Initial Environmental Examination (Part 1)

Project Number: 51228-001
April 2018

India: Railways Track Electrification Project
Ranchi Jn-Lohardaga-Tori Jn Section

Prepared by the Central Organization for Railway Electrification for the Asian Development Bank

ABBREVIATIONS

ADB	–	Asian Development Bank
AEE	–	Assistant Executive Engineer
ASI	–	Archaeological Survey of India
CAP	–	Corrective Action Plan
CPD	–	Chief Project Director
CFE	–	Consent for Establishment
CPD	–	Consent for Operation
CORE	–	Central Organization for Railway Electrification
CPCB	–	Central Pollution Control Board
EIA	–	environmental impact assessment
EMP	–	environmental management plan
EARF	–	environmental assessment and review framework
FSI	–	Forest Survey of India
GSI	–	Geological Survey of India
IEE	–	initial environmental examination
JUSNL	–	Jharkhand Urja Sanchar Nigam Ltd.
LHS	–	Left Hand Side
LED	–	Light Emitting Diode
MCC	–	model career center
MOEFCC	–	Ministry of Environment, Forests and Climate Change
MSL	–	Above Mean Sea Level
NOC	–	No Objection Certificate
NDMA	–	National Disaster Management Authority
RHS	–	Right Hand Side
ROW	–	Right of Way
SSE	–	Senior Section Engineer
SDMA	–	State Disaster Management Authority
SDO	–	Sub Divisional Officer
SP	–	Sectioning and Paralleling Post
SSP	–	Sub- Sectioning and Paralleling Posts
TSS	–	Traction Sub Station
SPS	–	Safeguard Policy Statement
SER	–	South Eastern Railways

CURRENCY EQUIVALENTS

(As of 20 Nov 2017)

Currency unit	–	Indian rupee (₹)
Re1.00	=	$0.01538
$1.00	=	₹65.000

WEIGHTS AND MEASURES

µg	–	microgram
dB(A)	–	weighted decibel
km	–	kilometer
km^2	–	square kilometer
m	–	meter
m^2	–	square meter

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EXECUTIVE SUMMARY

INTRODUCTION

At the request of the Government of India and the Ministry of Railways, the Asian Development Bank (ADB) will provide up to $750 million non-sovereign project finance loan to the Indian Railway Finance Corporation (IRFC), a 100% wholly owned subsidiary of Ministry of Railways for financing of 3,378 route kilometers electrification of existing rail tracks spread all over the country. The project will be executed by CORE through appointment of contractors through national tendering process. Detailed cost estimates and bid document have been prepared by CORE and process of tendering is followed for the identified corridor as per time frame prepared by the CORE for the electrification of each identified rail track.

This Initial Environmental Examination (IEE) has been prepared for the Ranchi Junction-Lohardaga-Tori Junction Section in accordance Asian Development Bank's Safeguard Policy Statement (SPS, 2009). An environmental compliance audit was also undertaken as part of the IEE for ongoing construction projects to identify past or present concerns related to environment and social impacts as well as to determine whether actions were and are in accordance with ADB's safeguard principles and requirements as well regulatory requirements. Any non-compliances or outstanding issues identified during the environmental and social compliance audit require corrective action(s) to be undertaken by the CORE to address the non-compliances or outstanding issues

PROJECT DESCRIPTION

The railway track from Ranchi Jn.- Lohardaga- Tori Jn. is about 111 km in length. It starts at Ranchi Junction Railway Station and ends at Tori Junction Railway station on Daltonganj- Muri Railway route. The stations en-route are Ranchi Junction, Argora, Piska, Itky, Tangarbansali, Narkopi, Nagjua, Akasi, Irgaon, Lohardaga, Barkichampi, Boda, and Tori Junction. As part of electrification infrastructure electrical poles, wiring and sagging, three SPs, five SSPs and two TSS will be constructed within the available right of way (RoW) of South Eastern Railways (SER). The tower wagon shed at and OHE / PSI Depot will be located near the Lohardaga junction for ease of maintenance during operation phase.

Two electricity supply transmission lines are planned for the subproject.: (a) electric 3.8 km supply transmission line which will start from 132 kV transmission line of JUSNL near Miral village (at outer skirts of Ranchi city) that will connect to Piska TSS; and (b) 5 km transmission line which will start from 132 kV substation of JUSNL at Lohardaga that will connect TSS near Lohardaga Railway station. The subproject electrification work is in progress in Ranchi Junction- Lohardaga section and schedule completion of work in entire route length is June 2019.

STATUTORY REQUIREMENTS

Under the EIA Notification, 2006 promulgated under Environment (Protection) Act, 1986, the project does not require prior environmental clearance. Tree Cutting permit will also have to be acquired by JUSNL prior to clearing the transmission line alignment. Other applicable regulatory (e.g. Water Act (1974) and Air Act (1981)) requirements will also have to be complied by CORE. The railway track passes through Kundguda Reserve Forest (about 16 km length) and Tudu protected Forest (about 2 km length) in Barkichampi to Tori Junction (CH500+000 to 529+000); this portion of the railway track was only completed in 2017 (although construction works started work in 2005) and all forest clearances have been obtained by the SER at the time of construction of this section.

ENVIRONMENTAL ASSESSMENT

The subproject Railway track does not cross any major river except few local streams. The entire subproject route and electric supply transmission lines alignments are on plain land in most portions. There are no wetlands; mangroves; or estuaries in or near the railway track or the transmission lines alignment; only the portion from Barkichampi Railway station to Tori Junction passes through Kundguda Reserve Forest (about 16 km length) and Tudu protected Forest (about 2 km length) and proposed alignments of both the electric supply transmission lines do not pass through any protected forest, reserved forest or protected areas (Wildlife sanctuary, bird sanctuary, national park, etc.). The sites proposed for construction of SSP, TSS and SP are in a relatively open area and civil works are of small scale. Construction works are also anticipated to extend for 45 days to complete. Hence, there are minimal ambient air quality and noise level issues anticipated during the construction.

The environmental impacts assessment due to electrification of Ranchi Jn. - Lohardaga- Tori Jn. Railway track indicates that the construction phase impacts include: (a) short-term deterioration of air quality which may take place due to increase in fugitive dust emission from earthmoving activities, unpaved transport, and emissions from equipment and other mobile sources; (b) surface water contamination due to increased siltation and turbidity; (c) elevated noise levels from civil works and mobile sources; (d) soil and water contamination from inappropriate waste disposal, (e) unsafe working conditions for workers due to inadequate training; and (e) habitat clearing along forested areas. Corresponding mitigating measures are presented in the Environmental Management Plan of this IEE which include the following: proper planning of location and timing of construction activities and regular maintenance of equipment; regular water sprinkling on unpaved surfaces of the construction vicinity, use of tarpaulin covers in storage areas to control dust; storage of solid and liquid wastes in predefined storage areas; limitation of construction activities nearby residential areas during evening and nighttime; use of temporary noise barriers near sensitive locations and forested areas; installation of silt fence to contain erosion; avoidance of locating construction camp near any surface water body and forest area; use of proper protective equipment (e.g. ear plugs, helmet) for workers, provision of adequate signage at construction sites, and provision for safety trainings. Approximately 30 trees will be cleared along the two transmission lines right of way, which need be compensated based on a 1:10 ratio. Necessary consultations with officials of State Forest Department have to be undertaken during finalization of mitigation measures in forest area portions of railway track

The environmental audit finds that the ongoing construction is not aligned with ADB SPS requirements in terms of Occupational, Health and Safety Guidelines - workers were not using personal protective equipment such as safety helmets, shoes, hand gloves. In addition, sanitation facilities and drinking water and resting areas at construction camps do not meet occupational health and safety standards. It was also noted that there were a lot of improvement required for the construction safety such as provision of safety signages on site and caution tape around excavation sites and designating chemical storage facilities on site. Corrective action plan (CAP) presented in the IEE to address these non-compliances include: rovision of protective equipment to workers, adequate safety trainings are provided to workers; provusion of signage at construction sites, and maintaining all safety measures on site. All construction camp shall also be provided with all basic infrastructures in terms of sanitary facilities, solid waste and sewage disposal, storm water management and health-care facilities etc. CORE will have to ensure that all ongoing contractors and subcontractors will be implement the CAP.

The operation phase will have positive impacts such as reduction in air emissions and green house gas emissions from reduced diesel fuel usage of the locomotives. Diesel locomotives can be a considerable source of engine noise, with significant engine exhaust

noise emitted at a height of approximately four metres above the rail; shift to electric locomotives generally produce less mechanical noise and require no exhaust. However, increased in train speed due to electrification may contribute to relatively short periods of high noise frequencies, that can trigger annoyance to nearby sensitive receptors. Acoustic barriers by creation of multilayer plantation and speed limitations shall then be implemented along railway track which passes along sensitive receptors. Railway workers are always at risk of accidents due to moving trains and exposure to occupational risks (e.g. elevated noise, electrical hazards). Safety manual will be prepared to identify all project related occupational and community health and safety issues, which will periodically be reviewed and implemented on site. Protective equipment and proper training will be provided to all operations and maintenance crew of the subproject. The operational EMP will be taken up by CORE to ensure mitigation measures implementation.

INSTITUTIONAL ARRANGEMENTS

The CORE through CPD office at Ranchi will be responsible for overall planning and implementation of the electrification works for this subproject. It will ensure that IEE and EMP prepared for this subproject, and the approved Environmental Assessment Review Framework (EARF), for Railway Sector Investment Program, are adopted and followed during implementation. Currently, there is no dedicated Environmental and Health and Safety Officers from CPD. Hence, ADB contemplated on providing a Technical Assistance to Indian Railway which will include support from environmental and health and safety consultants hired through the TA. To assist CORE and CPD office to comply with the EMP implementation during the construction and operations phases. The safeguards consultants will also assist India Railway in preparing semi-annual safeguards monitoring reports as required by ADB for category 'B' projects during construction and annual monitoring during operations.

CONCLUSION

The project has been categorized as category “B” under ADB’s Environmental Assessment Guidelines (2003) after evaluating all key environmental components. The stretch though passes through reserved and protected forests, but is not expected to lead to loss of medicinal plants, endangered floral species. Under the EIA Notification, 2006 promulgated under Environment (Protection) Act, 1986, the project is categorized as Category “B2” and does not require prior environmental clearance.

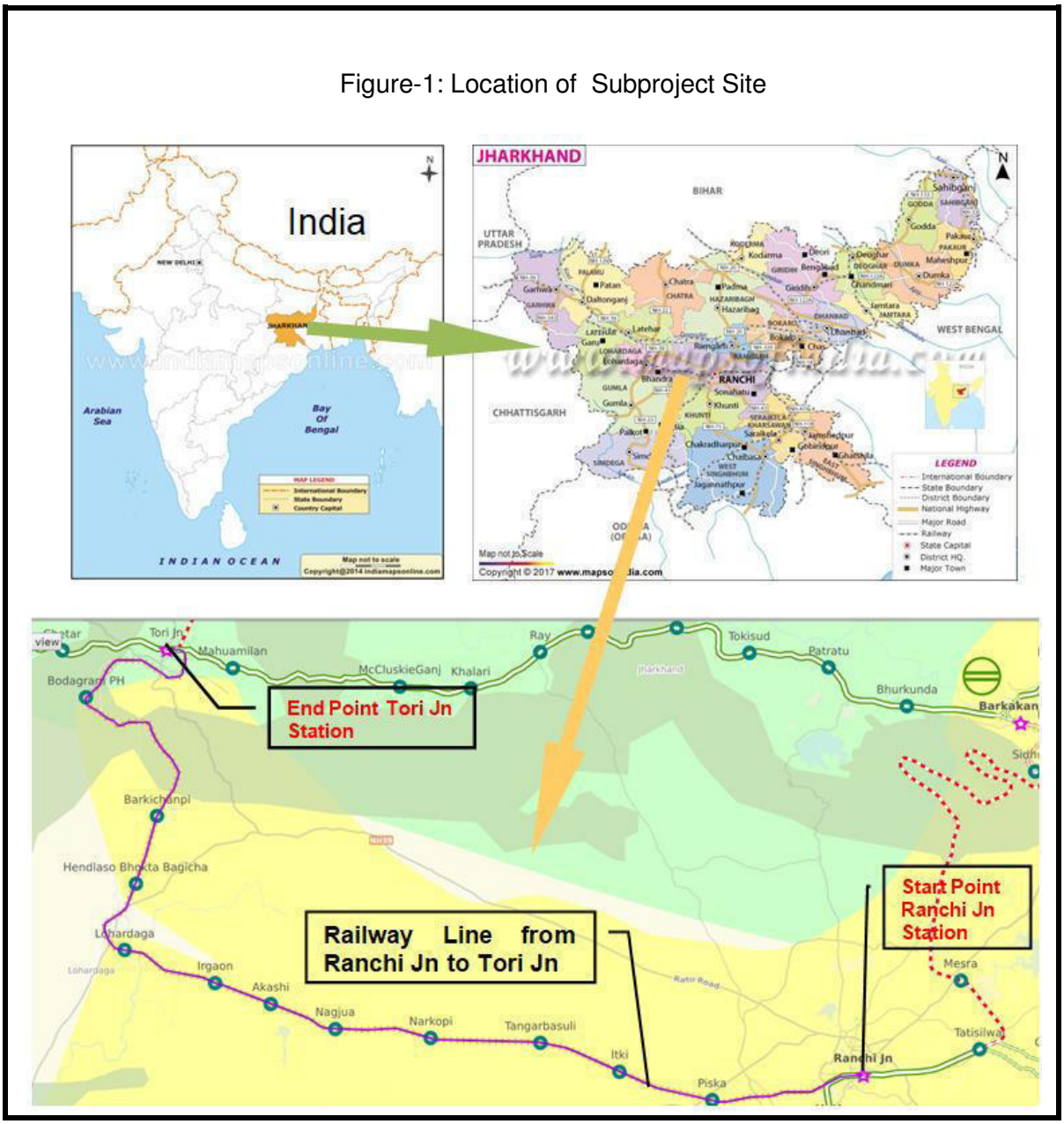
The finding of IEE indicates that the project is unlikely to cause significant adverse environmental impacts. The effective implementation of environmental management plan will facilitate the avoidance and minimization of the environmental impact to acceptable level. All attempts shall be made to minimize cutting of the trees along the transmission line right of way. ADB Technical Assistance will strengthen the institutional capacity of Indian Railway and CORE to implement the safeguards requirements in accordance with ADB SPS.

I. INTRODUCTION

A. Background

1. **Location:** The subproject covered under this IEE pertains to electrification of existing Ranchi Jn-Lohardaga-Tori Jn single line section (about 111 Km in length) under South Eastern Railways of Indian Railways. The Ranchi Jn-Lohardaga-Tori Jn single line section is traversing through Ranchi, Lohardaga and Latehar districts in the state of Jharkhand. The geographical area of the railway line alignment lies between the Latitude 23° 20′ 57″ N to 23° 40′ 52.32″ N, and longitude 85° 20′ 10″ E to 84° 44′ 29.4″ E. The project location, alignment and components are shown **Figure-1**. The elevation of rail track at Ranchi Junction Railway Station is about 633m above mean sea level, 643m at Lohardaga Railway Station and about 515m at Tori Junction Railway Station. In addition to rail track electrification works sub project also includes installation of two electric supply transmission lines (a) Near Miral Village - 132 kV Transmission line to Piska Railway station TSS site (about 3.8 km) and (b) Lohardaga 132 kV substation to Lohardaga TSS site about 5km length.

Figure-1: Location of Subproject Site



Source: Maps of India and Indian Railways.

2. **Present status of Rail Line Alignment.** The rail section from Ranchi Junction to Lohardaga is on plain land and the rail section between Lohardaga station to Tori Junction is partly on rolling terrain and partly on hilly terrain. The right of way (RoW) of this corridor is marked with boundary pillars on either side of rail corridor. There are thirteen numbers of railway stations that fall in the existing rail track from Ranchi Junction to Tori Junction. These stations are Ranchi Junction, Argora, Piska, Itki, Tangarbansali, Narkopi, Nagjua, Akashi, Irgaon, Lohardaga, Barkichampi, Boda, and Tori Junction. Some photos of existing rail corridor are shown **in Figure 2.** The photographs of alignments of electric supply transmission line are shown in **Figure-3.** The electrification work is in progress from Ranchi Jn to Lohardaga section.

Figure-2: Photographs of Sub Project Site

SP Under Construction at CH 419+520 on RHS

Proposed Location of TSS near Piska at CH 432+400 LHS

SSP Under Construction at Tangarbansali CH 448+100 RHS

SP Under Construction at Narkopi CH 458+200 RHS

SP Under Construction at Nagjua CH 467+400 RHS

Proposed Location of SSP at Irgaon CH 478+000 RHS

Proposed Location of Tower Wagon Shed at CH 484+900 RHS (near Lohardaga)

Proposed Location of TSS at CH 484+900 LHS (near Lohardaga)

Proposed Location of SSP at Barkichampi CH 500+255 RHS

Proposed Location of SP at CH 528+540 LHS (near Tori Junction)

Figure-3: Photographs of Electric Supply Transmission Lines Alignment

Crossing Point of Transmission Line at NH 23 (Miral Village to Piska TSS)

Start point of Transmission line (from Miral village to Piska TSS)

View of Transmission Line Alignment from Miral Village to Piska TSS

Location of Bay for Transmission Line from Lohardaga Substation to TSS at Lohardaga

View of Transmission Line Alignment from Lohardaga Substation to Lohardaga TSS

B. Compliance with India's Environmental Regulatory Framework

3. India's environmental rules and regulations, as relevant for this proposed subproject, are shown in **Table-1**. The Environmental Impact Assessment (EIA) notification, 2006 by the Ministry of Environment, Forests and Climate Change (MOEFCC), Government of India specifies the requirements for mandatory environmental clearances. All projects and activities are broadly categorized into two categories—category A and category B, based on the spatial extent of potential impacts on the environment, human health, and natural and human-made resources. However, all railway projects have been exempted from the ambit of EIA Notification 2006; accordingly subproject will not require any prior environmental clearance according to the environmental rules and regulations of India. The electric supply transmission lines have also not been listed in the schedule of activities / Industries requiring prior environmental in the EIA Notification 2006, so no prior environmental clearance is needed for both the transmission lines also. Further, as shown in **Table 1**, some other rules and acts pertaining to the Water (Prevention and Control) Act and Air (Prevention and Control) Act; and Noise Pollution (Regulation and Control) Rules 2000, will also apply to this subproject.

Table-1: Environmental Regulatory Compliance

Subproject	Applicability of Acts and Guidelines	Compliance Criteria
Electrification of Ranchi Jn-Lohardaga –Tori Jn Section	The EIA notification, 2006 (and its subsequent amendments till date) provides for categorization of projects into category A and B, based on extent of impacts.	The subproject components (electrification) are not covered in the ambit of the EIA notification (amended till date), either as a category A or Category B project. As a result, the categorization, and the subsequent environmental assessment and clearance requirements, either from the state or the Government of India, are not triggered. – **Not Applicable**
	The Ancient Monuments and Archaeological Sites and Remains Act, 1958, and the rules, 1959 provide guidance for carrying out activities including conservation, construction and reuse in and around the protected monuments.	The Rail section from Ranchi Jn to Tori Jn is not close to any monument which is protected by the ASI. Hence, no clearance is needed from ASI. – **Not Applicable**
	Water (Prevention and control of pollution) Act, 1974 and Air (prevention and control of pollution) Act, 1981	CFE and CFO from the State Pollution Control Board will be required during construction for installation of diesel generator set (>15 kW), hot mix plant, and concrete batching plant, if required for the project. Since construction is in process, Diesel Generator set of capacity more than 15 kW have not been installed so far. In case these are installed at construction site in future, corresponding regulatory requirement will apply. For the operation phase, no CFO or CFE will be required as electric supply will be from Grid. – **Applicable only if DG Set > 15 kW capacity installed**
	The Wildlife Conservation Act, 1972, amended in 2003 and 2006, provides for protection and management of Protected Areas.	No wildlife protected areas nearby (within aerial distance of 10 km). – **Not Applicable**

Subproject	Applicability of Acts and Guidelines	Compliance Criteria
	Forest (Conservation) Act, 1980	This act provides guidelines for conservation of forests and diversion of forest land for non-forest use. It describes the penalties for contravention of the provisions of the Act. If forest land has to be acquired for the project, clearance is required from the Forest Department. No forest land diversion is required for the electrification works. The forest land for Barkichampi- Tori section has already been obtained by at the time of rail line construction. This section was only constructed and completed in March 2017. **Not Applicable**
	Noise Pollution (Regulation and Control) Rules, 2000 (Amended 2002)	These Rules will be applicable during the construction phase of project. **Applicable for construction phase**
	Hazardous Waste Management, Handling and Transboundary Movement Rules 2008 (Amended 2009)	The subproject activities in construction and operation phases are not likely to generate any hazardous waste, so these Rules will not be applicable **Not Applicable**
	Batteries Management and Handling Rules 2001.	These Rules will be applicable during construction and operation phases of the subproject for disposal of discarded batteries **Applicable**

ASI = Archaeological Survey of India, CFE = consent for establishment, CFO = consent for operation, EIA = environmental impact assessment, RoW= Right of Way.
Source: Asian Development Bank.

C. Asian Development Bank's Environmental Safeguard Policy Principles

4. Since the proposed Rail Track Electrification project is being funded by the ADB, it has to comply with its Safeguard Policy Statement (SPS) 2009, in addition to India's own environmental laws and regulations. The environmental safeguard policy principles embodied in the SPS aim to avoid adverse impacts on the environment and on affected people and/or communities; minimize, mitigate and/or compensate for adverse project impacts, if unavoidable; help borrowers to strengthen their safeguard systems, and to develop their capacity in managing the environmental and social risks. The SPS categorizes all projects into three environmental categories (A, B or C) based on their potential impacts.[1] [1] The categorization form has been completed to confirm category of subproject (**Appendix-1**). Similarly, ADB's Rapid Environmental Assessment checklist method was followed to assess the potential impact of the proposed subproject (**Appendix 2**). As will be explained above, the subproject has been categorized as 'B' category project. Accordingly, this IEE has been

[1] As per the SPS, projects are assigned to one of the following four categories: (i) **Category A.** A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required. (ii) **Category B.** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required. (iii) **Category C.** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed (iv) **Category FI.** A proposed project is classified as category FI if it involves investment of ADB funds to or through a financial institution.

prepared to address the potential impacts in line with the requirements for category 'B' projects. This IEE also covers environmental audit of ongoing construction works to ascertain compliance with ADB SPS 2009. The IEE baseline data are generally from secondary sources of information and field reconnaissance surveys. Stakeholder consultation was an integral part of the IEE. An environmental management plan (EMP) outlining the specific environmental measures to be adhered to during implementation of the subproject is included in the IEE. An environmental audit was undertaken for the ongoing construction activities to assess compliance with national regulations and ADB SPS, while a corrective action plan was prepared to address the gap findings; these which have to be taken up by the contractor or implementing agency. The climate risk screening has also been carried out and it has been found that climate related risk is 'low' for the subproject (**Appendix-3**). The current Rail Track Electrification Project follows the Environmental Assessment and Review Framework (EARF) prepared for Rail Sector Investment Program in India. [2] This EARF has been accepted by the Ministry of Rail, Government of India. The current project is also being implemented by the Ministry of Rail through Central Organization for Rail Electrification (CORE) so the same EARF has been adopted. This EARF is presented in **Appendix- 4**.

D. Review and Approval Procedure

5. For category B projects, the draft environmental status report is reviewed by the relevant ADB departments and the borrowing agency. Additional comments are incorporated into the final documents as relevant. These are reviewed by the borrowing agency and ADB safeguards team. The borrowing agency then officially submits the IEE report to ADB for consideration by the Board of Directors. The final report is made available worldwide by ADB, via the depository library system and the ADB website.

E. Report Structure

6. This report contains eight sections: (i) introduction; (ii) description of project components; (iii) description of the existing environment around the subproject; (iv) Environmental impact and mitigation measures (including environmental audit and corrective actions for ongoing construction works between Ranchi and Lohardaga); (v) EMP; (vi) processes for public consultation and information disclosure; (vii) findings and recommendations; and (viii) conclusions.

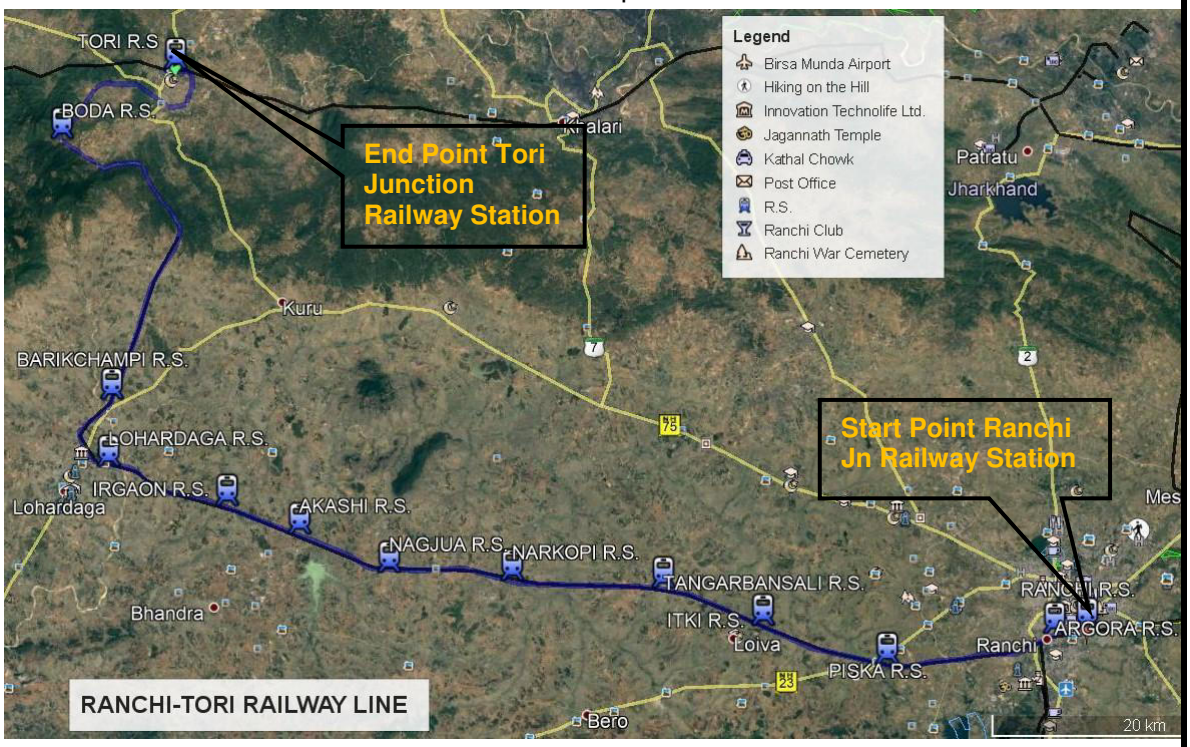
[2] ADB's Board of Directors approved a multitranche financing facility (MFF) for $500 million equivalent from its ordinary capital resources (OCR) for the Railway Sector Investment program, under sovereign department, on 31 August 2011 (https://www.adb.org/projects/36330-013/main).

II. DESCRIPTION OF THE PROJECT COMPONENTS

A. Components of the Subproject

7. The location of subproject site and surroundings are shown in **Figures 1.** The locations of Rail section on Google map are shown in **Figure-4.** The linear diagram showing chainages of various stations is given in **Figure-5** and in **Table-2.** Some subproject site photographs have been shown in **Figure 2** in previous section**.** The subproject comprises of electrification works along the existing rail section from Ranchi Junction Station to Tori Junction Station and installation of two transmission lines. The length of subproject is about 111 km. The detailed description of civil construction and electrification works has been provided in the subsequent sections.

Figure-4: Location of Existing Ranchi Jn-Lohardaga Tori Jn Rail line Site on Google Map



Source: Google map.

Figure-5: Linear Diagram with Chainages of Various Stations

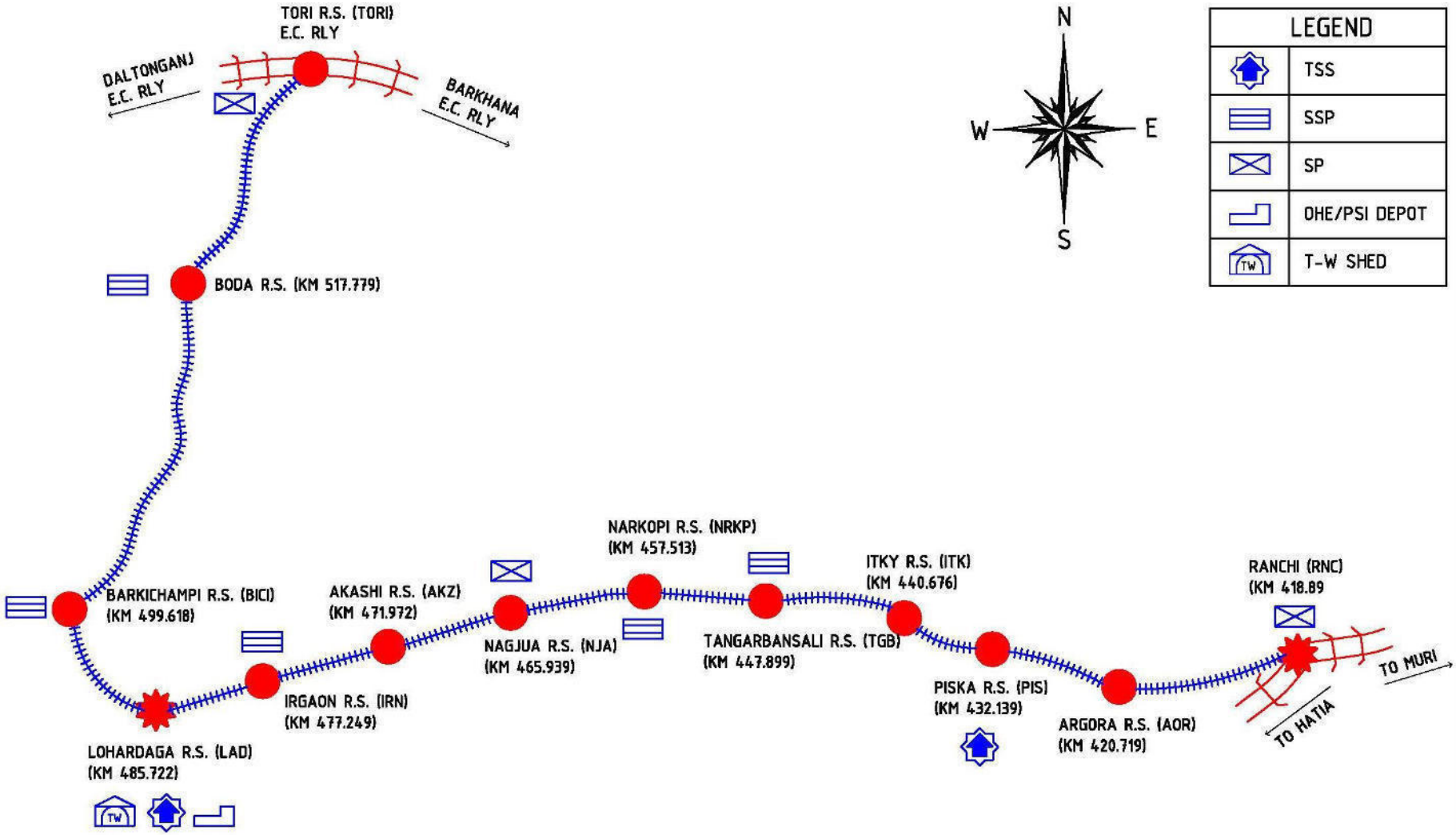


Table-2: Distance of stations from Ranchi Junction to Tori Junction Station

Sl. No.	Name of Station	Chainage	Elevation	Railway Zone
1	Ranchi Junction	0	633m	SER
2	Argora	2.1	641m	SER
3	Piska	13.5	708m	SER
4	Itki	21.9	713m	SER
5	Tangarbansali	29.3	712m	SER
6	Narkopi	38.8	696m	SER
7	Nagjua	47.2	690m	SER
8	Akashi	53.3	682m	SER
9	Irgaon	58.5	676m	SER
10	Lohardaga	67	643m	SER
11	Barkichampi	80.9	683m	SER
12	Boda	99.06	684 m	SER
13	Tori Junction	110.9	515m	ECR

Source: www.indiarailinfo.com.

B. Need for the Project

8. The subproject Ranchi- Lohardaga-Tori Section is an important rail link connecting three districts of Jharkhand namely Ranchi, Lohardaga and Latehar. This single line section connects Ranchi to Tori via Lohardaga. This route reduces travel distance between Ranchi and Delhi by about 100 km and travel time by about 3 hours. The entire subproject route is broad gauge. The other reasons necessitating electrification of this section are as follows:

- This route will help movement of Bauxite and coal from Latehar and Lohardaga mining areas. The Central Coal fields of Coal India have coal storages at Tori junction for loading into the rail racks
- The electrification will have faster economic development especially between Lohardaga and Tori a remote and under developed region of Jharkhand.
- Speed/Haulage of electric traction is higher as compared to the diesel traction; hence there is generation of additional section capacity to run more traffic thereby ensuring easy access to health and education facilities to the population living closer to the rail section.
- With 25kV Electrification, reliable supply from electrification works shall help improvement in signaling.
- Reduction in direct greenhouse gas emissions and reduced air from reduce use of diesel fuel
- Electric locomotives will have better control on speed, which can reduce noise level impacts on reserve forest between Barkichampi and Tori stations and nearby sensitive receptors near the railway tracks.

C. Detailed Description of Project Components

9. The subproject involves electrification of 111km length of the railway track between Ranchi Junction and Tori Junction. The subproject components include (i) erection of poles along the railway track to support overhead line suspended from poles; (ii) erection of overhead lines; (iii) erection of 3 numbers of Sectioning and Paralleling Posts (SPs); (iv) erection of 5 numbers of Sub Sectioning and Paralleling Posts (SSPs); (v) erection of 2

numbers of Traction Substation (TSS); (vi) erection of 2 bays each at Lohardaga Substation exclusively for this subproject; (vii) erection of 132kV transmission line from the High Tension (HT) Line Tower near Miral Village to Traction substation near Piska Junction; and (viii) erection of 132kV transmission line from Lohardaga substation to Traction substation near Lohardaga Junction. The summary of subproject components is given in **Table 3**.

Table-3: Summary of Proposed Subproject Components

Sl. No	Subproject Components	Location	Component Description
1	Erection of poles	All along the 111km track and adjacent to the track at a distance of 2.9m from the centre of the track	About 2464 poles will be erected.
2	Erection of overhead lines	All along the 111km track	Overhead lines will be erected suspended from poles erected along the entire length.
3	Erection of Sectioning and Paralleling (SP) Post	Three numbers, one at km 419/520 near Ranchi Junction, second at km 467/400 near Nagjua Junction and the third at km 528/540 near Tori Junction	The SP will be erected in an area of 5.67m x 20.8m (perpendicular x parallel) and is erected at about 3.5-4.5m away from the edge of the track
4	Erection of Sub Sectioning and Paralleling (SSP) Post	Five numbers, one at km 448/100 near Tangaribansali Junction, second at km 458/200 near Narkopi Station, third at km 478/000 near Irgaon Station, fourth at km 500/255 near Barkichampi Station and fifth at km 517/779 near Boda Station.	The SSPs will be erected in an area of 5.62m x 17.8m (perpendicular x parallel) and is erected at about 3.5-4.5m away from the edge of the track.
5	Erection of Traction Substation (TSS)	Two TSS, one at km 432/400 near Piska Junction and second at km 484/900 near Lohardaga Junction	The TSS will be erected in an area of 45m x 85m (perpendicular x parallel) and is erected at about 3.5m to 4.5m away from the track.
6	Erection of Bays	Two bays in 132kV Lohardaga Substation	Two additional bays will be erected in Lohardaga substation
7	Transmission line - I	132kV transmission line from HT in Miral Village to TSS near Piska Junction	132kV transmission line will be erected for a length of 3.8km
8	Transmission line - II	132kV transmission line from Lohardaga Substation to TSS near Lohardaga Junction	132kV transmission line will be erected for a length of 5km

Source: Asian Development Bank.

10. Except the two 132kV transmission line which pass through private land requiring the erection of electricity towers (pylon) in private land, all other components are sited on railway (government) land free from encumbrance and does not involve any private land acquisition. The description of each of the subproject components along with the details of their location is discussed in the following paragraphs.

Erection of poles

11. Poles would be erected all along the 111km length of the railway track on one side of the track with each pole erected at an interval of 49.5m and sometimes in the range of 27-49.5m depending on the need for additional poles at curves and level crossings. The poles

will be erected at a distance of about 2.90m from the centre of the track and within the existing right-of-way, which ranges between 6-12m. Hence, all poles would be erected within the railway right-of-way that is free from any encumbrance. In all about 2,464 poles is expected to be erected to support overhead line suspended from poles. Transect walks was undertaken along the route accompanied by Senior Section Engineer (SSE) of Ranchi and Site Engineer of the Contractor to confirm that the right-of-way is free from encumbrance for erecting the poles. The poles would be transported through flat wagons along the track.

Erection of Overhead Lines

12. Once the erection of poles is completed, the overhead lines will be erected suspended from poles by using wagons, designed for this purpose, which will move on the track transporting the poles and cables. At stations, where there are multiple tracks, the overhead lines are erected across the portal which is about minimum 3.3m wide. The overhead line is erected within the track and does not involve any impact to private assets.

Erection of Sectioning and Paralleling Post

13. Three Sectioning and Paralleling (SP) Post is proposed in this subproject, one at km 419/520 near Ranchi Junction, second one at km 467/400 near Nagjua Junction and the third at km 528/540 near Tori Junction. The SP requires an area of 5.67m x 20.8m and is erected at about 3.5-4.5m away from the edge of the track. The siting will be about 3.5-4.5m away from the edge of the track and the post area required is 5.67m perpendicular to the track and 20.8m parallel to the track. The location of SP is identified by the SSEs through a walkthrough survey in the particular location after ascertaining the availability of adequate right-of-way, suitability of land with no water logging and accessible from a nearby approach road. All the three SPs are proposed on railway right of way. Of the 3-SPs, the foundation work has just begun for the SP near Ranchi Junction, the SP near Nagjua Junction is nearing completion and work is yet to commence for the 3rd SP near Tori. In both Ranchi and Nagjua, the SPs are being built within the railway right-of-way and on enquiry and verification it was ascertained that the land had been free from encumbrance prior to commencement of civil works.

14. The SP posts are situated approximately midway between feeding posts marking the demarcating point of two zones fed from different phases from adjacent sub-stations. At these posts, a neutral section is provided to make it impossible for the pantograph of an electric locomotive or EMU train to bridge the different phases of 25 kV supplies, while passing from the zone fed from one sub-station to the next one. Since the neutral section remains 'dead', warning boards are provided in advance to warn and remind the Driver of an approaching electric locomotive/EMU to open locomotive circuit breaker (DJ) before approaching the 'neutral section', to coast through it and then switch 'on' on the other side. Special care is taken in fixing the location of neutral sections, on level tangent tracks far away from signals, level crossing gates etc. to ensure that the train coasts through the neutral section at a sufficiently high speed, to obviate the possibility of its stopping and getting stuck within the neutral section[3].

Erection of Sub Sectioning and Paralleling Post

15. Five Sub Sectioning and Paralleling Post (SSP) is proposed in this subproject, one at km 448/100 near Tangaribansali Junction, second at km 458/200 near Narkopi Station, third at km 478/000 near Irgaon Station, fourth at km 500/255 near Barkichampi Station and fifth at km 517/779 near Boda Station. The SSPs requires land measuring 5.62m x 17.8m and is sited at about 3.5-4.5m away from the edge of the track. The siting will be about 3.5-4.5m away from the edge of the track and the post area required is 5.67m perpendicular to the track and 17.8m parallel to the track. Similar to SPs, the location of SSP is identified by the SSEs through a walkthrough survey in the particular location after ascertaining the availability of adequate

[3] Source: Indian Railways Manual of AC Traction Maintenance and Operation (Vol - I).

right-of-way, suitability of land with no water logging and accessible from a nearby approach road. All the five SSPs are proposed on railway right of way and are free from encumbrance. The construction of SSP near Tangarbansali Junction and near Narkopi Station is in progress and it was ascertained through enquiry and verification that the railway land prior to construction was free from encumbrance.

16. One or more SSPs are provided between each FP and adjacent SP depending upon the distance between them. In a double track section, normally three interrupters are provided at each SSP i.e. two connecting the adjacent sub-sectors of up and down tracks and one for paralleling the up and down tracks[4].

Traction Substation

17. Two Traction Substations (TSS) have been proposed one at km 432/400 near Piska Junction and second at km 484/900 near Lohardaga Junction. The TSS requires land measuring 45m x 85m and is sited about 3.5m to 4.5m away from the track. Similar to SPs, SSPs the location of TSS is identified by the SSEs through a walkthrough survey in the particular location after ascertaining the availability of adequate right-of-way, suitability of land with no water logging and accessible from a nearby approach road. Both the TSS have been proposed on railway land. The site was inspected in the presence of SSEs and the contractor's site engineer, who took measurements and established the availability of railway land.

18. A 25 kV, ac, 50 Hz single phase power supply for electric traction is derived from the grid system of State Electricity Boards through traction sub-stations located along the route of the electrified sections at distances of 35 to 50 km apart. The distance between adjacent sub-stations may be even less depending on intensity of traffic and load of trains. The arrangement is that the supply authorities (JUSNL) supply power at 220/132/110/66 kV Extra High Voltage (EHV) at each traction sub-station which is owned, installed, operated and maintained by the Railway[5].

Bay at Substation and Transmission Line Alignments

19. It has been proposed to add 2 additional bays in the 132kV Lohardaga substation to feed the Lohardaga TSS and the land for the 2-bays is available within the campus of the substation free from any encumbrance and belongs to Jharkhand Urja Sancharan Nigam Limited (JUSNL). The transmission line to feed the Piska TSS is proposed to be drawn from the existing HT tower located in Miral village. Both these components will be executed by JUSNL and the cost will be borne by CORE.

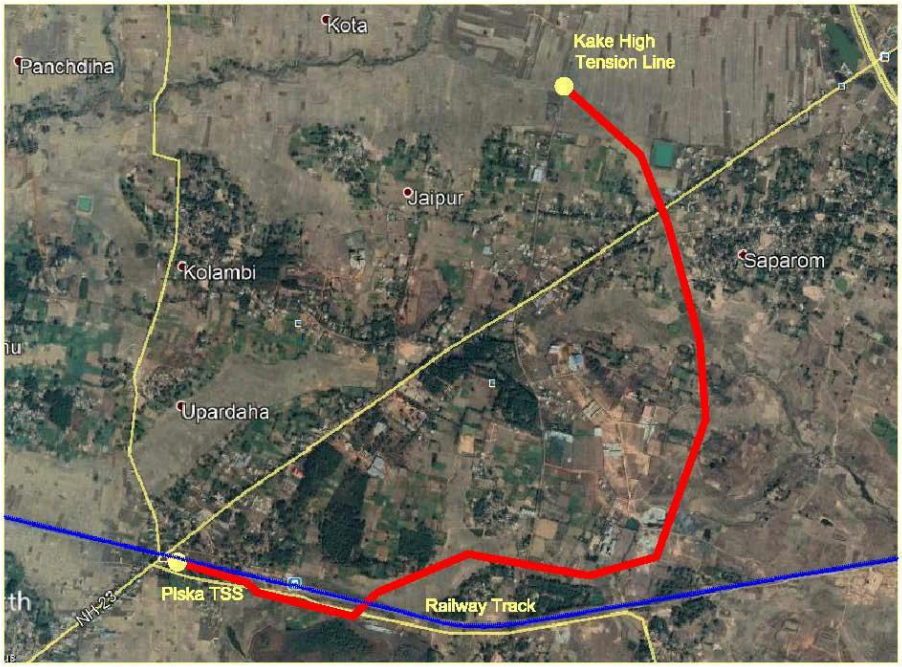
20. A bay of a substation is a part of a substation containing extra-high (or high) voltage switching devices and connections of a power line, a power transformer, etc., to the substation bus bar system(s) as well as protection, control, and measurement devices for the power line, the power transformer, etc.

21. A Google Earth map depicting the proposed transmission line alignment from the HT Tower in Miral village to the Piska TSS is presented below in **Figure-6.**

22. A Google Earth map depicting the proposed transmission line alignment from the Lohardaga substation to the Lohardaga TSS is presented below in **Figure-7.**

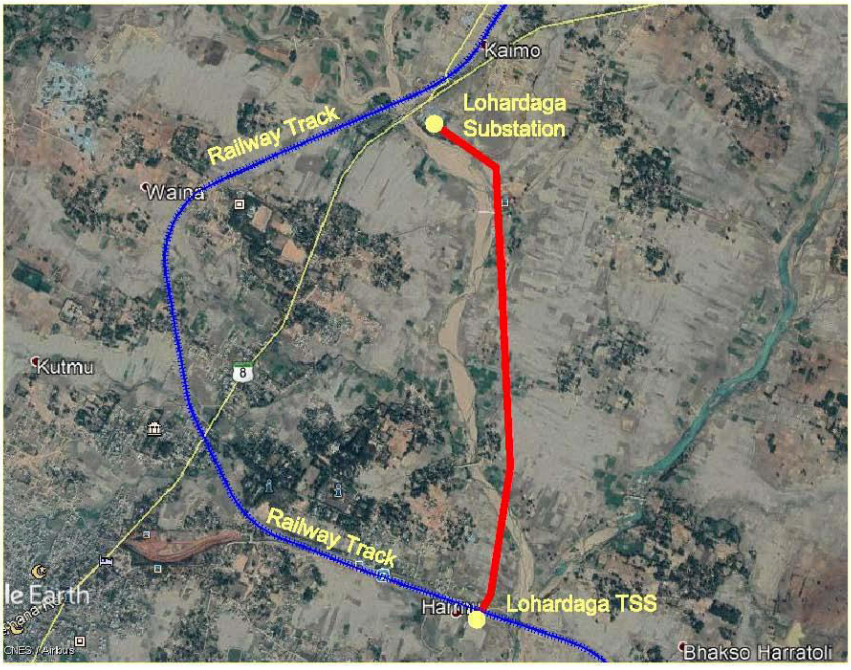
[4] Source: Indian Railways Manual of AC Traction Maintenance and Operation (Vol - I).
[5] Source: Indian Railways Manual of AC Traction Maintenance and Operation (Vol - I).

Figure-6: Google Earth Map Depicting the Proposed Transmission Line Alignment - Miral HT Tower to Piska TSS



Source: CORE CPD Office Ranchi.

Figure-7: Google Earth Map Depicting the Proposed Transmission Line Alignment - Lohardaga SS to Lohardaga TSS



Source: CORE CPD Office Ranchi.

D. Subproject Implementation

23. The subproject is one of the corridors being considered by ADB for funding. The cost of subproject is about INR 1050.2 millions. CORE, which was established by India Railway for railway electrification activities, is responsible for the project implementation through a contractor named M/s CEC-PGIPL and work is in progress in from Ranchi Junction to Lohardaga Section. The ADB will transfer credit to IRFC, a 100% wholly owned subsidiary of Ministry of Railways. There is currently no dedicated Environmental and Health and Safety Officers from CORE or India Railway. Hence, ADB contemplated on providing a Technical Assistance to India Railway which will include support from environmental safeguard experts to assist CORE and CPD offices comply with the subproject EMP implementation during the construction and operations phases. The safeguard consultants will also assist Indian Railway (CORE) in preparing semi-annual safeguards monitoring reports as required by ADB for category 'B' projects during construction and annual monitoring during operations.

E. Ongoing Construction Activities and Construction Material Sources

24. The ongoing construction activities are as follows:
1- Civil construction works at SP Locations at Ranchi (at CH 419+220) and near Nagjua (at CH 467+400);
2- Civil construction works at SSP Locations at CH 448+000 (Near Tangaribansali) and CH 458+200 (near Narkopi); and
3- Electrification works (laying of foundations for electric poles and erection of electric poles) in Ranchi (CH418+890) to Lohardaga section (CH 485+000).

25. The construction materials requirement is not significant as project involves construction of small buildings/rooms at SSP/SP and TSS locations. The construction materials are sourced locally.

F. Manpower

26. There will be employment of around 250 persons (skilled and unskilled combined) during construction phase of electrification works and 100 persons permanent employment in post construction phase.

G. Implementation Schedule

27. The work has been awarded to M/s CEC-PGIPL (JV), Mumbai. The contractor is solely responsible for the completion of all components of the electrification works in the subproject. The implementation period for the electrification works for each subproject is 24 months. The works for electrification commenced on June 9, 2017 and scheduled date of completion is June 2019.

28. Both the transmission lines will be implemented by JUSNL. The JUSNL is in the process finalization of transmission line alignments and in preparation of cost estimates for the same. Once estimates are approved, CORE will make necessary deposit of funds and JUSNL will award work to the selected contractors. These contractors will implement the work on turnkey basis.

F. Diposal and /or Utilization of Existing Diesel Locomotive and Source of New Locomotives

29. The existing diesel locomotives being used on Ranchi- Lohardaga- Tori Junction will be shifted to other rail lines not electrified in South Eastern Railways. The new electric

locomotives will be sourced from the Indian Railways electric locomotives manufacturing factory at Chiranjan in West Bengal. This factory is known as ' Chitranjan Locomotive Works'.

III. DESCRIPTION OF THE EXISTING SUBPROJECT ENVIRONMENT

30. This section presents a brief description of the existing environment around the subproject (rail line corridor and surroundings), including its physical resources, ecological resources, socio-economic development and social and cultural resources. Broad aspects of various environmental parameters such as geography, climate and meteorology, physiographic, geology, seismology, ecology, socio-cultural and economic development parameters that are likely to be affected by the proposed subproject have also been discussed. For completing the baseline description, secondary information was collected from relevant government agencies like the Forest Department, Central Pollution Control Board, Jharkhand State Pollution Control Board, India Meteorological Department, Central Ground Water Board and Census of India 2011.

A. Environmental Profile

1. Ambient Air and Noise Quality

31. In order to assess baseline ambient air quality along the Ranchi Jn - Lohardaga-Tori Jn Section data from secondary sources has been collected and data published by Jharkhand State Pollution Control Board have been referred. Since Ranchi- Tori rail line is in agriculture dominant area, so data of Ranchi and Lohardaga is available for reference. The data for Ranchi is given below in **Table-4**:

Table-4: Ambient Air Quality at Ranchi

Sl. No.	Parameter	Range (ug/m3)	NAAQ Standard (ug/m3)
1	Particulate Matter (PM_{10})	37-52.7	100
2	Particulate Matter ($PM_{2.5}$)	19.1-25.9	60
3	Sulphur Dioxide (SO_2)	9.3-12.2	80
4	Nitrogen Di Oxide (NO_x)	11.5-16.0	80
	Carbon Monoxide (CO)	200-371	2000

Source: Environmental Impact Assessment study Report for the Proposed 10.0 MTPA Integrated Steel Plant, 900 MW Captive Power Plant and Township near Barenda Village, Sonahatu Block, Ranchi District (Published by Jharkhand State Pollution Control Board, Year 2016.

32. The ambient air quality data for Lohardaga has been referred from EIA study of Bio Medical Waste Treatment facility proposed at Industrial Area of Lohardaga District. The ambient air quality data summary is presented below in **Table-5**:

Table-5: Ambient Air Quality at Lohardaga

Sl. No.	Parameter	Range (ug/m3)	NAAQ Standard (ug/m3)
1	Particulate Matter (PM_{10})	51.2- 55.8	100
2	Particulate Matter ($PM_{2.5}$)	20.5-25.2	60
3	Sulphur Dioxide (SO_2)	13.6-16.1	80
4	Nitrogen Di Oxide (NO_x)	17.2-20.3	80
	Carbon Monoxide (CO)	590-675	2000

Source: EIA Study of Bio-Medical Waste Treatment Facility Published by Jharkhand State Pollution Control Board (Year 2016).

33. It is clear from Tables 4 and 5 that ambient air quality is well within the stipulated limits of National Ambient Air quality Standards. Along the railway track from Ranchi to Tori ambient air quality is expected to be better than the values mentioned above as there are no industrial sources or pollution generating sources close to the rail line.

34. It was observed that ambient noise scenario in the surroundings of subproject rail track

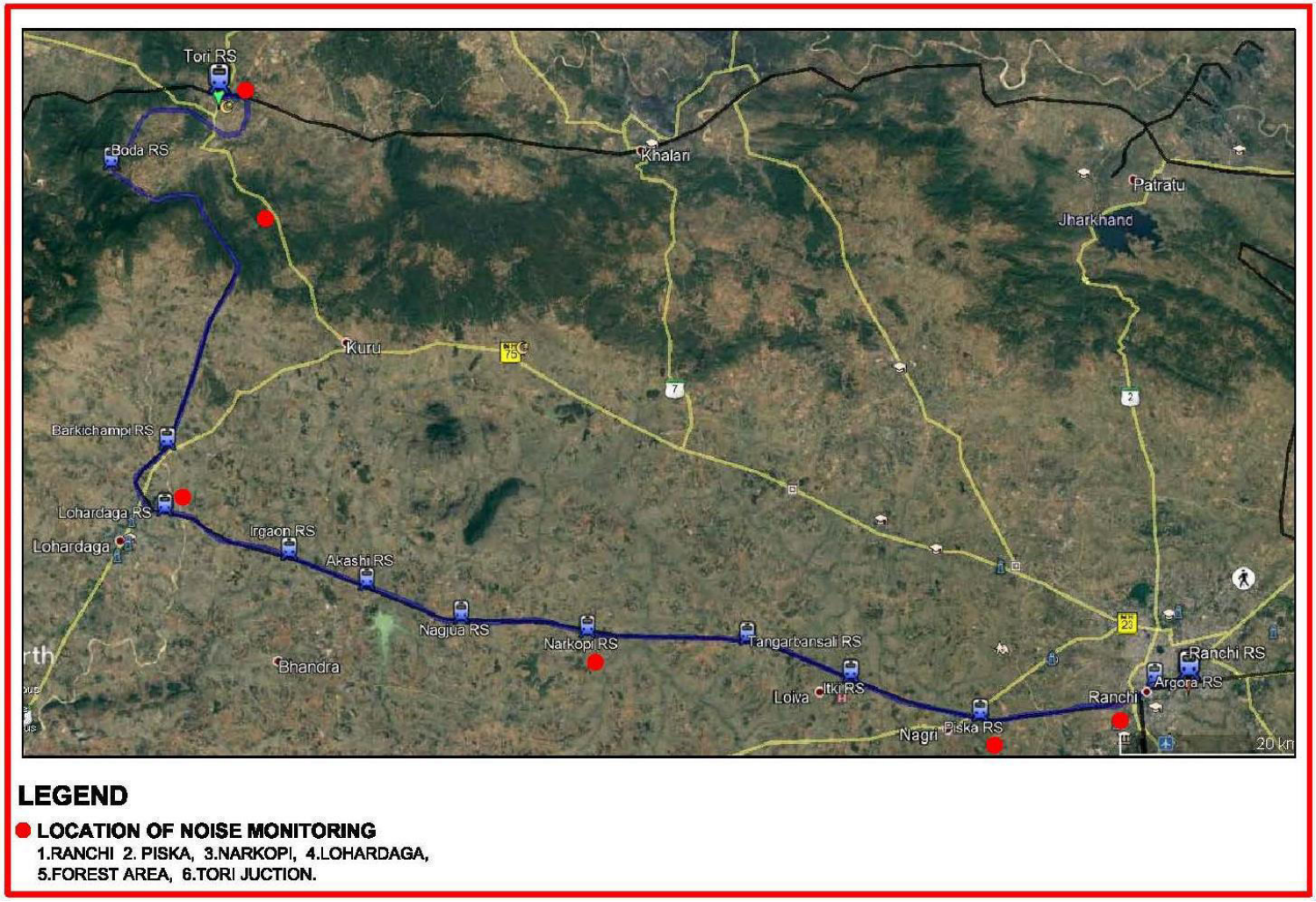
is quite low in open areas, but noise levels at major urban junctions is expected to be higher due to commercial activities. There are no industrial establishments along the rail track corridor as well as along the alignment of both transmission lines. In the surroundings of rail line, traffic density is very low, the noise either from point or nonpoint sources is not expected in the subproject area. The noise measurements were undertaken at habitations along the corridor to cover all types of land uses. The measured noise levels are given below in **Table-6**. These noise monitoring locations have been shown on map in **Figure-8.**

Table-6: Ambient Noise Levels Along Railway Line

Sl. No.	Location Name	Land Use	Measured Noise Levels dB(A)			Distance from Rail Line (m)	Applicable Standards (dB(A))	
			Leq (Day)	Leq (Night)	Lmax**		Leq (Day)	Leq (Night)
1	Ranchi City near SP location at CH 419+520 on LHS	Urban, Commercial and Residential	62.4	54.7	94.9	10.0	65	55
2	Near TSS Location at Piska at CH 432+400 on LHS	Urban, commercial and Residential	60.30	52.10	89.3	12.0	65	45
3	Narkopi village at CH 458+000 on LHS	Rural and Residential	50.30	42.20	88.7	15.0	55	45
4	Lohardaga Town at CH 485+500 on RHS	Urban, Commercial and Residential	62.30	52.30	91.6	25.0	65	55
5	Forest Area at CH 512+000 on LHS	Sensitive Area	46.80	40.40	86.7	10.0	50	40
6	Tori Junction near End Point at CH 528+500 on LHS	Urban, Commercial, and Residential	61.30	52.90	91.3	27.0	65	55

** Lmax measured during passage of train run by diesel locomotive.
Source: Consultant's Field Monitoring.

Figure-8: Noise Monitoring Locations



35. It is clear from the above baseline data that values of measured noise levels are well within the limits specified for the respective land uses of the locations. Recorded noise levels are higher at urban locations because of handling of coal at Tori, Bauxite at Lohardaga and busy area of Ranchi near SP location. The construction activity noise will be of no consequences as SP locations at CH 467+500 and CH 528+540 and SSP locations at CH 448+100, CH 458+200, CH 478+000, CH 500+255 and CH 517+779 as these are proposed to be located in open area with no habitations within 2 km. Hence baseline noise levels at these locations are not of much importance and have not been measured.

36. The Tower wagon Shed (at CH 484+900), OHE PSI Depot (at CH484+900) and TSS locations at Piska (CH 432+400) and Lohardaga (CH 484+900) are also proposed to be located in open areas away from habitations. Only the location of SP (CH 419+520) in Ranchi city is near Rail Over Bridge and also near market areas; the ambient noise level at this location is dominated by vehicular and commercial traffic but are witin the stipulated limits.

2. Climate

37. All three districts through which the subproject rail track passes (Ranchi, Lohardaga and Latehar) experience subtropical climate, which is characterized by hot summer from March to May and well distributed rainfall during southwest monsoon from June to October. Winter season in the area is marked by dry and cold weather during the month of November to February. The monsoon sets in usually in the third week of June and the climate during this period of the year compares very favorably with that of many hill stations. During July and August, the rainfall is the heaviest and there are on an average of 18 wet days in each of these two months. The rainfall in September is over 466 mm.

38. Although Ranchi has a humid subtropical climate, its location and the forests surrounding it combine to produce the unusually pleasant climate for which it's known. Its climate is the primary reason why Ranchi was once the summer capital of the undivided State of Bihar and was designated a preferable "hill station".

3. Topography, Floods and Soils

39. Since the Ranchi- Lohardaga- Tori rail line passes through three districts of Jharkhand namely Ranchi, Lohardaga and Latehar. So description of topography, floods and soil has been structured district wise. The present district of Ranchi comprises two broad natural divisions the lower Chotanagpur plateau and the Ranchi Plateau proper. The lower Ranchi plateau, with an average elevation of 500 to 1000 feet above sea level, comprises, a small area in the north-eastern part of the district extending over Silli, Rahe, Sonahatu and Tamar blocks. The rest of the district, which may broadly be termed as the Ranchi Plateau, has an average elevation of 2140 feet above sea level, though the land is undulating. The highest portion of the plateau is comprised of a ridge lying about 16 kms. south west of Ranchi city. The Subernarekha, emanates from this ridge Hills. Isolated hills are found in the Central Plateau. The most noteworthy of them is the Marang Buru (2434 feet) situated 16 kms south of Ranchi. It is the sacred hill of the Mundas. The Ranchi hill (2423 feet) is also worthy of mention. Major landforms which are situated in the district are as follows:

- **Buried pediments**- These are broad gently sloping erosional surface having detritus. Thickness of overburden is considerably high. Mandar, Itki and Ratu area comes in this segment.
- **Pediplain**- These are developed over granite gneiss. Undulating erosion surface with interrupting dykes, ridges and inselbergs are prominent features. Bero locality is marked by these features.

- **Valley fills**- These are developed over granite gneiss. It consists of boulders, cobbles, pebbles, gravels, sand, silt and clays. These features are developed in Parts of Nagri block.
- **Denudational hills**-These features are developed in northernmost portion of the district covering parts of Burmu block. Moderate to low relief and steep slopes characterizes area.
- **Structural ridges**— These features are developed over quartzite and having moderate relief and steep slope.
- **Laterite capping**— These are developed over metamorphic rocks. Hard laterite cappings are formed on the highland. Its thickness is upto 50-60 meters. They are developed in Ratu and Nagri locality.

40**.** **Floods:** The subproject districts are not liable to flood risk; however, flash floods occurred in 11 districts of the Jharkhand state including some parts of Ranchi district in the year 2002-2004. Railway line of the subproject area (Meter gauge) was not affected in these floods. All structure have been designed for 50 yr return flood period with anticipated risk of rarer flood generally of next higher frequency i.e. 100 yr return period flood on the designed structure.

41**.** **Soils:** The soils of the sub project districts are mostly of the residual type and texturally the soils have been classified into four classes- Stony and gravelly soils, Red and yellow soils, Lateritic soils, Alluvial soils. High temperature and high rainfall have led to the formation of lateritic type of soils from rocks of Archean metamorphic complex exposed in the greater part of the district. According to this classification almost the whole of the eastern part of the Ranchi district is covered by red yellow light grew catenary soil, the western part is covered by upland grey-yellow, grey-heavy soil, and some portions of the north western part which have steep slopes and highly dissected regions and are covered by hills and forest soils.

42. A variant of alfisols soil (older alluvial soil) is a red sandy soil occurring mainly in plateau and hilly regions of Lohardaga District. These soils have poor fertility and needs more water for crop production. The different types of soil encountered in the district are alluvial soil, grey eroded scrap soil, red calcareous soil and laterite and forest soil.

4. Surface Water and Groundwater

43. As per the Central Ground Board report, the ground water assessment of Ranchi District has been carried on block wise basis during 2009. This assessment indicates that Kanke block of district is in over-exploited category while Ratu block is in Semi-critical category. The other blocks in the district are in safe category. The net annual replenishable ground water resources of the Ranchi district are 35072 h-am. The gross ground water draft for all uses is 13954 ha-m and allocation for domestic and Industrial requirement up to year 2034 is 5080 ha-m. The present stage of ground water development in Ranchi district is 40%. At present maximum ground water development is in Kanke block (112.4%) and minimum ground water development is in Angara block (9%).

44. Similarly according to the report, the net ground water availability for Lohardaga district has been assessed to be 9375.93 ha-m and the existing ground water draft for all uses has been assessed as 3717.75 ham. The net ground availability for future irrigation has been assessed as 5421.14 ha-m. The stage of ground water development in Lohardaga district is found to be very low. It ranges from 17.69% in Kisko block to 67 % in Lohardaga block with an average of 39.65%. Minimum ground water development is found in Kisko block located in the northern part of the district.

45. The net ground water availability in Latehar district is 25256.47 ha-m. Gross draft for

all uses is 6685.57 ha-m. Net ground water availability for future irrigation has estimated to be 18206.47 ha-m. Stage of ground water development varies from 16.34% at Mahuadanar to 60.09% in Latehar. All the blocks in the district fall under Safe category.

46. The ground water quality of the Ranchi, Lohardaga and Latehar districts is good and potable and fit for all purposes i.e. for domestic, irrigation and industrial uses. Electrical conductivity: of ground water in the sub project area ranges between 60 to 1400 micro mhos /cm. at 25 ºC., Ground water of the parts of all three districts are slightly alkaline in nature where PH varies between 7.21 to 7.95, Chloride: concentration of chloride varies between 18 to 106 mg/l. Nitrate is present within permissible limit of BIS and concentration varies between 7.4 to 56 mg/l. Sulphate in ground water varies between 2.4 to 19mg/l, concentration of bicarbonate is between 43 to171 mg/l, Calcium is found between 14 to 64mg/l, Magnesium occurs between 6 to 19mg/l, concentration of sodium is between 4 to 55mg/l while potassium occurs between 0.3 to 1.95mg/l and Fluoride value varies between 0.3 to 2.6mg/l.

47. Based on data of 2015-16, the depth to water level in subproject region during pre-monsoon season dug wells were inventoried to know about water level scenario. According to the data of the selected wells of the sub project districts during pre-monsoon season the minimum and maximum water level were observed as 4.55 meter below ground level (mbgl) at Ranchi and 11.8 mbgl at Balumath respectively. The water level during the post-monsoon season ranges from 3.60 to 10.05 mbgl in the wells of the sub project blocks.

48. **Surface Water Quality:** In the subproject region several nallas originate from the slopes of the hills in and around this area and flow down into the valley. These small nallas combine as they flow into the valley/plains and forms perennial streams known locally as Banki Nallah, Shankh River and Auranga River, etc. However, hilltop remains very dry so much so that even during the rainy season, it is difficult to find water on the hill top even a couple of hours after it has stopped raining. Rainwater doesn't infiltrate deep down in area due to the existence of lithomarge and clay below the bauxite. All rain water percolate down to the escarpment slopes and falling to the valleys below. The hilly terrain of the area forms the originating drainage system of several rivers/nallas of the area such as Auranga, Jori, Dhandhari Nalla etc. Based on secondary data analysis, four surface water sources namely Banki Nadi, Chandkopa Nallah, Kisko nadi and Gala Nala in Lohardaga district have been referred for water quality data. All these sources are close to the subproject rail line. . The pH of these sources ranged from 7.26 to 7.59, and the TDS levels were in the range of 160 to 203 mg/l. The chloride concentrations in the above mentioned surface water sources ranges between 29 to 34 mg/l and the hardness was found to be between 77 to 120 mg/l. The review of these results indicate that surface water quality of these water bodies meets CPCB criteria E for all parameters and surface water samples were falling within the limits of Class 'A' norms as per IS: 2296-1992.

49. Similarly surface water quality data of five sources in Ranchi district (Subernarekha upstream, Subernarekha downstream, Kanchi nadi upstream, Kanchi nadi downstream, Raru nadi, Domra nadi)has been referred. The subproject rail line is in the catchment area of these sources in the Ranchi district. The water quality data results indicate that pH is in the range of 7.3-7.8, TDS in the range of 92.0-660.0 mg/l, and Dissolved Oxygen is in the range of 5.3-6.2 mg/l. Further, chlorides and sulphates were found to be in the range of 11.5-121.5 mg/l and 3.2-16.3 mg/l respectively. Bacteriological studies reveal the absence of E. coli forms. The analysis results indicate that there is no evidence of any industrial contamination. It is evident from the above values that all the parameters are well within the CPCB criteria 'C'. It means surface water quality is fit for drinking after conventional treatment.

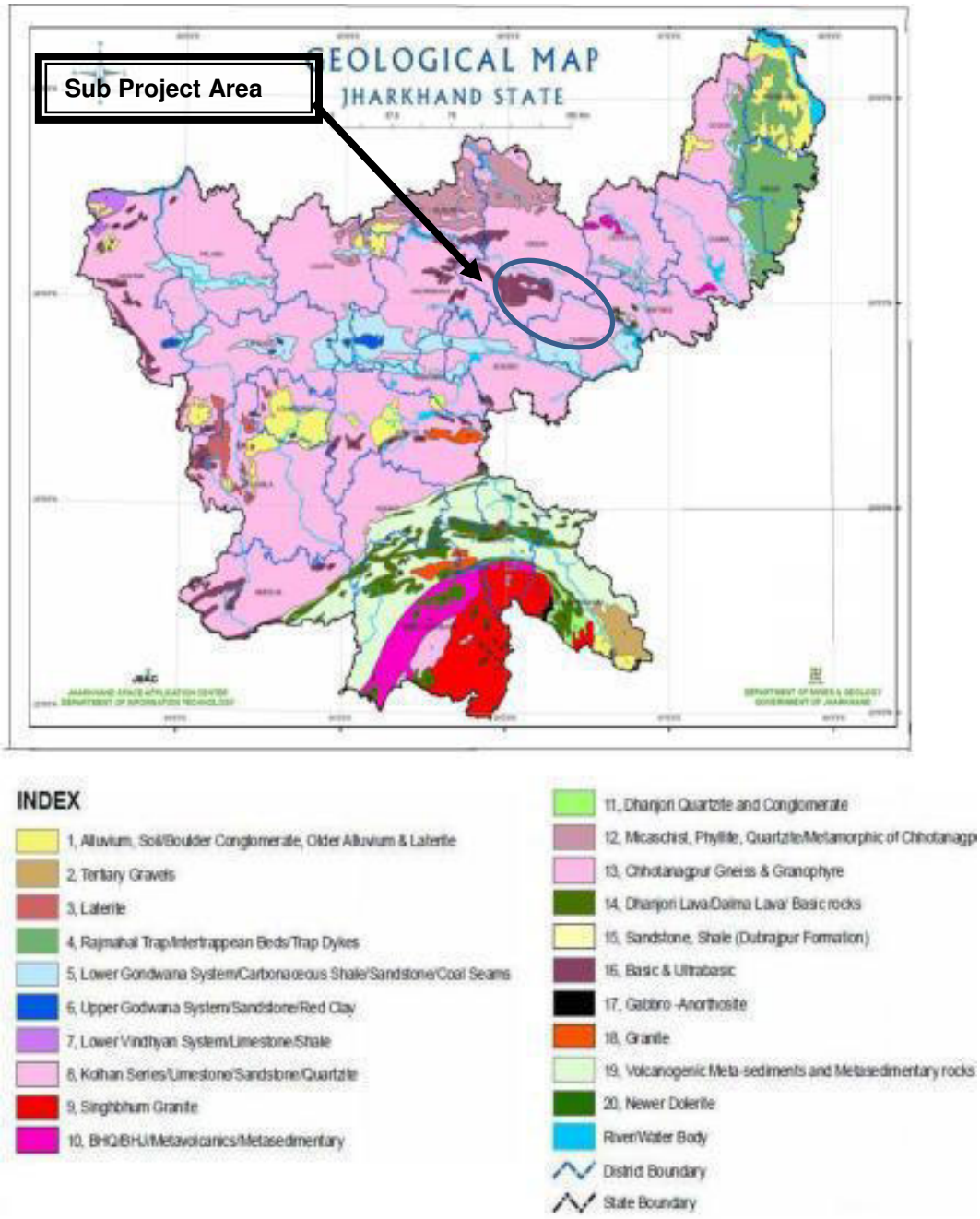
5. Geology and Seismology

50. Geologically the Jharkhand State is known for its diversified set up. The whole of Singhbhum region is considered as a natural geological museum. Geologically, Jharkhand consists of different types of rock formations ranging from Pre-Cambrian to Cenozoic era. The most predominant hard rocks in the state comprise of the Archaean metamorphics with associated intrusives and sedimentaries belonging to Vindhyan and Gondwana Super Group with associated igneous rocks. The Raj Mahal hills, lying in the north-eastern extremity of the Chotanagpur Plateau consists of Jurassic volcanic lava flows. The Archaean metamorphics occur in East and West Singhbhum, Ranchi, Gumla, Lohardaga, Palamu, Giridih, Hazaribagh, Chatra, Ramgarh, Dhanbad, Godda, Deoghar and Dumka districts. They are represented by various types of Schists, Gneisses, Granulities, Quartzites, Meta basics and other basic intrusives and Granites.

51. The Archaean formation of West Singhbhum district possesses the iron bearing Iron Ore Group. The Vindhyans comprising chiefly of Khenjua-shales, Procelanite, Limestone and Sandstones occupy a small area in the north-western part of Garhwa district. The Gondwanas are represented by alteration of agrillaceous and arenaceous sediment & intervened with numerous coal seams. They are located in Palamu, Ranchi, Hazaribagh, Bokaro, Chatra, Dumka, Giridih, Dhanbad and Godda districts. Structurally the state can be divided into “Southern Singhbhum Province” and “Northern Chotanagpur Province” divided by Tamar – Khatra Fault (TKF) popularly known as the “Northern Singhbhum Shear Zone”. The famous “Singhbhum Thrust Zone” is the store house of several important minerals traversing East Singhbhum, West Singhbhum and Saraikela-Kharsawan district.

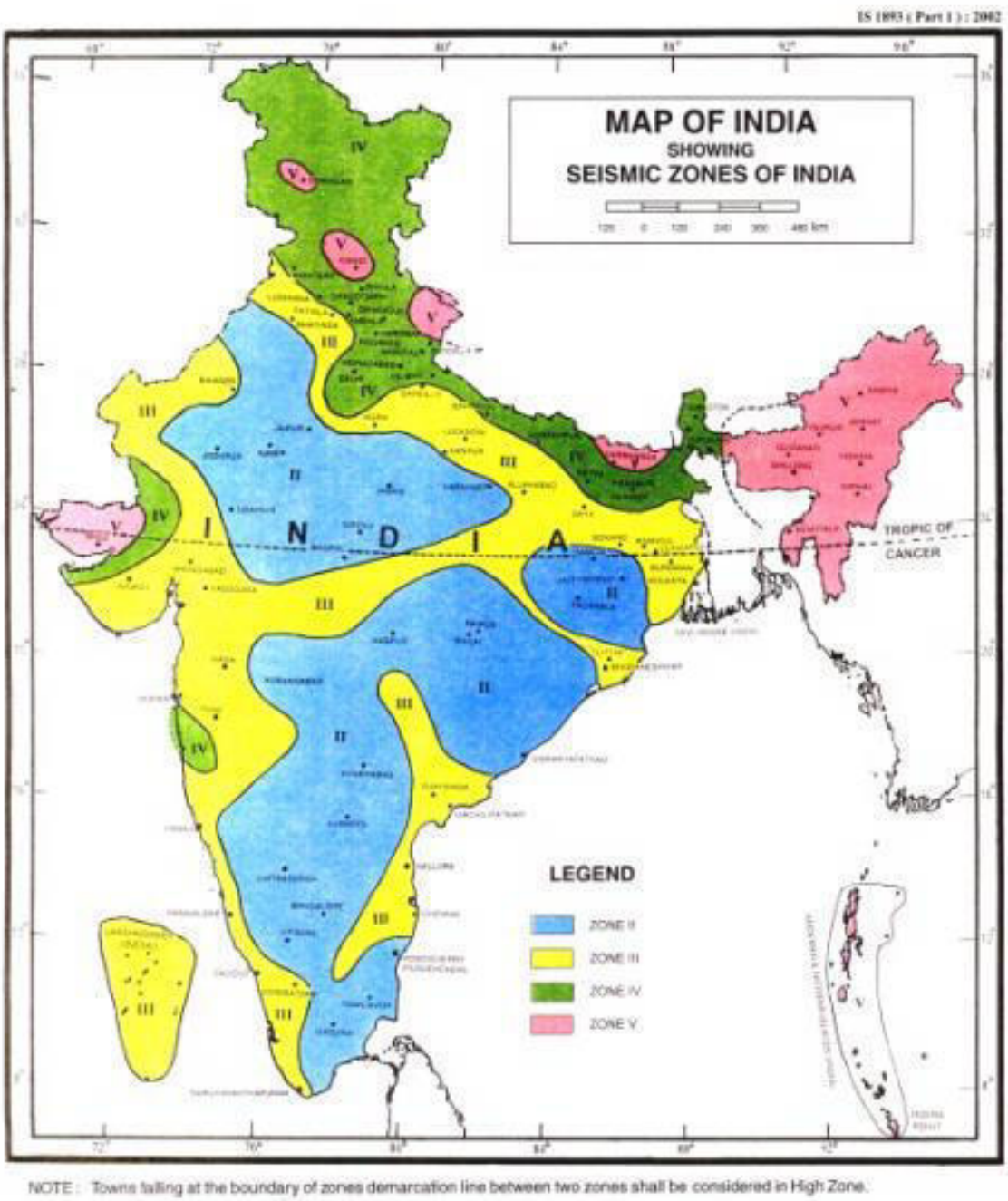
52. Singhbhum Shear Zone: The most spectacular structural element of the Singhbhum Craton in the southern part of the state is a 1-10 km wide and over 160 km long arcuate belt of shear zone called Singhbhum Shear Zone (SSZ). It separates the North Singhbhum Mobile Belt in the north from the Iron Ore Group and the Singhbhum Granite in the south. The SSZ consists of a number of thrust planes with variable upward displacement of the northern block. A number of cross faults are also known to have displaced the shear zone. The SSZ is host to mineral occurrences of economic importance. This belt hosts several copper, uranium and apatite-magnetite and several other deposits. Besides these, nickel, gold, molybdenum, silver, tellurium and selenium are also extracted as by-products from the copper and uranium ores. The mineralized sections are Baharagora, Badia-Mosabani, Pathargarah-Surda, Kendadih-Chapri, Roam-Rakha Mines-Tamapahar, Ramchandra Pahar-Nandup-Turamdih, etc. The geological map of the subproject area in Jharkhand is shown in **Figure-9.** In Lohardaga district, there are bauxite mines and in Latehar district there are mines of Central Coal Fields, which is subsidiary of Coal India Ltd.

Figure-9: Geological Map of Jharkhand



53. India's seismic code divides the country into five seismic zones (I to V). The subproject region comes under seismic zone IV as defined by Urban Earthquake Vulnerability Project and the Atlas prepared by the Building Materials Promotion and Technology Council Government of India and UNDP (IS 1893 [Part I: 2002]). The earthquake hazard map prepared for India is given in **Figure-10**. It may be mentioned that intensity of earthquake increases from Zone I to V. According to IS: 1893-1984, areas falling in Zone II denote less damage risk zone which covers entire Ranchi District, Lohardaga District and Southern part of Latehar District (Chandwa sub block). The Northern part of District Latehar falls in Zone III denotes moderate damage risk zone. Hence, as per the map provided below, the subproject region falls in less damage risk zone II.

Figure-10: Earthquake Hazard Map of India



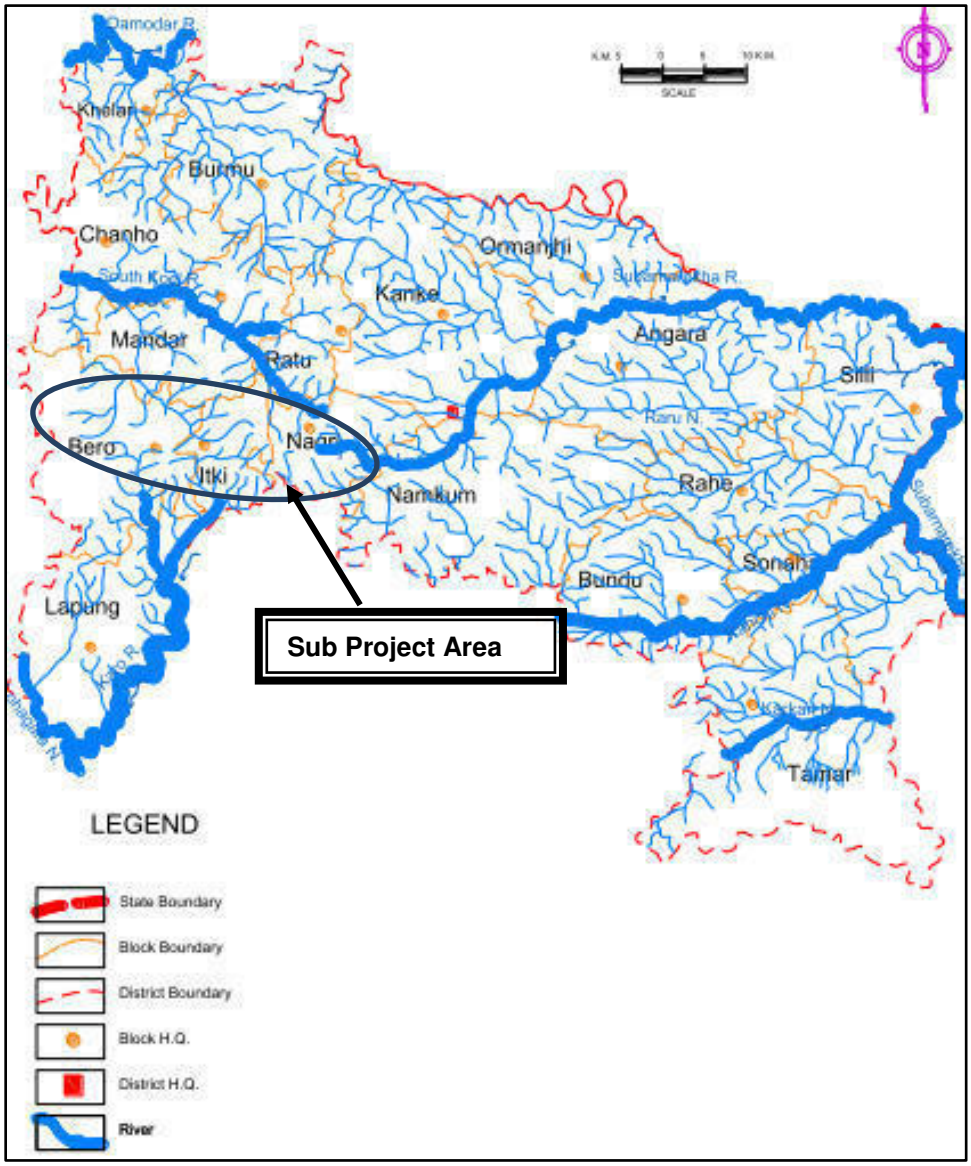
Source: Indian Standard Criteria for Earthquake Resistant design of Structures Bureau of Indian Standard- June 2002,

6. Drainage

54. The drainage system of the subproject in Ranchi District is highly dissected by rivers of varying magnitude. The major water divides in the district run north to south direction through the Ratu and Lodhma. The area in the eastern part of the water divide is drained by Subarnarekha and the western part of the divide is drained by South Koel and Karo. The

important river basins are the Subarnarekha, the South Koel, the Damodar and the Karkari. The Kanchi and Ratu are the tributaries of river Subarnarekha. The South Koel originates from Piska near Ranchi. The Karkari river drains the southeastern part of the district. The drainage map of Ranchi district is given in **Figure-11.**

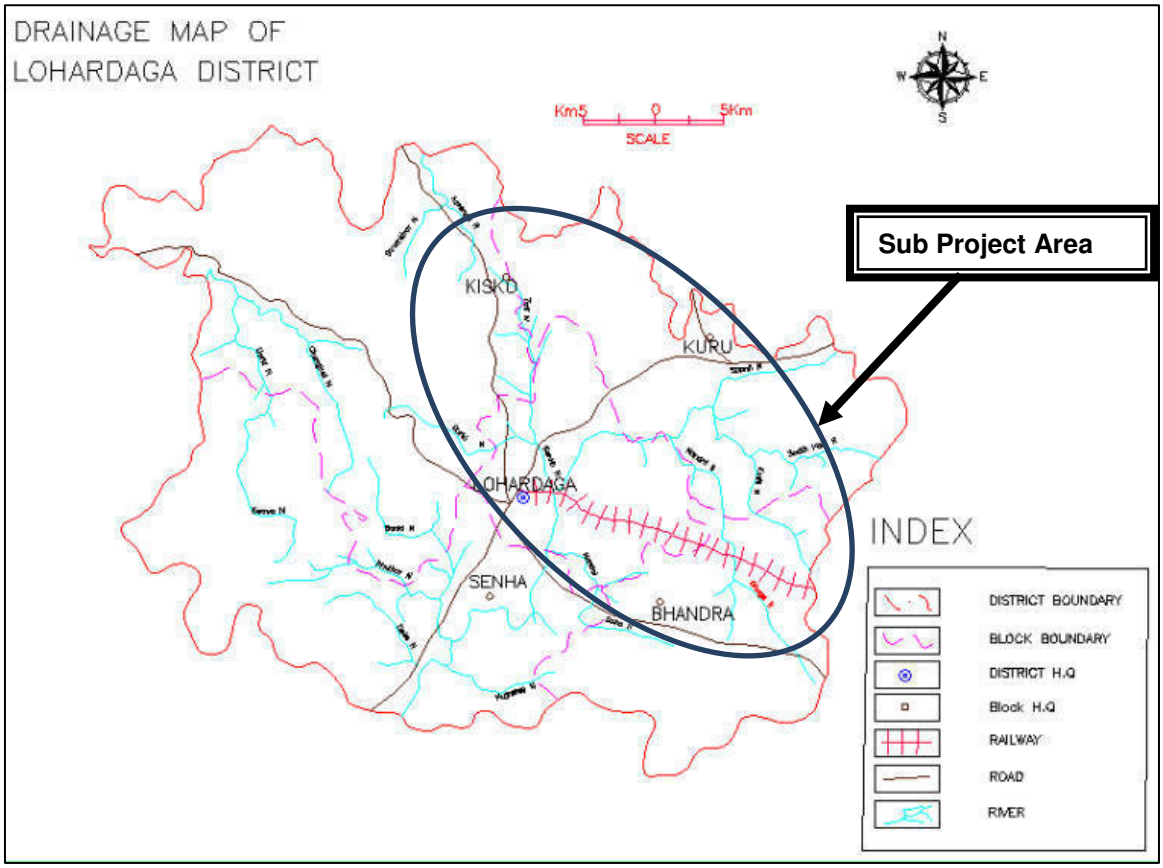
Figure-11: Drainage Map of Ranchi District



Source: Central Ground water Board, Ministry of Water Resources, India.

55. The Lohardaga district is drained by the tributaries of three major river of the state viz. North Koel, South Koel and Damodar. The North Koel river flows from the south to north dividing the region into two parts. The south Koel originates from this tract and drains toward the south. There are many other small tributaries which flow in the region. Ravines are found along the tributaries. The Shankh river is also the principal and it flows in the north of the town of Lohardaga The plateau region in west of Lohardaga town is the major water divide for north and south Koel river. Drainage of the district has been shown in the **Figure-12** below.

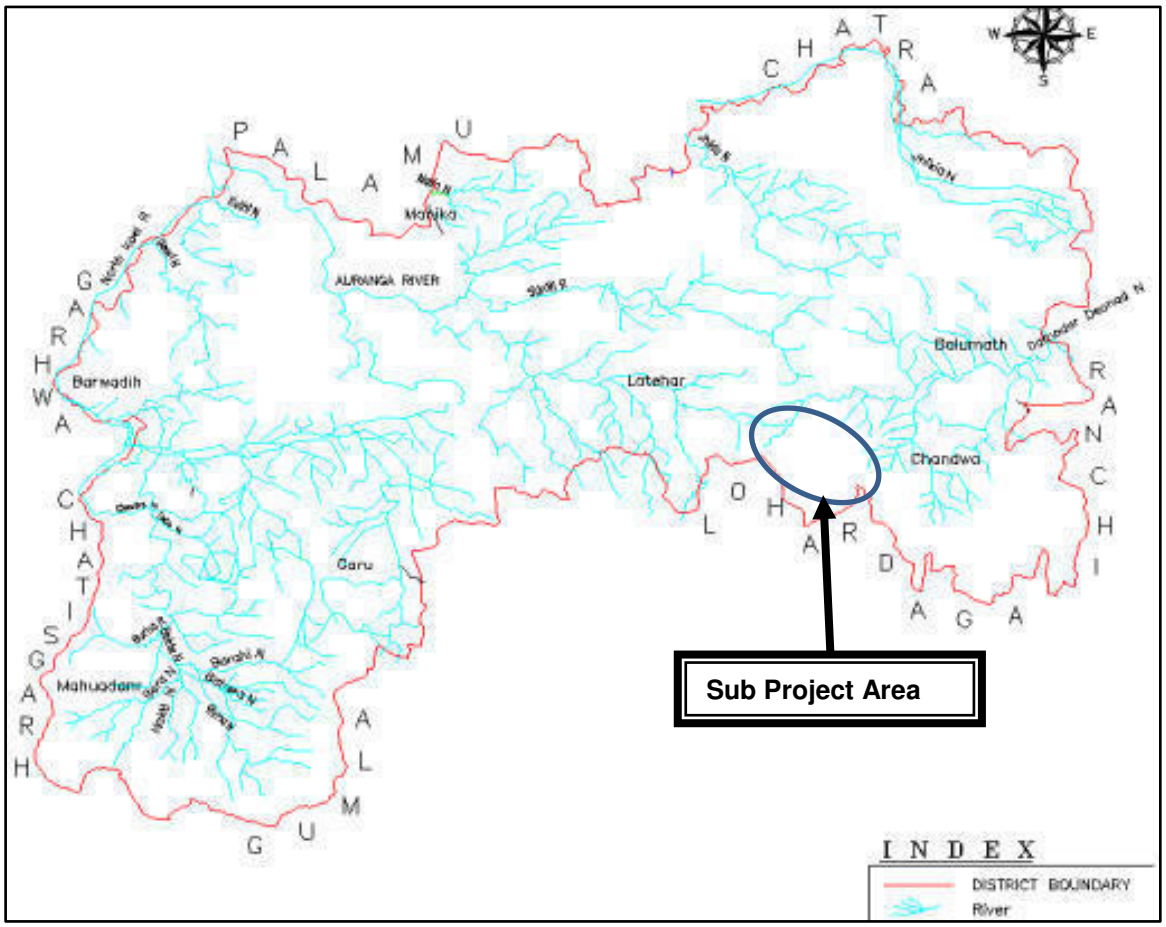
Figure--12: Drainage map of Lohardaga District



Source: Central Ground water Board, Ministry of Water Resources, India.

56. In the Latehar district drainage flow direction is from South to North. The principal rivers of the district are the North Koel, the Auranga and their tributaries. The Koel and Auranga have the upper reaches characterized by rocky bed while the lower reaches by sandy beds. North Koel river receives the water from several of its tributaries. The Auranga originates from the eastern part of the district. The drainage map has been shown in **Figure-13** below

Figure-13: Drainage map of Latehar District



Source: Central Ground water Board, Ministry of Water Resources, India.

B. Ecological Resources

1. Forests and Protected Areas

57. Forests cover a considerable portion of the Ranchi district and account for nearly 23 per cent of the total area. They are scattered throughout the district. “Dry peninsular Sal” is the main type of forest found with patches of mixed forest towards the north-western and south-western part of the district. Sal trees are a-gregarious. The principal companions of Sal are Aswan, Gamhar, Kend and Simal. The Mahua is common throughout Ranchi but in the forest is chiefly confined to the hills.

58. In the district Lohardaga district forest cover is around 32-35% of the total area. Sal trees are a gregarious. The tree species are same as mentioned for Ranchi district above.

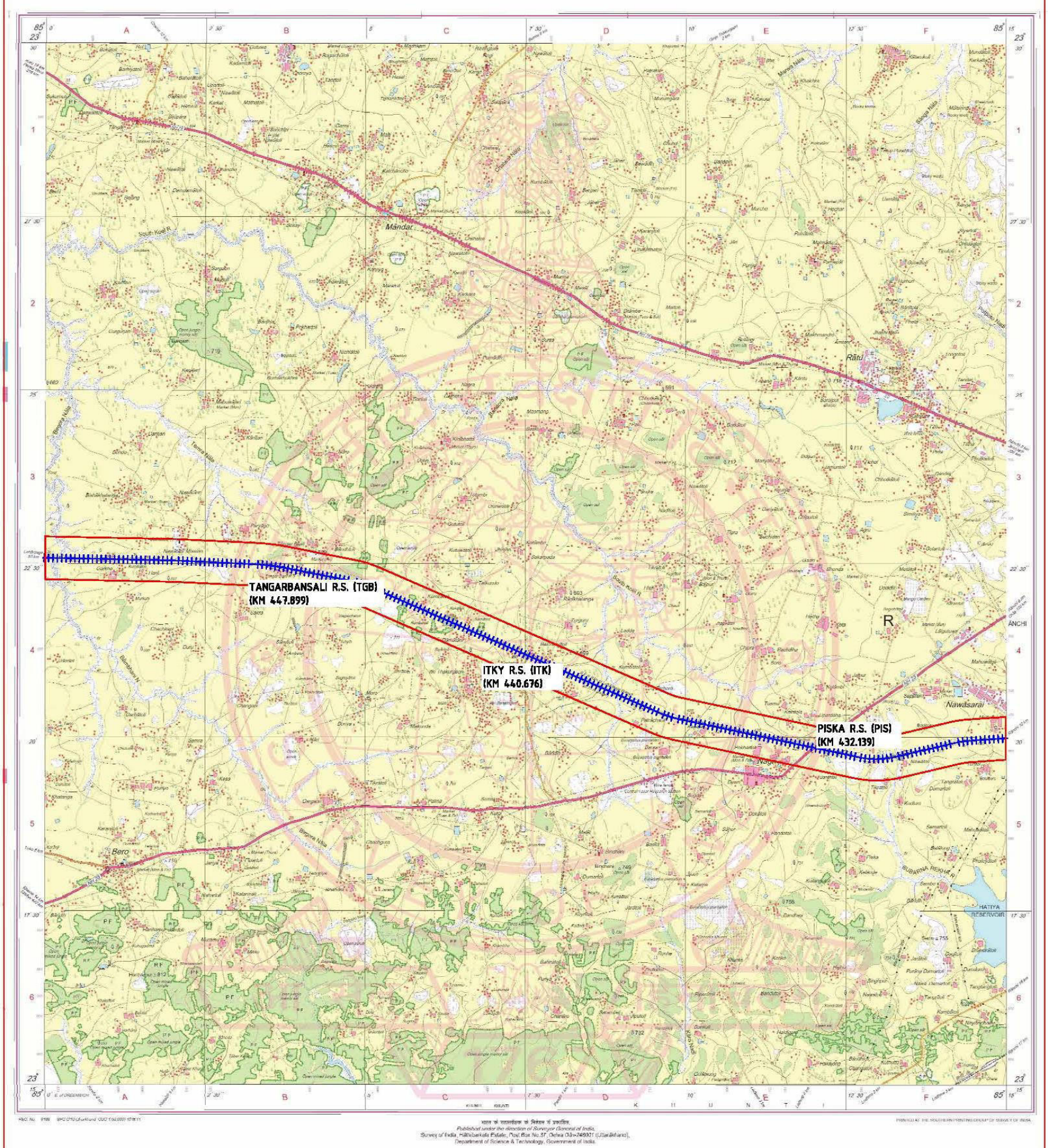
59. Latehar is one of the richest districts of Jharkhand in forest resources. About 43 percent of the total area of the district is covered by forests. The area under forests is estimated at 226850 hectares. The species of forest trees which are found in the district include Sal, Dhaura, Mahua, Kendu, Bamboo, Asan etc. The major products of forest include Timber, Palas, Firewood, Sal seed, Mahua seed, Biripatta etc. These forests are a source of

revenue for the government and also help to meet the demand for timber, firewood, fodder etc.

60. The subproject rail line corridor from CH 506+000 to CH 522+000 and from CH 526+000 to CH 528+000 passes through Kundgada Reserved forest (Length of rail line in reserved forest = 22km) and Tudu Protected forest (length in protected forest = 2 km) respectively. Formation of rail track is a new stretch from Barkichampi (CH499+619) to Tori junction (CH 530+000) and has been completed in March 2017. Type of flora in these forests is same as mentioned above for Latehar district. The subproject Railway Track alignment on Survey of India Topo Sheet has been shown in **Figure-14** below. There are no protected areas (National Park, Wildlife Sanctuary, Bird sanctuary, Tiger Reserve, etc.) within 25 km aerial distance from the Ranchi- Lohardaga- Tori rail track.

Figure-14: Sub project Alignment on Survey of India Topo Sheets

Figure-14: Sub project Alignment on Survey of India Topo Sheets (Contd.)



NOTES:

- DIMENSIONS ARE IN METER UNLESS SPECIFIED.
- BOUNDARY OFFSET: 500 M BOTH SIDE FROM CENTRE OF RAILWAY LINE

SOUTH EASTERN RAILWAY

RAILWAY LINE RANCHI RS – TORI RS (SHEET 2 OF 5)
(FROM PISKA RS TO TANGARBANSALI RS)

SOI SHEET NO: 73E/3

Figure-14: Sub project Alignment on Survey of India Topo Sheets (Contd.)