- Analysis of dumped material for their physical and chemical properties to assess the nutrient status to support vegetation.
- Formulation of appropriate blends of organic waste and soil to enhance the nutrient status of rhizo sphere.
- Isolation and screening of specialized strains of mycorrhiza fungi, rhizobium, azotobacter.
- Phosphate solubilizes (bio fertilizers inoculum) suitable for the dumped material.
- Mass culture of plant specific bio fertilizer and mycorrhiza fungi.
- Use of locally available manure and compost.

3.2.3 PLANTATION TECHNIQUE:

Planting of trees would be done in pits of 0.60 m x 0.60 m x 0.60 m size. Soil mixture would be used while filling the pits. Balance dug up soil/ muck will be stacked on downhill side of the pit for trapping the rain water and allowing it to percolate in the pit. It is proposed to use soil mixture in the pits & patches consisting of soil imported from nearby areas mixed with compost or vermin-compost manually. The ratio for the mix would be 5 parts: Compost/manure 2 parts: Sand 2 part: and humus or vermin compost 1 part. This will make nutrients available for the plants in the preliminary stages and also help increase soil aeration, porosity & permeability and improved moisture available for the plants.


Divisional Forest Officer
Kalimpong Forest Division

The diagrammatic representation is given below:

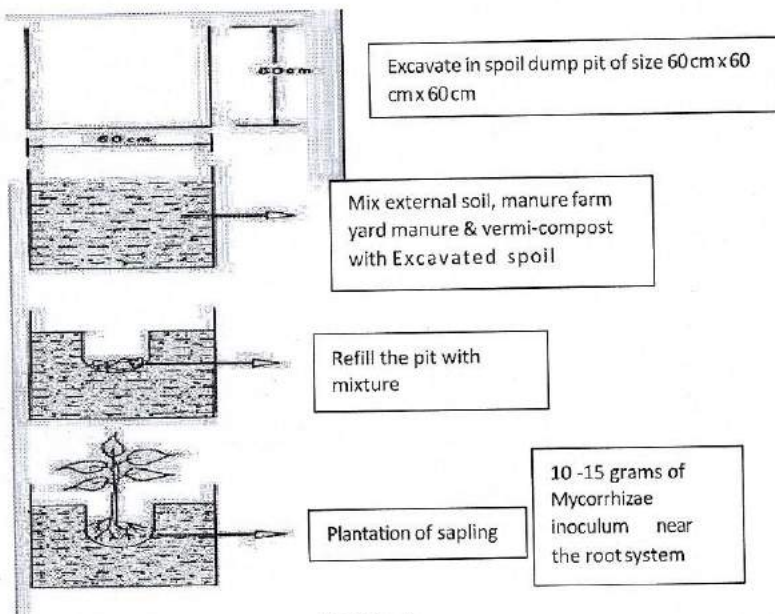


Figure- 6

4.0 CONCLUSION

The muck will be material generated when we go for a tunnel construction and thus considered safe for dumping as we can analyse from the geological log of drill hole data. The present section gives emphasis on the muck disposal techniques. As the proposed tunnels passes through several forest divisions and wildlife sanctuaries, therefore it becomes a part and parcel to review the impacts caused by construction activity on the wild flora and fauna. All mitigation measures for flora and fauna to be considered. Also, the muck is dumped in such a way that it should not give rise to any unwanted environmental consequences. All precautionary measures will be taken during the muck dumping procedure. The concerned muck will be kept confined within boundary/protection wall which will prevent it from leaching outside. The top of the surface will be levelled and kept suitable for further development.