

**GEOLOGICAL ASSESSMENT REPORT**  
**WITH FEASIBILITY STATEMENT FOR**  
**CONSTRUCTING MOTORABLE ROAD**  
**FROM GELDUNG TO NITI PASS (ROAD**  
**ALIGNMENT), DISTRICT CHAMOLI,**  
**UTTARAKHAND**

**PREPARED FOR**

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**"USE GEOLOGICAL KNOWLEDGE FOR MAKING DISASTER**  
**RESILIENT COMMUNITY"**

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CONSTRUCTING MOTORABLE ROAD FROM  
GELDUNG TO NITI PASS (ROAD ALIGNMENT),  
DISTRICT CHAMOLI, UTTARAKHAND**

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**GEOLOGICAL ASSESSMENT REPORT WITH FEASIBILITY STATEMENT FOR CONSTRUCTING MOTORABLE ROAD FROM GELDUNG TO NITI PASS (ROAD ALIGNMENT), DISTRICT-CHAMOLI, UTTARAKHAND**

**TERMS OF REFERENCE**

The Road Alignment Geological Report, entitled "GEOLOGICAL ASSESSMENT REPORT WITH FEASIBILITY STATEMENT FOR CONSTRUCTING MOTORABLE ROAD FROM GELDUNG TO NITI PASS (ROAD ALIGNMENT), DISTRICT CHAMOLI, UTTARAKHAND" prepared for L. N. MALVIYA INFRA PROJECTS PRIVATE LIMITED, Plot no.29, F/F sector-11, Dwarka, New Delhi-110078, (Consultancy agency of BRO) via *work order letter No. WNIPPL/W.O/Geldung-Niti Pass/2021-22/1713 Dated 30/7/2021*, by Chief Geological Consultant of Progressive Geological & Geotechnical Services (PG2S), Bhuwan Joshi, Empanelled Geologist, Govt. of Uttarakhand & RQP- IBM, Govt. of India for assessing geological conditions of the proposed improvement/development road alignment in order to assure its feasibility.

Undersigned (Geological Consultant) geologically evaluated the area through secondary sources. Investigations are done, based on information extracted from available toposheets, geological maps published in referred journals, high resolution satellite imageries and literature on work previously done in the area.

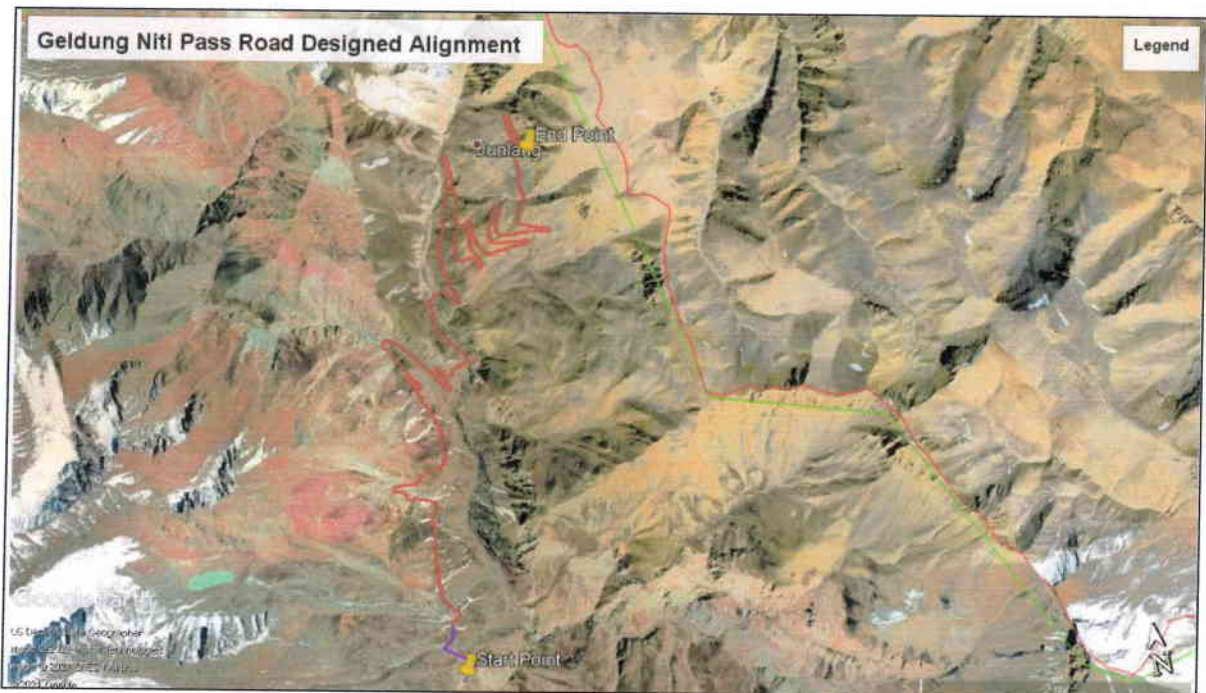
The proposed road is 16.53 km, high altitude Indo-China border motorable road from Geldung to Niti pass in Chamoli district of Uttarakhand. The road is strategically very important for the safety of nation and will be used primarily by armed forces for moving of their goods and ammunition.

**LOCATION SITE**

The proposed road section from Geldung to Niti Pass is located in northernmost part of Chamoli district which is Uttarakhand near China Border. It is about 380 km from state capital, Dehradun. Starting, geographically, from the coordinates 79°51'10" E; 30° 53' 54.25" N, the road alignment will be moving in undulating mountain terrains of Tethyan Himalaya to its end point at coordinates 79° 52' 18.52" E; 30° 56' 45.54" N. The extreme north of Uttarakhand contributes approximately 1% of the total Tethyan Himalayan region of India covering Nilang, Niti and Mana valleys and Johar valley in Uttarkashi, Chamoli and Pitthoragarh districts, respectively.

Chamoli district is the second largest district of Uttarakhand having area of 7320 sq km and shares its northern boundary with Tibet. Geomorphologically, it is characterized by hilly terrain, deep

gorges having very high gradient, and river valleys. Alaknanda River is the main river and its major tributaries are Dhauli Ganga, Vishnu Ganga, Nandakini, Pindar and Mandakini. The highest mountain peaks of the Himalayan Ranges such as Nandadevi, Kamet, Trisuli, and Chaukhamba are also located here. The morainic materials occupy the valley areas. The prevalent landforms are lateral moraines, end moraines, U shaped glacier valleys, V shaped fluvial valleys, river terraces and denudational structural mountains.



**PROPOSED ROAD ALIGNMENT, DISTRICT-CHAMOLI**

### PHYSIOGRAPHY OF SITE

The proposed construction is in Upper Dhauli Ganga valley. The valley is between the Kamet groups of peaks in the west and Nandadevi group in the east. The river Dhauliganga rises from the Niti Pass at about 5070 meters in the border regions between Uttarakhand and southwestern Tibet. It flows 50 km southwards until it meets the Rishiganga on its left bank at Reni village, in the vicinity of Tapovan in Chamoli district, where it is almost a narrow gorge with perpendicular cliffs on either side. It then flows 20 km westwards until it meets the Alaknanda at Vishmuprayag, just upstream of the city of Joshimath.

Starting point of road alignment, Geldung area has an elevation ranging from 4,400 to 5,500 m while Niti pass is at an elevation of 5070m. These areas lie in Nanda Devi Biosphere Reserve. The slope is steep to highly steep. Dhauli Ganga river and a number of other dry local streams are

crossing the route. Vegetation is scanty and grazing pasture lands are present. Though habitation is minimal but Bhotiya, an ethnic community of Indo-Mongoloid origin, inhabited in the valley.

Dry arid climate is observed in the upper reaches of the valley, which remain snow bound for more than 6 months in a year. Summer is very short and generally lasts from June to August. The region receives low amount of precipitation and remains dry and dusty above 3,200 m above mean sea level.

### **PURPOSE AND SCOPE**

The present report aims to assess geological conditions of the proposed road alignment in order to assure its feasibility. This 16.53 km long road at the Indo-China border is strategically very important for the safety of nation and may be used primarily by armed forces for movement of their goods and ammunition etc. High altitude road construction will be challenging due to tough hilly terrain, rugged topography and difficult climatic conditions. The major scope of the assignment includes as:

- Regional Geological correlation with respect to proposed alignment.
- Local Geological interpretation with respect to proposed alignment.
- Identification of major hazards/natural hazards & possible recommendations/feasibility for construction of road as per proposed alignment.

### **METHODOLOGY**

The report is based on secondary methods/sources of investigation. No physical field work has been carried out due to weather constraints. Following sources being used for locating/assessing the alignment: -

- Identification of proposed road alignment through high resolution satellite imageries and Survey of India toposheets etc.
- Literature review, collection of site history, regional geology & community requirement etc.
- Interpretation of geomorphology, drainage characteristics, vegetation cover, instability etc from satellite imageries.
- Data provided by implementing agency.



## REGIONAL GEOLOGY

In Uttarakhand, Himalaya has been broadly divided into four linear, east-west trending physiographic zones, viz. the Outer Himalaya, Lesser Himalaya, Higher Himalaya and the Tethyan Himalaya. Outer Himalaya is the southernmost comprising chiefly of Cenozoic sediments-the Siwalik Supergroup, and is also called as Siwalik Range. It raises abruptly the Indo-Gangatic Plain along the HFT and is limited by Lesser Himalaya along MBT in North. Lesser Himalaya is a broad zone that lies between the Outer Himalaya in the south and the Higher Himalaya in the north. This attains heights between 1200m to 3000m. The MBT and MCT define its southern and northern limits. The Higher Himalaya lies between the Lesser Himalaya in the south and the Tethyan in the North, and is chiefly made up of Archean - Palaeoproterozoic sequences constituting the Central Crystalline and Mesoproterozoic - Dar Formation, which forms the basement for the Phanerozoic succession of the Tethys Himalaya. This is limited by MCT in south while in the north, it imperceptibly passes into the Tethys Himalaya, through at places a tectonic plane. The main relief varies between 4800m to 6000m. This zone is characterized by highly rugged topography with snow bound peaks. It hosts a number of glaciers.

Tethys Himalaya is the northernmost subdivision of the Himalaya that imperceptibly passes from the Higher Himalaya that lies to its south. The ISTZ (Indo-Tsangpo Suture Zone) separates it from the Trans- Himalayan zone in the north. It is chiefly made up of phanerozoic rocks and is characterized by anticlinal ridges and synclinal valleys. It attains heights of 3500 m to 4800 m.

The Tethys Himalaya is confined between the South Tibetan Detachment Fault (STDF) in the south and the Indus Tsangpo Suture Zone (ITSZ) in the north. It comprises the Late Precambrian to Eocene marine sediments deposited in the Tethyan Sea. These sediments are largely unmetamorphosed and dominantly fossiliferous occurring in synclinorium-type basins.

In Dhauliganga valley of Chamoli district, Higher Himalayan Crystallines and Tethyan Himalayan Sequences are present. The overthrust Vaikrita Group contains three formations in structurally ascending order: (a) lowermost Joshimath Formation of muscovite schist, gneiss and leucogranite, (b) the Surraithota Formation is equivalent to Pandukeshwar Formation of flaggy banded gneiss, kyanite-garnet-biotite schist, calcsilicates, garnet-amphibolite, and (c) the uppermost Bhapkund Formation of schist, gneiss, migmatite and leucogranite.

## SITE GEOLOGY (SITE SPECIFIC GEOLOGY ALONG THE ALIGNMENT)

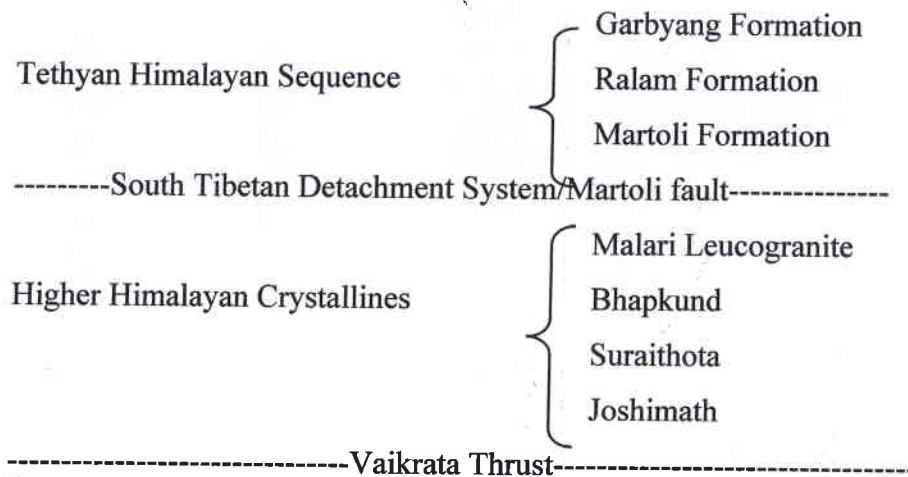
The road section from Geldung to Niti pass lies in Tethyan Himalayan zone. The Tethyan succession along the proposed road begins with the Martoli Formation overlain successively by the Ralam and Garbyang formations. Martoli present in the area consists of greyish green rhythmic

alternating greywacke, siltstone and slate. It makes up the lowermost part of the Tethyan Himalayan Sequence above the Higher Himalayan Sequence.

This formation is overlain by the sedimentary succession of Ralam and Garbyang Formations. Ralam formation, encountered, consists of oligomictic conglomerate and interbedded quartzite. Garbyang formation consists of shaly dolomitic limestone, calcareous phyllites and quartzites.

South Tibetan Detachment fault confining the southern boundary of Tethyan Himalaya is observed at Niti village. This fault separates the basement complex of high-grade metamorphic rocks with their granites from the cover sediments of the Martoli formation in the Dhauliganga valley. Geological formations are moderately to steeply dipping.

Lithostratigraphic sequence in Dhauliganga valley



### PROPOSED ALIGNMENT AND FEASIBILITY STATEMENT

State- Uttarakhand

District- Chamoli

Development Block- Forest Land (Boarder area of India)

Proposed Site Location- 16.53 km long road from Geldung to Niti Pass

Proposed Structure- Road

Alignment points-

- Start Point  
Latitude- 30° 53' 54.25" N/Longitude- 79° 51' 10" E
- End Point  
Latitude- 30° 56' 45.54" N/Longitude- 79° 52' 18.52" E

Vegetation- Scanty

Dominant Lithology- conglomerates, greywacke, siltstone and slate

Important Hazards- Earthquake, Landslides and excessive rain fall induced Landslides & related phenomena

### **DESCRIPTION OF ALIGNMENT**

The alignment is not smooth as it is passing through hilly and steep terrain in its entire length. It runs from an elevation of 4480m to 4900m having many acute curves & hair pin curves. Starting point of alignment is about 280m above from river (Dhaulti Ganga River) bed but in higher reaches, it crosses the Dhaulti Ganga river path twice. Besides Dhaulti Ganga River crossing, the alignment crosses about 14 minor nalas, few of them are dry. Presently within the proposed alignment route one small bridge, 14 small puliyas (or culverts) and 1 flush causeway existed but these are in poor conditions possibly not serving the purpose (Alignment map attached as Annexure).

### **FEASIBILITY STATEMENT**

*Based on above facts, proposed alignment of road construction from a part of Geldung to Niti Pass Road, Chamoli district, Uttarakhand seems feasible under informed conditions with proper consideration of recommendations as mentioned in the report below.*

### **CONCLUSIONS AND RECOMMENDATIONS**

#### **CONCLUSIONS-**

Based on above data & community requirement, the road alignment from *a part of Geldung to Niti Pass*, within portion of forest land, point position coordinate are- Latitude- 30° 53' 54.25" N to 30° 56' 45.54" N, Longitude- 79° 51' 10" E to 79° 52' 18.52" E; District- Chamoli, Uttarakhand, for construction of motor road is conditionally feasible.

Based on the available data, the following conclusions are drawn: -

- The alignment falls under seismically high hazard and very high hazard zones (seismic zone IV and V) as per seismic zonation map of India. Hence suitable provisions should be made for seismic resilience.
- Proper drainage should be constructed by the side of the hill all along the road.
- Outer edge of the road should be kept slightly higher than the inner one, so that water does not cross the road during rainy season.
- Few minor unstable slopes are observed in satellite imageries. A perusal of the slides indicates that they have insignificant importance as far as the road alignment is concerned.

During construction phase, near unstable zone/Landslide scarp developed area precautionary measures shall be essentially recommended.

- Near HP bends within the alignment proper stability measures like construction of proper retaining walls shall be recommended.
- Tough weather conditions prevail within the proposed alignment during the entire year, either by rains or by snow, hence construction should be well tolerated to frost and thaw weakening.
- Construction of road shall be as per the specifications defined for the construction of motorable roads in hilly terrain (IS code).
- In view of Himalayan fragile setting, slope cutting recommended to be done through without blasting.
- Reference of site specific geotechnical assessment would be highly recommended for road construction (Load bearing analysis).
- This report is based on secondary sources, hence, during construction if any stability issue arise within any part of the alignment then specific consultation for geological, geotechnical and stability investigations would be required/recommended.

#### **CERTIFICATION**

**BHUWAN JOSHI**, Empanelled Geologist, RQP, IBM, Govt. of India with Business Address: - 20-Shastrinagar, Lane No.-3, Dehradun, Uttarakhand; do hereby certify that:-

- a) I am Consulting Geologist registered with National & State Accreditation bodies.
- b) I am Life member of Himalayan Geology, Wadia Institute of Himalayan Geology, 33-GMS road, Dehradun
- c) I hold M.Sc. Geology from University of Lucknow, Lucknow.
- d) I was associated as RA with Wadia Institute of Himalayan Geology, Dehradun.
- e) I have obtained various trainings from JNU, New Delhi, Centre University, Allahabad, Wadia Institute of Himalayan Geology, Anna University, NIDM, IIRS, Dept. of Space, Govt of India etc, related to my professional Career.
- f) I am consulting various departments in the state as per their requirement.
- g) This report is based on secondary sources of data.

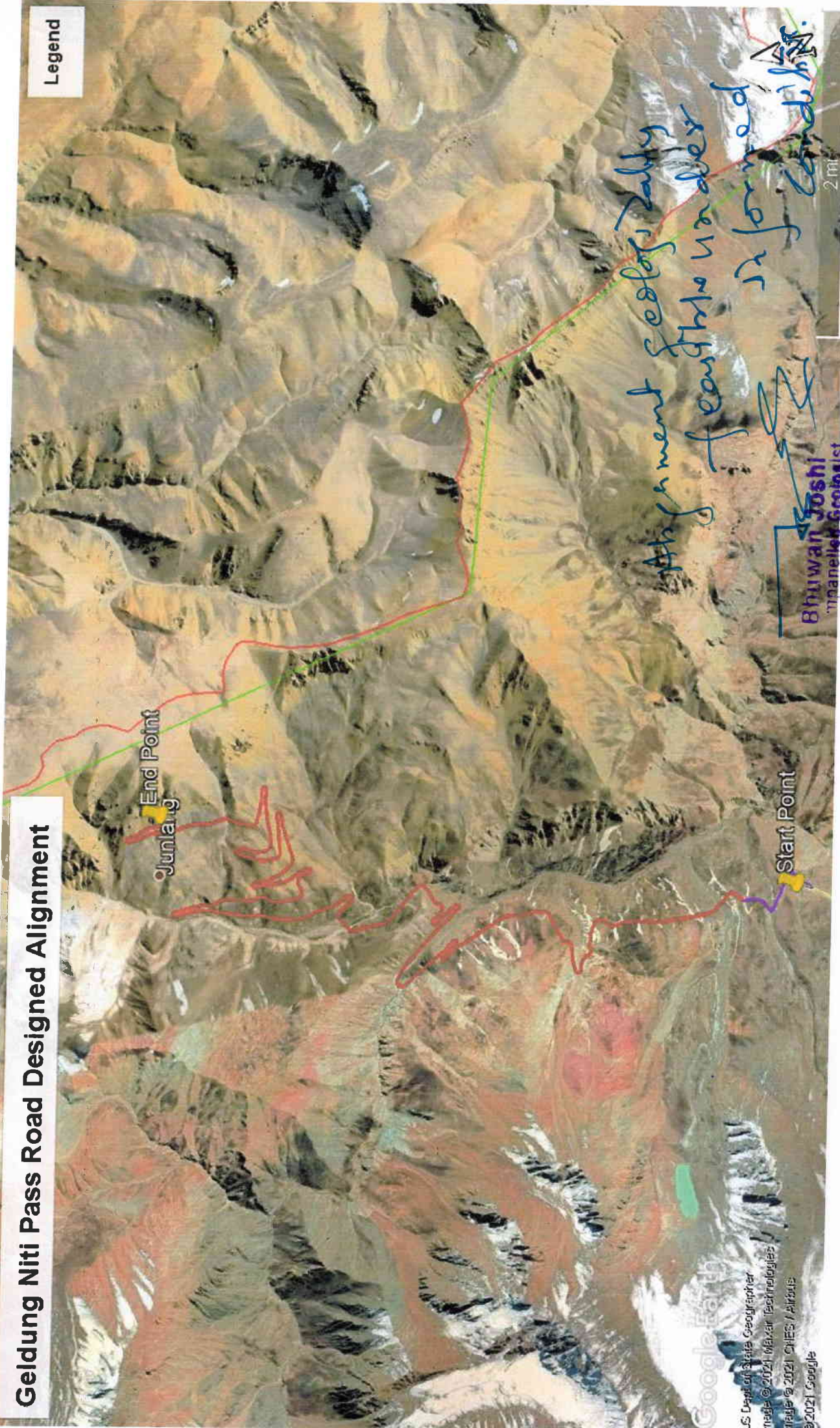
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#### **ANNEXURE, - MAPS OF THE PROPOSED ALIGNMENT**

# Geldung Niti Pass Road Designed Alignment

Legend

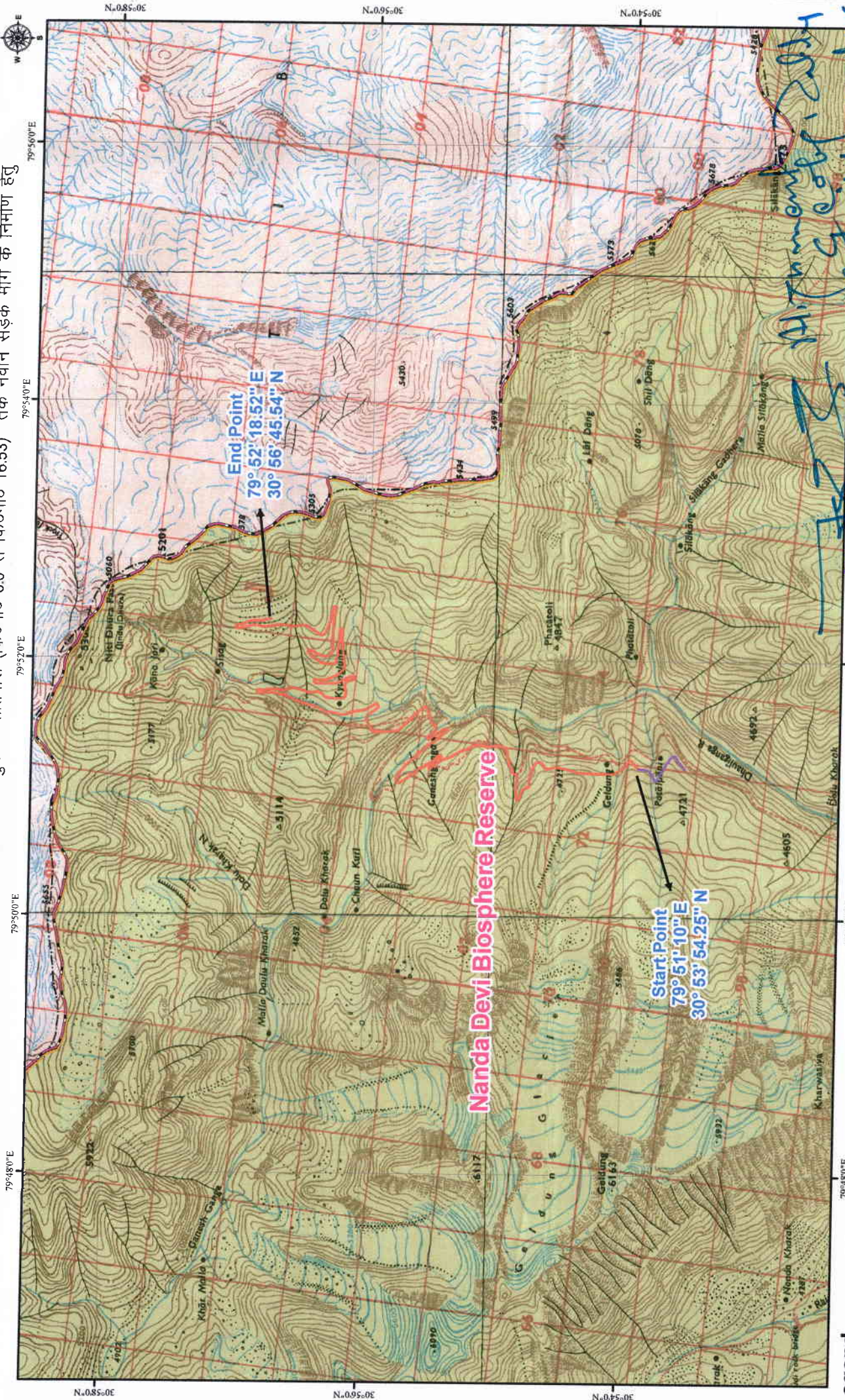


Alignment Geology Dully  
feasible under  
in formed  
condition

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 Govt. of India

जियोरफेरिक्स मैप:-उत्तराखण्ड राज्य के जनपद चमोली में गैलुंग - नीतिपास (कि०मी० 0.0 से कि०मी० 16.53) तक नवीन सड़क मार्ग के निर्माण हेतु

Annexure-2



**Start Point**  
79° 53' 10" E  
30° 53' 54.25" N

**End Point**  
79° 52' 18.52" E  
30° 56' 45.54" N

**Nanda Devi Biosphere Reserve**

**Legend**

- Existing Road
- Proposed Road
- Reserve Forest Area
- Reserve Forest Boundary
- Forest Division Boundary

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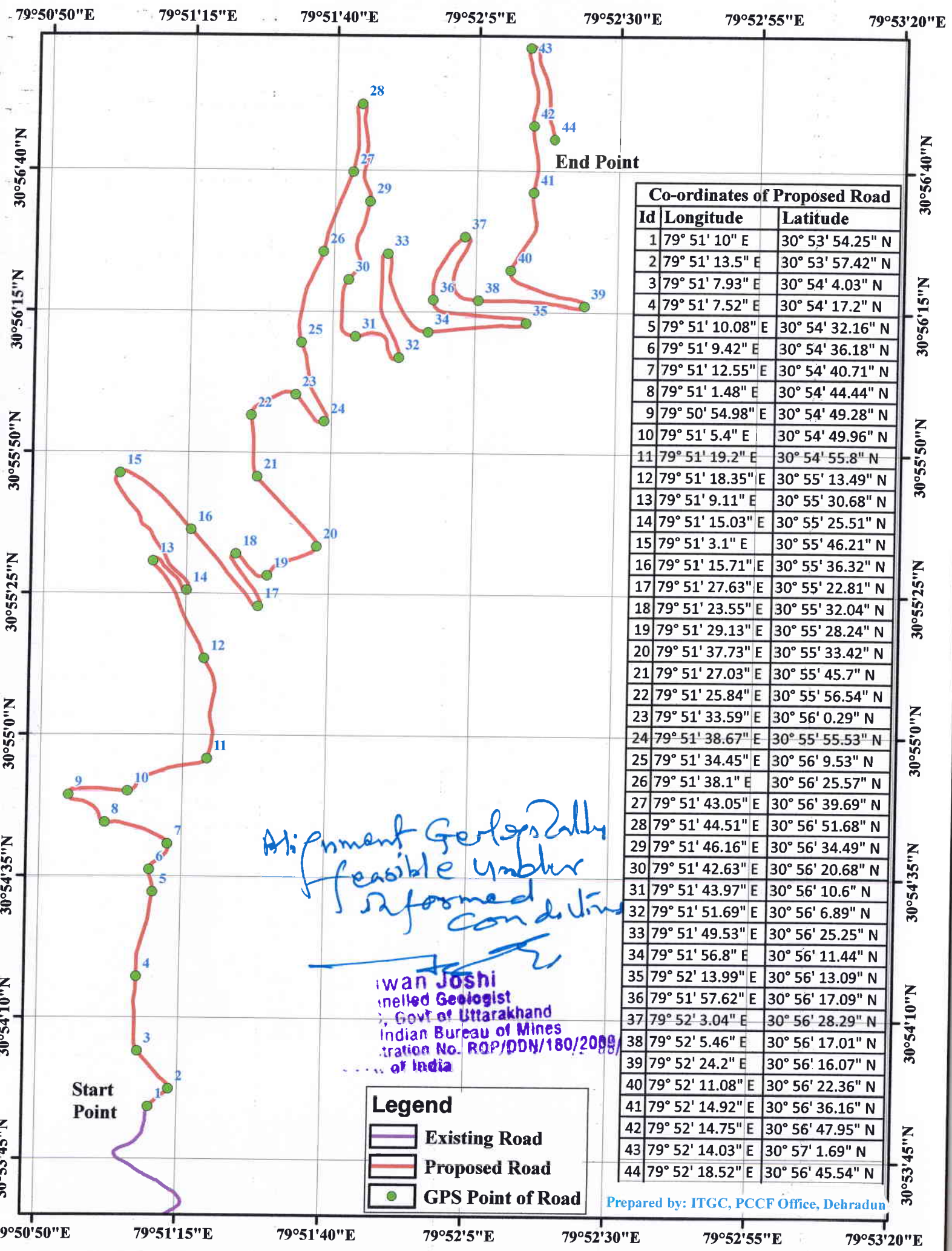
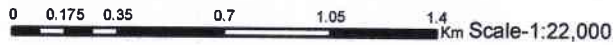
With reference to the  
feasibility under  
informed  
conditions

Scale: 1:50,000

Prepared by: JTGC, PCCF Office, Dehradun

जियोरेफेरेंस मैप :-उत्तराखंड राज्य के जनपद चमोली में गेल्दुंग – नीतेपास (कि०मी० 0.0 से कि०मी० 16.53) तक नवीन सड़क मार्ग के निर्माण हेतु

Annexure-2



Co-ordinates of Proposed Road		
Id	Longitude	Latitude
1	79° 51' 10" E	30° 53' 54.25" N
2	79° 51' 13.5" E	30° 53' 57.42" N
3	79° 51' 7.93" E	30° 54' 4.03" N
4	79° 51' 7.52" E	30° 54' 17.2" N
5	79° 51' 10.08" E	30° 54' 32.16" N
6	79° 51' 9.42" E	30° 54' 36.18" N
7	79° 51' 12.55" E	30° 54' 40.71" N
8	79° 51' 1.48" E	30° 54' 44.44" N
9	79° 50' 54.98" E	30° 54' 49.28" N
10	79° 51' 5.4" E	30° 54' 49.96" N
11	79° 51' 19.2" E	30° 54' 55.8" N
12	79° 51' 18.35" E	30° 55' 13.49" N
13	79° 51' 9.11" E	30° 55' 30.68" N
14	79° 51' 15.03" E	30° 55' 25.51" N
15	79° 51' 3.1" E	30° 55' 46.21" N
16	79° 51' 15.71" E	30° 55' 36.32" N
17	79° 51' 27.63" E	30° 55' 22.81" N
18	79° 51' 23.55" E	30° 55' 32.04" N
19	79° 51' 29.13" E	30° 55' 28.24" N
20	79° 51' 37.73" E	30° 55' 33.42" N
21	79° 51' 27.03" E	30° 55' 45.7" N
22	79° 51' 25.84" E	30° 55' 56.54" N
23	79° 51' 33.59" E	30° 56' 0.29" N
24	79° 51' 38.67" E	30° 55' 55.53" N
25	79° 51' 34.45" E	30° 56' 9.53" N
26	79° 51' 38.1" E	30° 56' 25.57" N
27	79° 51' 43.05" E	30° 56' 39.69" N
28	79° 51' 44.51" E	30° 56' 51.68" N
29	79° 51' 46.16" E	30° 56' 34.49" N
30	79° 51' 42.63" E	30° 56' 20.68" N
31	79° 51' 43.97" E	30° 56' 10.6" N
32	79° 51' 51.69" E	30° 56' 6.89" N
33	79° 51' 49.53" E	30° 56' 25.25" N
34	79° 51' 56.8" E	30° 56' 11.44" N
35	79° 52' 13.99" E	30° 56' 13.09" N
36	79° 51' 57.62" E	30° 56' 17.09" N
37	79° 52' 3.04" E	30° 56' 28.29" N
38	79° 52' 5.46" E	30° 56' 17.01" N
39	79° 52' 24.2" E	30° 56' 16.07" N
40	79° 52' 11.08" E	30° 56' 22.36" N
41	79° 52' 14.92" E	30° 56' 36.16" N
42	79° 52' 14.75" E	30° 56' 47.95" N
43	79° 52' 14.03" E	30° 57' 1.69" N
44	79° 52' 18.52" E	30° 56' 45.54" N

Alignment Geologically  
feasible under  
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Ministry of India

Legend	
	Existing Road
	Proposed Road
	GPS Point of Road

Prepared by: ITGC, PCCF Office, Dehradun