BIODIVERSITY CONSERVATION AND MANAGEMENT PLAN FOR MUGUTHANG TO 20R LINK ROAD, NORTH SIKKIM

FOREST & ENVIRONMENT DEPARTMENT
GOVERNMENT OF SIKKIM

PREPARED BY:
NORTH TERRITORIAL DIVISION

SUMMARY

Sikkim, apart from being biodiversity rich is also diversified geo-morphologically with hill ranges traversing the length and breadth of this Eastern Himalaya State. The water bodies comprising of glaciers, river/streams, lakes and wetlands dotes the entire landscape. 48TH Bn ITBP (User Agency) Govt. of India has proposed for diversion of 19.36 Ha. of forest land for construction of Road from Muguthang to 20R Link Point under Lachen Territorial Range in North Sikkim. The proposed road alignment runs along the ridge, passing through Reserve Forests under Territorial jurisdiction of Lachen Territorial Range of North Territorial Division, Forest & Environment Department. The Reserve Forest consisting of alpine forest is dense with rich floral and faunal biodiversity. The proposed road aligned on/along the ridge line of the hill range is 13.42 Kms within the Reserve Forests. Considering the present alignment, the road construction will impact the geography, biodiversity and water catchments in the affected region. To mitigate this impact, a Biodiversity Management Plan (BMP) has been proposed with the following components;

- Conservation of indigenous floral species like Rhododendron and medicinal herbaceous species by creating a dedicated field nursery at Muguthang valley.
- Wildlife conservation and mitigation to address/avoid man-animal conflicts in project affected area by delineating critical area, rescue/medication and translocation of wildlife.
- Water Management by conservation of existing water bodies and developing traditional water sources at different locations.
- Forest protection through strengthening of infrastructure.
- Research, forest development, public awareness and training.
- Monitoring and Evaluation.

The proposed detail estimate is at page no. 15-16 of the BMP with component wise brief as follows;

SL. No.	Components	Budget (Rs. In Cr.)
1.	Flora Conservation	0.5236
2.	Wildlife Conservation	0.5719
3.	Soil Conservation	0.2033
4.	Water Management	0.5800
5.	Forest Protection Measures	0.1600
6.	Research, forest development, public awareness and training	0.9358
7.	Monitoring and Evaluation	0.0059
8.	Miscellaneous	0.4164
	Total	**3.450**

BIODIVERSITY MANAGEMENT PLAN FOR MUGUTHANG TO 20R LINK POINT ROAD NORTH SIKKIM

I. INTRODUCTION

At a distance of 19 km from Chopta Valley, 24 km from Thangu, 51 km from Guru Dongmar Lake and 59 km from Lachen, Muguthang Valley is a mountain valley situated to the east of famous Chopta Valley near Lachen. It is one of the popular places of trekking in Sikkim and among the must visit places in Lachen.

Also called as Lhonak Valley, it is situated at an elevation of almost 14,850 feet (4526.28 meter) and can be reached by trekking from the Chopta Valley. This valley is normally uninhabitable except for some occasional settlements by Tibetan nomads for grazing their Yaks. This high mountain valley is basically under the constant vigil of Indian Army as this is the last outpost of Indian Army in the eastern part of extreme North Sikkim. From here they monitor the Nepal-Tibet border.

Lhonak Valley is a trans-Himalayan grassland in the exposed river valley of Goma Chu in northwest Sikkim, with boggy marshes, glacial lakes, barren scree slopes and glaciers. High alpine valley of Muguthang is only inhabitable for rare high altitude ruminants and their predators. Lakes and marshes here are used as stopover sites for migratory water birds. Muguthang is also popular for the annual Yak race which takes place during the festival of Drukpa Tshe-zi.

The climate is very cold and a windy place with the temperature falling below zero degrees Celsius and a mean annual rainfall of 821 mm. The area is endowed with rich floral and faunal diversity. The forest type of this region is alpine and alpine meadows. The valley is surrounded by several mountains covered by snow, glaciers, lake, beautiful landscape and beautiful flowers. The main vegetation in an around the Muguthang valley (Between 3812m and above) are *Rhododendron nivale, Rhododendron anthopogon, Rhododendron setosum, Rhododendron campanulatum* and associated species of *Juniperus indica, Epherda gerardiana, Salix sp., Ribes sp., Potetilla arbuscula, Taraxacum eriopodum, Koenigia islandica, Cremanthodium oblongatum* are the dominant taxa. The herbaceous plant species such as *Saxifraga sp., Androsace sp., Gentiana sp., Cotonaester sp., Aster sp., Cyananthus sp., Anaphalis sp., Aralia sp.., Arenaria sp., Astragallus sp., Berberis angulosa, Carex sp., Juncus sp., Hemiphragma heterophyllum, Elshotzia sp., Delphinium sp., Rumex nepalensis, Ranunculus sp., Saussurea sp., Stellaria sp., Prunella vulgaris, Primula glomerata, Primula lenticulate, Hypericum sp., Bistorta sp., Juncus thomsonii, Juncus sikkimensis, Juncus himalensis, Geranium polyanthes, Lonicera sp.* And *Aconitum sp.*, etc. For faunal diversity, the valley is a common habitat for Snow leopard, Pika, White rabbit, Wild dog, Tibetan fox, Tibetan wolf, Blue sheep,

Himalayan marmot, Siberian Weasel and Wild Yaks. The most common bird species in this area are Red-billed Chough, Guldenstadt's Redstart (male & female) and Robin Accentor.

The area falls within the region of some of the important high-altitude glacial fresh water holy lakes including the **South Lhonak glacial lake, Chho Lhamo lake, Gurudongmar lake, Crows lake etc.**. Apart from the biodiversity, Muguthang is a small village and the settlement is inhabited by 7 Dokpa families. There is a Forest Guest House and a Government Primary School at Muguthang valley. This area is protected by the Indian Army and Indo-Tibetan Border Police (ITBP) in the Sikkim Himalayan Region. The main livelihood option of Dokpas families is yak and they have approx. 150 individual of yaks per family. As per the local sources, the yak dung is good manure for the vegetation growth of ground flora. The grazing is done at one time and shifted to another location to avoid over grazing as they maintain the forest alpine ecosystem in the Himalayas. Yak is the only livelihood of Dokpas families because they give milk products (Cheese, Butter and Curd). One of the famous milk products that is made out of yak milk is Churpi which is in high demand in local market fetching upto Rs. 1000 per kilogram. The skin fur is used as a blanket/carpet and the white fur tail is used for special worship, the dung of yak is dried and used as a convenient source of renewable fuel. The yak fur is separated from the skin and is used to make pillow cover and warm clothes etc. Lastly, the agricultural practice is not possible in Muguthang valley, however, once in a year they cultivate potatoes for consumption in kitchen garden. Otherwise, the yak meat is the alternative option for consumption. Yak is a versatile animal which depends upon the inhabitants.

2. Table-1: The name of office along project road:

SL.No.	**Name of Office**	**Location**	**Remarks**
01	**MANGAN**		
1	Range Office	Lachen	
2	Revenue Block	Thangu	
3	G.P.U	Lachen Dzumsa	
4	Constituency	Lachen-Mangan	
5	Sub-Divison Office	Chungthang	
6	BAC	Chungthang	

3. Table-2: Checklist of faunal diversity of Muguthang to 20R Link Point, North Sikkim

SL. No	Common Name	Scientific Name	IUCN Status
1	Snow leopard	*Panthera uncia*	VU (Vulnerable)
2	Wild Yaks	*Bos grunniens*	VU
3	Woolly Hare	*Lepus oiostolus*	LC (Least Concern)
4	Tibetan Wild dog	*Cuon alpinusa*	EN (Endangered)
5	Tibetan Sand fox	*Vulpes ferrilata*	LC
6	Tibetan wolf	*Canis lupus chanco*	CE(Critically Endangered)
7	Blue sheep	*Pseudois nayaur*	LC
8	Himalayan marmot	*Marmota himalayana*	LC
9	Siberian Weasel	*Mustela sibirica*	LC
10	Pika	*Ochotona sp.*	EN

4. Table-3. Checklist of floral diversity of Muguthang to 20R Link Point, North Sikkim

Sl. No	Common Name	Scientific Name	Remarks
1	Sukpa	*Juniperus macropoda*	
2	Jatamashi	*Nardostachys jatamansi*	
3	Panch Auli	*Orchis latifolia*	Highly Medicinal Value
4	Sunpatey	*Rhododendron anthopogon*	
5	Jussey sunpatey	*Rhododendron setosum*	
6	Lek Chimping	*Heracleum wallichii*	
8.	Nilo Bikh	*Acontium heterophyllum*	Medicinal Value
9.	Bikhma	*Acontium bisma*	Medicinal Value
11	Kutki	*Picrorhiza kurroa*	Medicinal Value
12	Gueleno	*Callicarpa arborea*	
13	Yarchagumba	*Cordyceps sinensis*	Medicinal Value
16	Himalayan Shrub Willow	*Salix sp.*	
17	Tarabu	*Hippophae sp.*	
18	Aankhe Phool	*Aster sp*	
19	Thomson's Rush	*Juncus thomsonii*	
20	Rushes	*Juncus sikkimensis*	
21	Himalayan Rush	*Juncus himalensis*	
27	Many-Flower Geranium	*Geranium polyanthes*	
28	Globe Primrose	*Primula glomerata*	
29	Drumstick Primrose	*Primula denticulata*	

5. Table-4. Checklist of Birds of Muguthang to 20R Link Point, North Sikkim

Sl. No	Family	Local Name	Scientific Name	IUCN status
1	Phasianidae	Tibetan Snowcock	*Tetraogallus tibetanus*	LC
2	Gruidae	Black necked Crane	*Grus nigricollis*	NT
3	Sandgrouse	Tibetan Sandgrouse	*Syrrhaptes tibetanus*	LC
4	Muscicapidae	Guldenstadt's Redstart	*Phoenicurus erythrogastrus*	LC
5	Corvidae	Hume's Groundpecker	*Pseudopodoces humilis*	LC
6	Falconidae	Lesser Kestrel	*Falco naumanni*	LC
7	Prunellidae	Alpine Accentor	*Prunella collaris*	LC
8	Upupidae	Hoopoe	*Upupa epops*	LC
9	Prunellidae	Robin Accentor	*Prunella rubeculoides*	LC
10	Fringillidae	Brandts Mountain Finch	*Leucosticte brandti*	LC
11	Prunellidae	Rufous-breasted Accentor	*Prunella strophiata*	LC
12	Motacillidae	White wagtail	*Motacilla alba*	LC
13	Alaudidae	Horned Lark	*Eremophila alpestris*	LC
14	Muscicapidae	Common Stonechat	*Saxicola torquatus*	LC
15	Turdidae	Grandala	*Grandala coelicolor*	LC

* ENVIRONMENTAL IMPACT ASSESSMENT

INDIAN FOREST ACT, 1927

The Indian Forest Act 1927 was enacted after repealing the Indian Forest Act, 1878 for the purpose of consolidating the law relating to forests, the transit of forest produce and the duty applicable on timber and other forest produce. The Act is an important piece of the Central Legislation and various state enactments have made amendments to suit their local requirements and some states enacted their own full scale Forest Acts. The Indian Forest Act was enacted to preserve and safeguard the forests generally in India. The act makes various provisions for such conservation of forests and in the scheme it provides for a state government to constitute any forest lands or waste lands, which are property of Government or which the Governments have proprietary rights, a reserved forests. All though the Indian Forest Act specifically speaks with (i) Reserved forests (ii) Village forests and (iii) Protected forests. The preamble and other provisions of the Forest Act are wide enough to cover all categories of forests.

1. IMPACTS ON THE WILDLIFE:

Disturbance to Wildlife the wildlife population often decline due to the cumulative impacts of the linear projects. The impacts are quite substantial are severe and more detrimental. The major impacts are listed below:

- **Wildlife mortality**
- **Habitat loss and degradation**
- **Habitat fragmentation**
- **Landslides and soil erosion.**
- **Effect on arboreal animals**
- **Impact on the flora and fauna components**
- **Impacts on aquatic ecosystem.**
- **Change in animal behavior**
- **Pollution from construction activity and due to construction equipment.**

There is a direct loss of habitat during establishment and maintenance of linear project. This may happen due to clearing of vegetation, dumping of excavated earth and material movement of heavy vehicles and earth movers, creation of labour camps etc. the effect of these disturbances may persist in the landscape for years to decades. The effect of infrastructure on bird populations extended over distances up to 1 km and for mammal's population up to about 5 km. Mammals and birds areas should be avoided for infrastructure developmental activities except in open areas over larger distances compared to forested areas. The construction work gives raise to landslides and other forms of erosion in steep forested landscapes. During the construction period, large number of machinery and construction workers shall be mobilized, which may create disturbance to wildlife population in the vicinity of project area. The operation of equipment will generate significant noise, especially during blasting which will have adverse impact on fauna of the area. The noise may scare the fauna and force them to migrate to other areas. Likewise shifting of construction plants, workshops, stores, labour camps etc. could also lead to adverse impact on the fauna of the area.

During the construction phase, accessibility to area will lead to influx of workers and the people associated with the allied activities from outside will also increase. Increase in human interference could have an impact on terrestrial ecosystem. The other major impact could be the blasting to be carried out during construction phase. This impact needs to be mitigated by adopting controlled blasting and strict surveillance regime and the same is proposed to be used in the project. This will reduce the noise level and vibrations due to blasting to a great extent. The impacts caused by the construction activity can be easily mitigated.

Suggested biodiversity management measures:

- Delineation of critical wildlife zones in the project area based on presence of Himalayan marmot and other major species i.e., Snow leopard and Tibetan wolf.
- Segregation of solid waste into bio-degradable and non-biodegradable at project site and strict compliance against dumping of waste in open spaces. There should be a mechanism for transporting inorganic waste out of the project site to the nearest recycling facility on a regular basis
- Strict compliance against dumping of road construction debris near water sources and inside critical wildlife zones
- Strict compliance to ensure that vehicular effluents and fuel are not dumped near /inside water sources
- Strict monitoring for detection of any illegal activities against wildlife by the labour/ project staff engaged at the site
- Sensitization for all engaged project staff and construction labour regarding biodiversity and illegal wildlife activities
- Strict compliance against deployment of generators/ noise inducing equipment after evening.
- Enough speed breakers/ rumble strips should be constructed at regular intervals.
- Installation of signages signifying the code of conduct and important biodiversity of the areas, at strategic locations.
- No damage should be done to any natural wetland or water body during the construction.

2. MITIGATION MEASURES:

• Scheduling construction activities to avoid disturbances to bird populations during feeding and reproduction periods;

• The contractors to establish environmental units and implement public awareness programs during construction regarding the impacts caused by the construction activity.

• All wood building material for workers' housing should be brought from outside the project area it should not be procured from the same project site.

• Workers should be supplied with non-wood fuels such as kerosene or liquefied petroleum gas for the duration of the contract

• All contract equipment and plants should be cleaned to the satisfaction of the project engineer prior to their relocation to project sites.

• During site clearance, care should be taken to ensure that the minimum area of vegetation area is affected

• The water sprinkling of trucks used, as construction vehicles should be properly and regularly undertaken, so that dust deposition problem on vegetation is minimized.

• Clearing only necessary amount of vegetation from the forest area.

• Project staff and workers should not be allowed to have fire-arms and animal traps etc.

• Employment agreements should specify heavy penalties for illegal hunting, trapping and wildlife trading all other ancillary works should also agree not to participate in such activities;

• If any of the hunting activity is observed then the worker will be removed from the employment with immediate effect.

• There should be speed limit for the material carrying trucks/dumpers while traversing through the forest areas if at all. It is always better not to travel in the forest areas that would disturb the animal behavior.

• Honking should be strictly prohibited in the forest area by the trucks and dumper used for the construction activity.

• No construction yard will be established at the forest area.

• No disposal of construction waste in the forest premises

• No earthen material or water from the springs present in the forest area will be used for the construction activity.

• Hunting will be strictly prohibited for the workers.

3. IMPACTS DUE TO MOVEMENT OF VEHICLES:

Sprinkle water on the road surface in settled areas when dust levels rise, particularly in the dry season.

Maintain all construction vehicles to minimize toxic vehicle emissions.

Set and enforce speed limits, especially near schools and populated areas.

Install appropriate signs warning drivers to slow down in settlement areas.

Arrange flagmen to control the traffic at the muck disposal areas.

Proper training imparted to the workers involved in the construction activity.

The wind breaks well and fully maintained.

4. IMPACTS DUE TO MUCK DISPOSAL

Waste will be generated due to construction of new road from Muguthang to 20R Link Point, North Sikkim. Waste generated by excavation and by the construction activity will be dumped in proper dumping ground designated by the Forest Department. There are several measures suggested to prevent polluting the environments.

5. MITIGATION MEASURES:

• The waste material generated during the excavation of rock will be reused during the site development to some extent. The material will be used after testing its quality.

• Construction debris will be disposed of in suitable pre identified dumping location, suggested by the Pollution Control Board. A prior approval from the Forest & Environment Department, Govt. of Sikkim will be required before disposal of muck.

• Construction labour camp should be more organized with adequate facilities and should be away from the muck disposal yard as suggested by the Concern Department.

• Required a regular inspection for the debris disposal site from Forest Department.

• A waste disposal site should be away from human settlement, to prevent incidence of health hazards.

• Generally suitable barren lands are preferable for this purpose.

• Ideally speaking a disposal site should be away from the ecologically sensitive areas such as water streams/scared areas/wetlands/petlands.

• It should be easily accessible from the main roads.

• No dumping allowed on private property without written consent of the owner.

• The truck and dumpers used should be spill proof as they move through settlements.

• There should be direction showing boards to the disposal site.

• The worker working at this area should be given proper training regarding the health hazards associated with the work.

6. IMPACTS ON WATER QUALITY

The major sources of water pollution during project construction phase are as follows:

• Sewage from Construction work camps/colonies

• Effluent from Construction Plants and Workshops

• Disposal of solid waste

• The sewage will be treated appropriately.

• The effluents will be suitably treated before letting out

• No disposal of cut spoils into gullies or watercourses.

• A waste disposal site should be away from human settlement, because of incidence of health hazards. Generally barren lands are preferable for this purpose.

• A disposal site should be away from water streams sources.

7. SEWAGE FROM CONSTRUCTION WORKER CAMPS

The project construction is likely to last for a period of almost 3 years (approx.). Most of the employees/workers during construction phase are likely to be employed from outside the project area. The construction phase, also leads to mushrooming of various allied activities to meet the demand of immigrant Construction Worker population in the project area. Additionally drivers and labour associated with transportation of material will also stay in the area on temporary basis. There will be increased quantum of wastewater and sewage is generated, which requires immediate treatment.

8. MITIGATION MEASURES

The construction wastewater and kitchen waste water will be sent out to two settling pits and once settled the water will be used for watering surrounding plantations. The settled material will be either used as fertilizer.

9. IMPACT ON NOISE ENVIRONMENT

As discussed earlier, two major construction plants viz. aggregate processing and concrete mixing and major repair workshops will be established, apart from minor workshops and other construction equipment. Water is used and in these construction plants and wastewater generated contains suspended solids. Similarly from workshops, major pollutant will be oil and grease. Discharge of untreated wastewater will have serious impact on water quality of receiving water body. Turbidity and oil & grease levels will increase substantially in small tributaries, especially, in lean season

10. MITIGATION MEASURES

- Treatment in settling tanks before discharge to any water body or for land application.

Sources of noise will be the vehicles and equipment for excavation and stationary equipment, including concrete batch plant located at the construction sites. Other sources of noise will be the use of explosives for blasting purposes for construction activities, drilling machines and quarrying and crushing activities.

11. NOISE DUE TO CONSTRUCTION EQUIPMENT

Under the worst case scenario, considered for prediction of noise levels during construction phase, it has been assumed that all these equipment generate noise from a common point. The increase in noise levels due to operation of the different construction equipment has been worked out. However, such noise levels will only affect the operators and construction workers who will be in the vicinity of the noise generating equipment and they should always be using PPEs to ward off any negative impact due to exposure to high noise levels. As the distance from the source increases the noise levels decrease considerably. By erecting a noise barrier would additionally reduce the noise level as the sound wave passes through a barrier.

12. NOISE MITIGATION MEASURES

- Site the quarries away from communities and livestock grazing areas.
- Inform people of the possible vibration before using Vibrating Rollers near settled areas.
- Machinery and vehicles will be maintained regularly, with particular attention paid to silencers and mufflers, to keep construction noise levels to minimum.
- Construction yards will be located away from settlement areas. Aggregate crushing plants shall be located on the down wind direction of sensitive areas such as schools, hospitals or human settlement etc. In unavoidable circumstances, the time of the operation of the plant shall be limited. The necessary permission should be obtained from the local government officials.
- A vegetative barrier will be suitably less expensive for a construction yard. The native species is always preferable.
- Operations will be scheduled to coincide with period when people would least likely to be affected. Construction activities will be strictly prohibited between 6 A.M. and 6 P.M.

13. THE FOLLOWING IMPACTS ARE ENVISAGED ON AIR QUALITY:

- Pollution due to fuel combustion in various equipments
- Emissions from various crushers and other construction plants
- Fugitive Emissions from material handling and transportation

14. MITIGATION MEASURES

- Maintain all construction vehicles to minimize toxic vehicle emissions.
- Placing of dust arresters surrounding the crusher and the construction yards will prevent the dispersion of the dust to a great extent.
- Spray water on the stones while unloading from the truck/dumper.
- Spray water at the primary crusher feeder chute.
- Spray water at the transfer points from one belt conveyor to another.
- Payload area of trucks will be covered by tarpaulins when transporting crush to prevent fall out of fines and emissions of dust
- Facility for regular cleaning and wetting of the ground should be provided.
- Trees of native species should be planted to develop a green belt within and along the boundary of the premises of construction yards and the labor camps
- Vegetation of the pile is an excellent option whenever soil is likely to be exposed for a long period of time (greater than four weeks), or whenever works are completed in an area. Note there is also a requirement by the Department of Planning for dust control measures to be left in place until at least 70% vegetative cover has been established.
- Alternatively mulched green wastes can be temporarily laid over the stockpile and removed when required, and retained for later landscaping purposes.

15. IMPACTS DUE TO QUARRYING OPERATIONS

Opening of the quarries will cause visual impacts. Other impacts will be the noise generated during crushing activity, which could affect wildlife in the area, dust produced during the crushing operation to get the aggregates to the appropriate size and transport of the aggregates, and transport of materials. The quarry sites would lead to disturbance to forest area and rural areas surrounding the project site.

16. MITIGATION MEASURES

- Paving road surfaces within the quarry site to prevent the dust emissions.
- Water spraying of conveyors/conveyor transfer points, stockpiles and roads, appropriate maintenance of vehicles and machinery; landscaped mounds on the periphery of the site and around storage areas. The quarries should be sited away from the sensitive locations like the schools and health Centers.
- The quarries should not be very near to human settlements; at least 500 meters away from the human settlement.

.* **PROPOSAL FOR DIFFERENT FORESTRY ACTIVITIES UNDER BELOW:-**

CREATION OF NURSERY:

The majority of the proposed road passes through the Reserve Forest, which has a considerable amount of Rhododendron species and medicinal herbaceous plants growing in its natural habitat. Hence to conserve the already rare and threatened species, setting up of a nursery in the transition zone is of paramount importance.

Sl.No	Proposed Nursery	Location	Preferred Species	Area in HA	Remarks
1	Lachen Territorial Range	Muguthang RF High Altitude	Rhododendron species, Kutki, Bikhma, Panchamle, Jatamansi	1	Rhododendron species, Kutki, Bikhma, Panchamle, Jatamansi the best climate resilience species and considered to be a rare and threatened species.

* **BIO-ENGINEERING MEASURE**

1. SOIL MOISTURE CONSERVATION WORKS:

The gentle slope to undulating slopes will be considered for soil and moisture conservation with contour trenching across the slopes with 1m depth x 0.75m width and 3m length at spacing of 3m along the contour in staggered alignments. The creation contour trenches across the slope will retain moisture regime, check the soil being carried out by the heavy precipitation, establishes soil formation and improves soil quality.

2. CONSTRUCTION OF BRUSHWOOD CHECK DAMS (BCD):

Siltation is one of the major causes of lake degradation, hence construction of Brushwood Check Dams are suggested along the streams feeding the lakes.

3. CONSTRUCTION OF DRY RUBBLE STONE MASONRY WALL:

To check the soil erosion/slides along the rivulets, construction of Dry Rubble Stone Masonry Wall is proposed.

4. CONSTRUCTION OF ECO-FOREST TRAIL FROM ZANAK TO CHUMIGATSAR:

The main entry point of Muguthang Valley is via Lachen-Thangu-Kalapathar-Lungnak La which is accessible by road. Since Kalapathar, Lhonak Pass, Zanak & Chumigatsar are the important trekking corridors for the trekkers who visit yearly, therefore development of an Eco trail is important to improve forest management and to mitigate future risk of Human-Animal conflict.

5. FOREST PROTECTION MEASURES WITH DRY STONE WALL FENCING:

Dry stone wall fencings would be required at various locations within the Reserve forest to protect the forest and its allied afforestation from cattle grazing, discourage encroachment, and prevent soil slippage.

*** FORESTRYCONSERVATION MEASURE**

6. HOLY LAKE CONSERVATION:

The proposed road passes in close proximity to 3 different lakes, these lakes are attached with the religious sentiments of the local people (Buddhism & Hinduism). It will be necessary to conserve the lakes once the road becomes operational and the number of pilgrim's increases. Further, the lake attracts large number of local trekkers and nature enthusiasts; hence proper solid waste management practices needs to be implemented. Also, the lakes need to be demarcated and protected by boundary walls with proper provision of amenities for the visitors.

7. WATER SOURCE DEVELOPMENT:

The above-mentioned lakes are a source of water for the villages lying in the downstream side of the lake and source development is required to ensure clean and uninterrupted water supply.

8. RESEARCH AND FOREST DEVELOPMENT:

The virgin valley with pristine forest of this Muguthang to 20R Link Point holds an array of biodiversity. So far, no serious research work has been conducted in the area and there is a need to develop, encourage, allow, support positive research programmed. The information obtained from the research could be used further for better administrative and planning as well as better management of this fragile ecological forest area.

*** INFRASTRUCTURE DEVELOPMENT**

9. CONSTRUCTION OF LOG BRIDGE:

The Reserve forest affected by the proposed road is vast in area and with no motor able roads sometimes our field staff has to commute across small/ big streams & rough terrain roads with rudimentary equipment's during patrolling for which log bridges are required to be constructed to enable our field staff/officers to check the activities of Indian Army especially related to illegal diversion of forest lands as this is the last outpost of Indian Army in the eastern part of extreme North Sikkim.

10. CONSTRUCTION OF WAITING SHED:

Since Kalapathar, Lhonak Pass, Zanak & Chumigatser are the important corridors for the field staffs for patrolling as well as for the trekkers who visit these places yearly to offer prayers. The weather being totally unpredictable here, small structured waiting shed is totally important to be constructed alongside eco-forest trails/roads that that can provide shelter for the people from heavy rain or from a very sunny weather.

11. ENGAGEMENT OF TEMPORARY NURSERY LABOUR FOR 10 YEARS:

With the creation of new nurseries as mentioned above, the requirement of manpower for the nurseries need to be met up for the proper functioning of the Nurseries.

12. PURCHASE OF CAMPER PIK-UP VEHICLES:

The purchase of Camper Pick-Up/ Mini Truck vehicle is required to support the field staff in patrolling and Emergency Duties viz. Forest Fire, Man-Animal Conflict, Seizures in cases etc.

13. PUBLIC AWARENESS AND EDUCATION:

The intensity of disturbances caused is due to ignorance or lack of proper education of understanding of the ecosystem of the Reserve Forest and other forest land. The proper awareness and dissemination of information to the local residents is very essential and should be made mandatory in the project. The important floral and faunal resources of the proposed Muguthang to 20R Link Point road construction with a stretch of 13.42 Kms area highlighting the local sentiments should be printed in handouts or pamphlets in language which can be read and understood by the local community. Several meeting with the local community and the stakeholders and people residing at the fringes of the Forest area may be organized constantly asking them to Preservation and conservation of Forest area. Audio visual aids should be provided to the local community to understand and educate themselves through the media. A film on successful conservation of Forest Land may be screened to the public especially on the festivals and other community meeting to benefit more involvement. The local schools may be taken to the entire reserve forest to educate the value and significance of conservation. Radio talks in local language are very effective means of communication and it reaches to all the area on earth and is affordable by many. The tourist guides and porters and taxi drivers should be trained to acquaint them with the local environment of the Forest land and their multiple uses and disseminate the information to the tourists. They may be taught about DOs and DON'Ts of environmental protection and conservation. Proper literature may be arranged before they conduct tour in the virgin Forest area. Workshop on conservation of Forest land may be organized with the participation of local community and tour operators. Colorful signage informing about the reserve forest area and other forest land and their significance with Do's and Don'ts may be displayed at the vantage points. The information about the Forest area and religious and cultural values may be written. During the tourist peak season cultural shows may be organized with emphasis on the conservation of Forest Land and to spread the message for conservation.

14. MONITORING AND EVALUATION: Monitoring and evaluation is an integral part of the project.

15. OVERHEAD EXPENDITURE: 2% of the proposed work amount.

16. CLIMATE RESILIENCE MEASURE FOR MUGUTHANG TO 20R LINK POINT ROAD:

The forest of Sikkim, a Himalayan State in north-east India, is vulnerable to the impacts of climate change. The Sikkim landscape comes under the Eastern Himalayan Biodiversity Hotspot, one of the global biodiversity hotspots, due to its floral and faunal biodiversity. Climate change is basically driven by anthropogenic activities and other natural calamities such as landslide, earthquake etc. The State of Sikkim has one of the highest percentages of land under forest and tree covers among the states of India. These forests provide opportunities towards climate change mitigation and adaptation.

1. Plantation of degraded forest land to increase the green cover.

2. Encouraging participation of JFMCs and EDCs towards conservation of Forest which is important watersheds and for habitat wildlife species.

3. Establish and plantation of climatic resilience indigenous species such as Rhododendron species.

4. Provision of climate-resilient alternate livelihoods option such as ecotourism, bird watching and Home-stay training.

5. Promoting responsible solid-waste management program.

6. Capacity building programs to forest department personal as well as local communities.

7. Support the development of community forest management plans.

PROPOSED BUDGET REQUIREMENT FOR CONSERVATION AND MANAGEMENT OF RESERVE FOREST MUGUTHANG TO 20R LINK POINT ROAD, NORTH SIKKIM

Sl. No.	Item of Work	Unit	Target		Total
		Cum	Phy	Fin	
A.	**FLORA CONSERVATION**				
	Creation of a Rhododendron Nursery at Muguthang @10,84,916.00 per Hectare	Ha	1	₹ 10,84,916.00	₹ 10,84,916.00
	Maintainence of 1Ha Nursery for 10yrs @ 8,80,825.00	Ha	1	₹ 8,80,825.00	₹ 8,80,825.00
	Engagement of 4 Nos Supervisor @320/day for 7 years	Ha	4	₹ 8,17,600.00	₹ 32,70,400.00
	TOTAL OF A			**₹ 27,83,341.00**	**₹ 52,36,141.00**
B.	**WILDLIFE CONSERVATION**				
	Rescue of wild animals and medication of animals in forest fringe village	–	–	₹ 5,00,000.00	₹ 5,00,000.00
	Chain link fencing 1km @31,47,421/-	Kms	1	₹ 31,47,421.00	₹ 31,47,421.00
	Stone wall fencing 1km @11,21,655/- (HA)	Kms	1	₹ 11,21,655.00	₹ 11,21,655.00
	Purchase of Patrolling Van	Nos.	1	₹ 9,50,000.00	₹ 9,50,000.00
	TOTAL OF B			**₹ 57,19,076.00**	**₹ 57,19,076.00**
C.	**SOIL CONSERVATION**				
	Soil Erosion control with dry rubble stone masonry works 1000cum @3,197/cum	Cum	500	₹ 3,197.00	₹ 15,98,500.00
	Brushwood Check dam in catchment area 10nos @18,534/-	–	10	₹ 18,534.00	₹ 1,85,340.00
	Construction of water hole 5nos @50000/-	–	5	₹ 50,000.00	₹ 2,50,000.00
	TOTAL OF C			**₹ 71,731.00**	**₹ 20,33,840.00**
D.	**WATER MANAGEMENT**				
	Holy Lake conservation at different location 2nos @14,00,000/-	–	2	₹ 14,00,000.00	₹ 28,00,000.00
	Water Source Development	–	–	₹ 30,00,000.00	₹ 30,00,000.00
	TOTAL OF D			**₹ 44,00,000.00**	**₹ 58,00,000.00**
E.	**FOREST PROTECTION MEASURES**				
	Construction of Log Bridge at Muguthang-20R Link Point during patrolling @8,00,000/-	Nos.	2	₹ 8,00,000.00	₹ 16,00,000.00
	TOTAL OF E			**₹ 8,00,000.00**	**₹ 16,00,000.00**
F.	**RESEARCH, FOREST DEVELOPMENT, PUBLIC AWARENESS AND TRAINING**				
	Sinages 50nos @7,000/-	Nos:	50	₹ 7,000.00	₹ 3,50,000.00

Sl. No.	Item of Work	Unit	Target		Total
		Cum	Phy	Fin	
	Construction of Eco forest trail, resting/waiting shade, camping site Zanak to Chumigatsar-2 Kms @12,00,000/-	Kms	2	₹ 12,00,000.00	₹ 24,00,000.00
	Long range patrolling-engagement of porter, purchase of ration, purchase of utensils, TA/DA for staffs	–	–	₹ 5,00,000.00	₹ 5,00,000.00
	Capacity building programme and awareness programme to field staff and local committee	–	–	₹ 5,00,000.00	₹ 5,00,000.00
	Dry stone wall at different dumping site of the project. 5 locations @11,21,655/-	–	5	₹ 11,21,655.00	₹ 56,08,275.00
	TOTAL OF F			**₹ 33,28,655.00**	**₹ 93,58,275.00**
G.	**MONITORING & EVALUATION**				
	Monitoring & Evaluation @ 2% of above	–	–		**₹ 5,94,947.00**
H.	**MISCELLANEOUS**				
	Office Expenses, Stationery, TA/DA, Repair of vehicle/ computer etc. @ 10% of above	–	–		₹ 29,74,733.00
	Contingencies @ 4 % of above	–	–		₹ 11,89,893.00
	TOTAL OF H				**₹ 41,64,626.00**
	GRAND TOTAL (A+B+C+D+E+F+G+H)			**₹ 1,71,02,803.00**	**₹ 3,45,06,905.00**

(Rupees Three Crore Forty-Five Lakhs Six Thousand Nine Hundred and Five) Only

Divisional Forest Officer
North Territorial Division
Forest & Environment Department

Tenzin [illegible]
Range Officer
Lachen Territorial
Range, North Sikkim.

CONCLUSIONS

The proposed Muguthang - 20R Link Point Road in North Sikkim, involves the degradation of the Reserve Forest, however the construction of this road would greatly strengthen the road network of the State especially for National Security and State Tourism. To compensate and mitigate the environmental damage due to the proposed project, the Biodiversity management plan has been prepared under North Territorial Division, Forest & Environment Department, Government of Sikkim.

Range Officer
Lachen Territorial Range
North Territorial Division
Forest & Environment Department

Tenzing Bhutia
Range Officer
Lachen Territorial
Range, North Sikkim.

Assistant Conservator of Forest
North Territorial Division
Forest & Environment Department

Divisional Forest Officer
North Territorial Division
Forest & Environment Department

Divisional Forest Officer
North Territorial Division
Forest & Environment Department

Fig. 1) Blue Sheep (*Pseudois nayaur)*

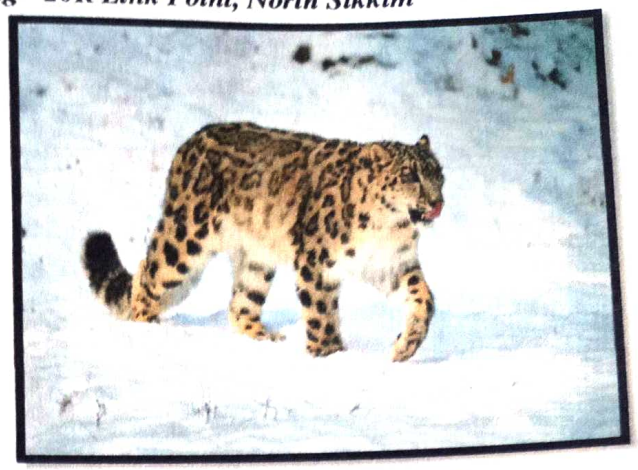


Fig. 2) Snow Leopard (*Panthera uncial)*

Fig. 3) Himalayan Marmot (*Marmota himalayana)*

Fig. 4) Pika (*Ochotona sp.)*

Fig. 5) Siberian Weasel (*Mustela sibirica)*

Fig. 6) Woolly Hare (*Lepus oiostolus)*

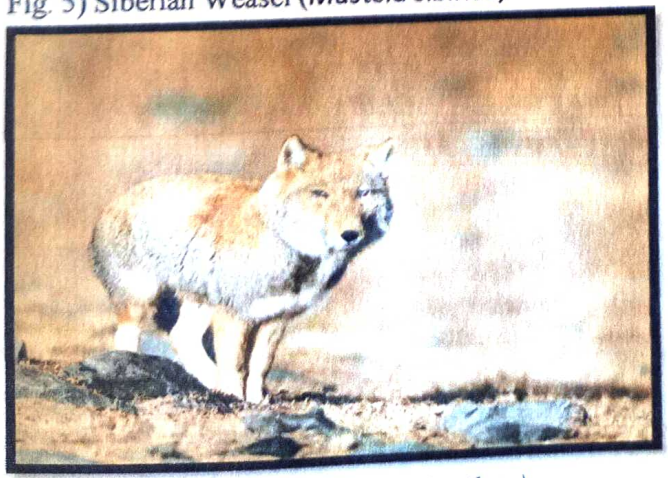


Fig. 7) Tibetan Sand Fox (*Vulpes ferrilata)*

Fig. 8) Tibetan Wolf (*Canis lupus chanco)*

Fig.1) Horned Lark (*Eremophila alpestris*)

Fig. 2) Common Stonechat (*Saxicola torquatus*)

Fig. 3) Hume's Grounpecker (*Pseudopodoces humilis*)

Fig. 4) Lesser Krestel (*Falco naumanni*)

Fig. 5) Tibetan Snowcock (*Tetraogallus tibetanus*)

Fig. 6) Grandala (*Grandala coelicolor*)

Fig. 7) Black necked Crane (*Grus nigricollis*)

Fig. 8) Alpine Accentor (*Prunella collaris*)

DIFFERENT HOLY LAKES OF MUGUTHANG - 20R LINK POINT, NORTH SIKKIM

SOUTH LHONAK LAKE

GURUDONGMAR LAKE

TSO LHAMO LAKE

Flowering Species found in Muguthang - 20R Link Point, North Sikkim

Fig.1) Jatamashi (*Nardostachys jatamansi)*

Fig.2) Many-Flower Geranium (*Geranium polyanthes*)

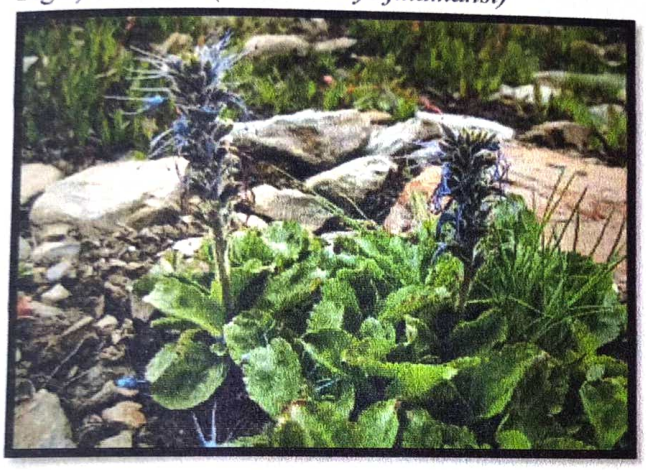


Fig.3) Kutaki (*Picrorhiza kurroa)*

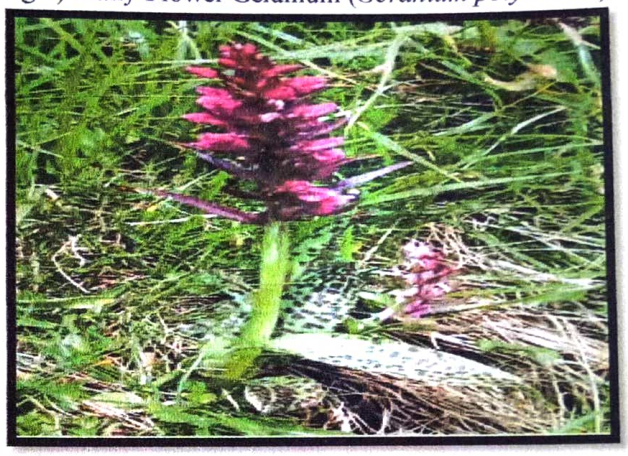


Fig. 4) Paanch auli (*Orchis latifolia)*

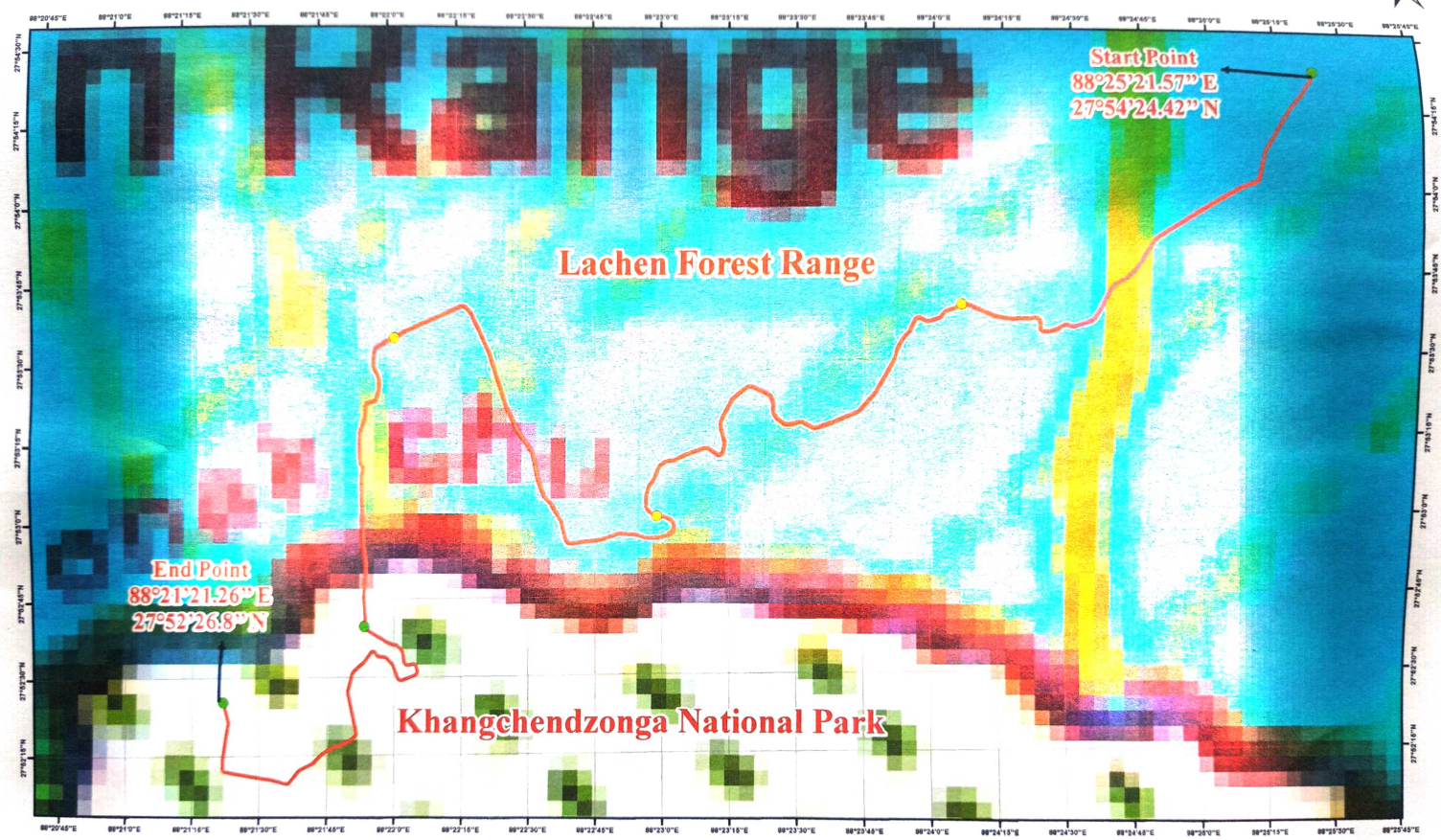
Fig. 5) Sunapatey (*Rhododendron anthopogon)*

Fig. 6) Primula (*Primula glomerata)*

Fig. 7) Thomson's Rush (*Juncus thomsonii)*

Fig. 8) Nilo Bikh (*Acontium heterophyllum)*

Digital Map:- Muguthang 20r (Length- 13.42 Km)



Legend

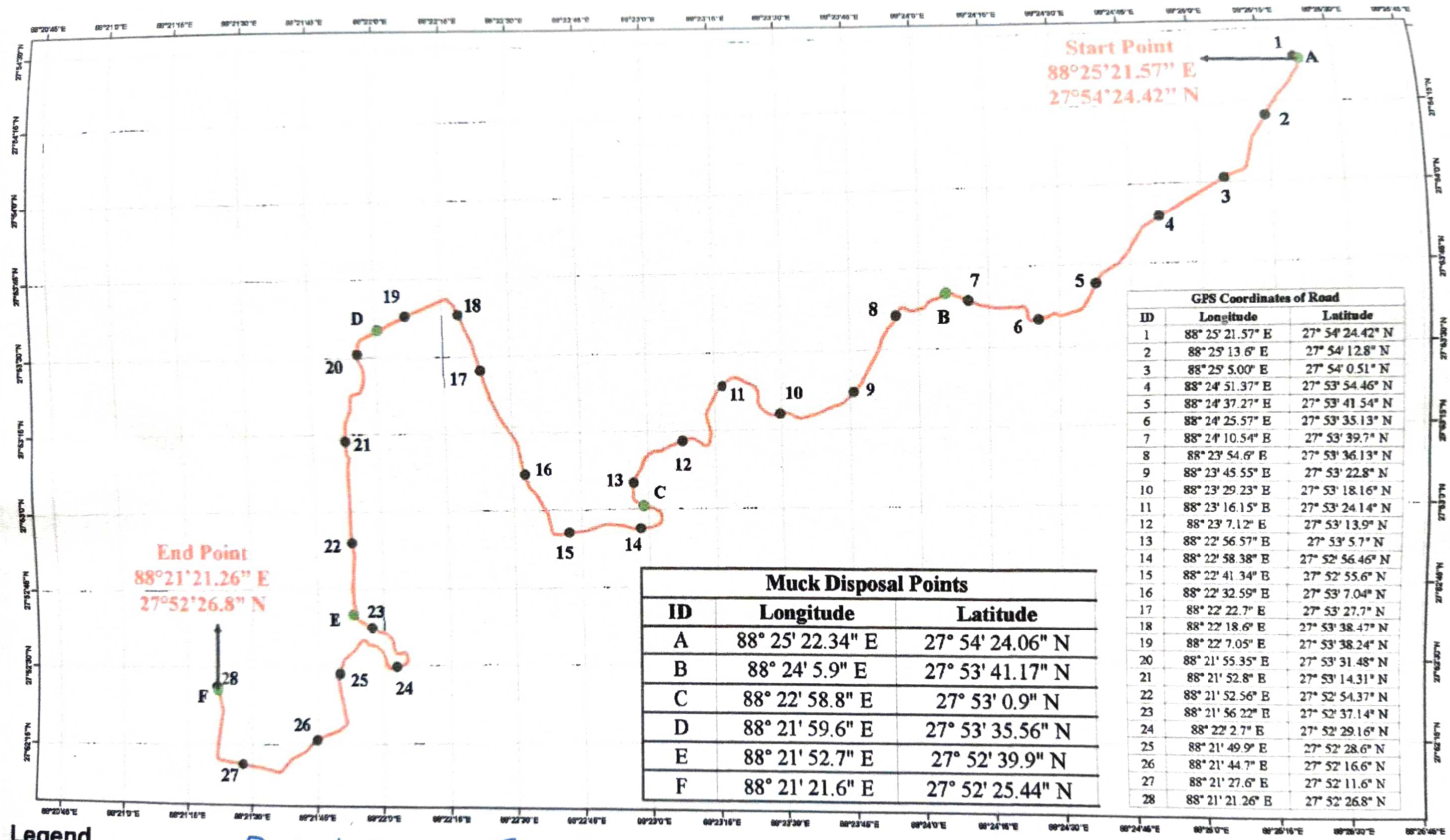
- Proposed Road
- Muck Disposal Points

0 0.2 0.4 0.8 1.2 1.6 Miles

Scale- 1:50,000

Prepared by: ITGC, PCCF Office, Gangtok

Georeference Map:- Muguthang 20r (Length- 13.42 Km)



Muck Disposal Points		
ID	Longitude	Latitude
A	88° 25' 22.34" E	27° 54' 24.06" N
B	88° 24' 5.9" E	27° 53' 41.17" N
C	88° 22' 58.8" E	27° 53' 0.9" N
D	88° 21' 59.6" E	27° 53' 35.56" N
E	88° 21' 52.7" E	27° 52' 39.9" N
F	88° 21' 21.6" E	27° 52' 25.44" N

GPS Coordinates of Road		
ID	Longitude	Latitude
1	88° 25' 21.57" E	27° 54' 24.42" N
2	88° 25' 13.6" E	27° 54' 12.8" N
3	88° 25' 5.00" E	27° 54' 0.51" N
4	88° 24' 51.37" E	27° 53' 54.46" N
5	88° 24' 37.27" E	27° 53' 41.54" N
6	88° 24' 25.57" E	27° 53' 35.13" N
7	88° 24' 10.54" E	27° 53' 39.7" N
8	88° 23' 54.6" E	27° 53' 36.13" N
9	88° 23' 45.55" E	27° 53' 22.8" N
10	88° 23' 29.23" E	27° 53' 18.16" N
11	88° 23' 16.15" E	27° 53' 24.14" N
12	88° 23' 7.12" E	27° 53' 13.9" N
13	88° 22' 56.57" E	27° 53' 5.7" N
14	88° 22' 58.38" E	27° 52' 56.46" N
15	88° 22' 41.34" E	27° 52' 55.6" N
16	88° 22' 32.59" E	27° 53' 7.04" N
17	88° 22' 22.7" E	27° 53' 27.7" N
18	88° 22' 18.6" E	27° 53' 38.47" N
19	88° 22' 7.05" E	27° 53' 38.24" N
20	88° 21' 55.35" E	27° 53' 31.48" N
21	88° 21' 52.8" E	27° 53' 14.31" N
22	88° 21' 52.56" E	27° 52' 54.37" N
23	88° 21' 56.22" E	27° 52' 37.14" N
24	88° 22' 2.7" E	27° 52' 29.16" N
25	88° 21' 49.9" E	27° 52' 28.6" N
26	88° 21' 44.7" E	27° 52' 16.6" N
27	88° 21' 27.6" E	27° 52' 11.6" N
28	88° 21' 21.26" E	27° 52' 26.8" N

Legend

- Proposed Road
- GPS Point of Road
- Muck Disposal Points

0 0.2 0.4 0.8 1.2 1.6 Miles

Scale- 1:50,000

Prakash Kumar Sharma

Executive Engineer
BRPD-I, CPWD, Chungthang
North Sikkim

Prepared by: ITGC, PCCF Office, Gangtok

MAP SHOWING THE LOCATION OF MUCK DUMPING ALONG WITH THE CONSTRUCTION OF I.T.B.P ROAD FROM MUGUTHANG TO 20R LINK ROAD LENGTH OF 10.70 KMS BY CPWD GOVT. OF INDIA IN THE BLOCK OF LACHEN, NORTH SIKKIM