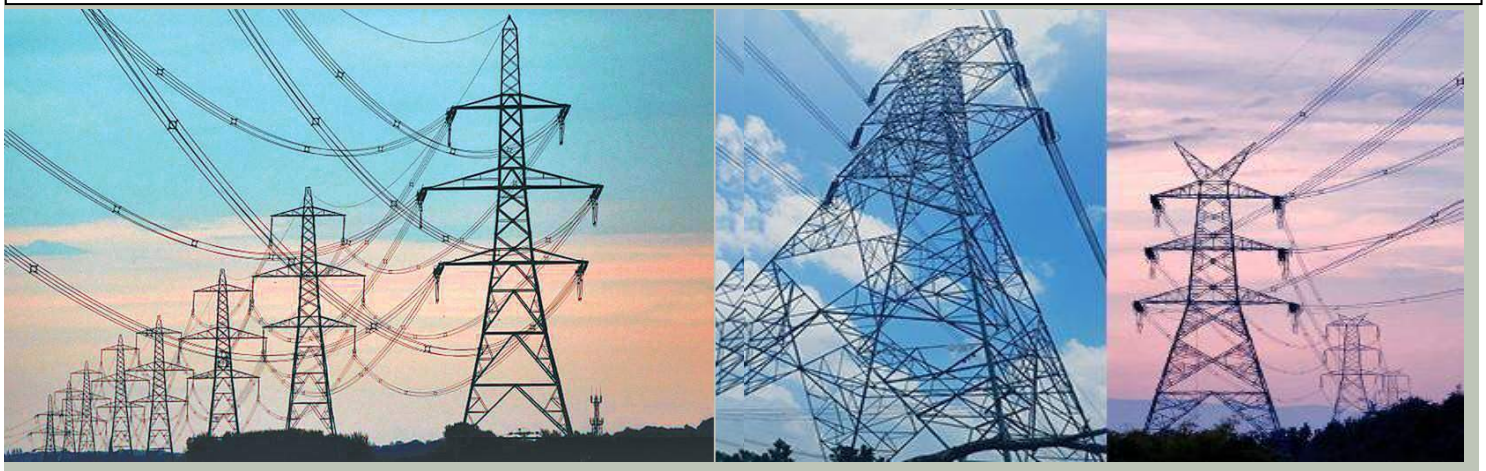
NEPAL ELECTRICITY AUTHORITY



FINAL ESIA REPORT

PRIORITY TRANSMISSION LINE PROJECT (TL3)

Arun Hub - Inaruwa Transmission Line and Substations-(TL-3)

वाप्कोस लिमिटेड
WAPCOS LIMITED
(भारत सरकार का उपक्रम - जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय)
(A Government of India Undertaking - Ministry of Water Resources, River Development & Ganga Rejuvenation)

In association with

ENVIRONMENT RESOURCE MANAGEMENT ERMC
ERMC
Environment & Resource Management Consultant

WAPCOS LIMITED
(A Government of India Undertaking)

76 C, Sector 18, Gurgaon - 122015,
Haryana, INDIA
Tel. 0124-2397396, Fax. 0124-2397392
Email: environment@wapcos.co.in

ERMC (P.) Ltd.

Puja Pratisthan Marga-91, New
Baneshwor, Kathmandu, Nepal
Tel: +977 01 4483064,
Fax: +977 1 4479361

MAY, 2024

Document details	**ESIA Study of Priority TL Projects**
Document title	ESIA Study of The Priority Transmission Line Project (TL-3)
Document Code	TL3-ESIA_R3 (3rd Revision)
Project Contract No.	PSRSHD/NEA/TL/QCBS-2IDA, Credit No. 5728-NP
Date	29.03.2024
Version	3
Client Name	Nepal Electricity Authority

Document Code: TL3_ESIA_R3 (3rd Revision)

Revision Control Sheet					
Version	**Submitted Date**	**Reviewed by and Date**	**Comment Addressed and submitted**		**Final submission**
			Date	**Reviewed by**	
TL3_ESIA_R1	14.12.2023			ESIA Team	
TL3_ESIA_R1	05.01.2024			ESIA Team	
TL3_ESIA_R1	12.01.2024			ESIA Team	
TL3_ESIA_R1	24.01.2024			ESIA Team	
TL3_ESIA_R2	26.02.2024			ESIA Team	
TL3_ESIA_R3	11.03.2024			ESIA Team	
TL3_ESIA_R3	29.03.2024			ESIA Team	
			08.04.2024	ESIA Team	5.00 pm
TL3_ESIA_R3	29.03.2024		02.05.2024	ESIA Team	
TL3_ESIA_R3	29.03.2024		07.05.2024	ESIA Team	
TL3_ESIA_R3	29.03.2024		09.05.2024	ESIA Team	

EXECUTIVE SUMMARY

The Government of Nepal (GoN) has outlined an ambitious vision for economic development through the efficient use of the country's abundant water resources. This vision is encapsulated in a white paper promulgated by the Ministry of Energy, Water Resources, and Irrigation (MoEWRI) in May 2018. GoN aims to generate 3000 MW by 2021, 5000 MW by 2023, and 15,000 MW (with 5000 MW for export) by 2028, on the supply side and plans to raise annual per capita electricity consumption from 170 kWh to 700 kWh by 2023 and further to 1500 kWh by 2028, on the consumption side, aligning with a commitment to achieving zero emissions by 2045.

All energy sector institutions have embraced the targets outlined in the white paper, with the Water Energy Commission Secretariat (WECS) playing a pivotal role in developing plans and policies to meet electricity demands across various sectors. The Rastriya Prasharan Grid Company Limited (RPGCL) has formulated a transmission master plan, incorporating different power plants at various stages of study and construction. The Nepal Electricity Authority (NEA), as the implementing agency, is conducting feasibility and detailed studies for transmission lines essential for evacuating power generated by 2035. NEA is studying three critical transmission lines for evacuating power generated from the eastern part of Nepal.

TL-1: Arun Hub (Sitalpati) - Inaruwa 400kV Transmission Line

TL-2: Arun Hub (Sitalpati) - Tingla - Dudhkoshi 400kV Transmission Line

TL-3: Inaruwa - Anarmani 400kV Transmission Line

Priority transmission line project TL3 originates from the Inaruwa Substation in Sunsari District and terminates at the Anarmani Substation in Jhapa District. This TL is a crucial for the establishment of the groundwork for electricity trading between Nepal, India, Bangladesh, and other Southeast Asian countries. Also, this line will enhance the reliability of electricity in the eastern part of Nepal as well as entire Nepal. The scope of this project includes the construction of 90km, 400kV Double Circuit Transmission line from Inaruwa substation to New Anarmani substation, expansion of bay at existing Inaruwa substation and construction of new 400/132kV New Anarmani substation at Haldibari, Jhapa. This project affects three districts namely Sunsari, Morang and Jhapa.

The estimated average height of the tower will be 58.85 m and the tower types will be DA/DB/DC/DD in major portions whereas multi-circuit tower has proposed in the vicinity of SS. The average tower pad area will be 35 m X 35 m. The Right of Way (RoW) of the TL will be 23 m on each side from the centre line, starting from Inaruwa to New Anarmani substation. Quad Moose conductor has been proposed based on N-1 Contingency.

The environmental screening criteria in line with EPR 2020 for TL projects include:

- Brief Environmental Studies (BES)-Schedule 1, F, 1: All the projects up to 66 kV TL that require forest area;
- IEE-Schedule 2, F, 1A: 132 kVA or more than 132 kVA TL projects and
- EIA- Schedule 3, L: Implementation of Any project in National Park, Wildlife Reserve, Hunting Reserve.

The proposed transmission line project does not fall in any National Parks, Wildlife Reserves or Hunting Reserve. Similarly, this TL project is 400 kV double circuit, therefore, for the legal requirement in Nepal, it is necessary for preparation of Initial Environmental Examination (IEE) Report. However, for international financing purpose ESIA is required. Environmental and Social Impact Assessment (ESIA) document will be prepared in conformance with the World Bank's requirements under the new Environmental and Social Framework (ESF), and its applicable provisions/ requirements of ESS 1 to ESS 8 and ESS 10 Performance Standards.

Existing Environmental Condition

The existing Environmental conditions were studied by collecting the baseline condition along the entire TL route.

Physical Environment

The proposed alignment of TL-3 ranges from tropical to temperate climate. During the winter season there is dense fog and in rainy season, flood is a problem in Southern part of the Koshi Province. The average relative humidity is 64% and annual precipitation ranges from 1150 mm to 2400 mm. The project area for TL-3 lies along the settlements with very less of the forest area. Another source of air pollution is cow dung and waste of crops burning, which is more in TL-3 sites and also in Sunsari District for TL-3. The sound levels measured were converted to equivalent values and then compared with the National Ambient Air Quality Standard, 2012, which sets limits for noise in silent zones at 50 dBA during the day and 40 dBA during the night. Similarly, in the Rural Residential Area, the limits are 45 dBA during the day and 40 dBA during the night. Interestingly, our study found that the measured sound levels were within these normal limits, indicating a satisfactory noise environment in the project area. It was noticed that the water sample of Sunsari river had higher total coliform while other parameters were as per the limits of NDWQS 2079. The elevation of TL-3 varies from 84 to 89 m and along the Terai plain. The study area of TL-3 lies in the flat land of the Indo-Gangetic Plain.

Biological Environment

TL-3 has tropical forest types. There are two community forest in Sunsari District along the RoW. Most of the TL-3 alignment pass from the cultivated land, therefore, the enumeration of plants in the TL-3 transmission line route was done based on the Angle Points at different intervals. There were two forest types in TL-

3 route and two community forests. Total tress loss in TL-3 is 105 and poles loss will be 194. A total of 15 plant species observed along the RoW of proposed transmission line TL3, of these, herbs (5), trees (9), and shrubs (1) listed in Table 4-13. TL-3 has tropical forest types. Most of the section of the alignment is located on cultivable land only in Sunsari, there are community forests that are very close to settlement area. No critical faunal habitat areas were observed along the alignment during the preliminary field visit. The presence of some common faunal species in the project area includes fox (*Vulpes bengalensis*), golden jackal (*Canis aureus*), Indian hare (*Lepus nigricollis*), jungle cat (*Felis chaus*) etc. Asian elephant (*Elephas maximus indicus*) is one of the longest distances travelling migratory animal of the Indian subcontinent.

From Anarmani substation to Kankai River is very important habitat for birds. Along the TL-3 Inaruwa to Anarmani TL routes, the following 67 species were notes. Among them Leptoptilos *javanicus, Circus aeruginosus, Vanellus malabaricus and Anastomus oscitans* are vulnerable while *Circus aeruginosus, Anastomus oscitans, Spilornis cheela, Buteo refectus* are under CITES II.

The alignment of TL-3 crosses the streams Sunsari Khola, Budhi Khola, Bakraha Khola, Ratuwa Khola, Kamal Khola, Kankai Khola and Biring Khola. The common fishes in these rivers include *Gudusia chapra, Salmonstoma acinaces, Barilius bendelisis, Chela laubuca, Puntius chola, Puntius ticto, Macragnathus aral, Anabas cobojius, Channa punctatus.* There will be not much impact on the aquatic life except in some of the APs located in river bank.

Socio-economic and cultural environment

The settlement patterns in the project areas includes the arable land which is a main source of livelihood and the type of houses structures etc. The major settlements in the project area includes Bakraha, Chariya, Pachira, Kaiktol Parasitaki, Gidhaniya, Jhapta, Takiya, Koigada, Jaliya Bishal, Jamanpur, Domana, Haldibari, Sijuwa, Gwalmani, Devigada, Kwedi, Kunjbari, Kamatoli, Sarnamati. Most of the settlements in the project area are clustered. There are also semi-clustered and scattered types of settlements in the project area. Most of the houses in the settlements are semi- modern and traditional type. The transmission line TL 3 passes through 03 districts namely Jhapa, Morang and Sunsari. A total of 205 households in Jhapa, 109 households in the Morang and 132 households in the Sunsari district are to be affected by the proposed project. The project affected households from 03 districts are the residents of 13 local bodies with 446 households. The following table shows the Ownership of land Project affected Families and the status of Female. Among 446 HHs Female represent are only 7.40% among Three district Sunsari District has more gap on Awareness of Ownership of land on Female. There are total of 128 Indigenous and Vulnerable People along the TL route. However, only Indigenous people included 53. Amongst 109 PAFs in Morang district, land ownership with males is 97 (88.99%) while females are only 12 (11.01%) with the land ownership. Similarly, amongst

205 PAFs, land ownership with males is 186 (90.73%) with land ownerships while females are 19 (9.27%) with land ownership in Jhapa District. But in Sunsari district, amongst 132 PAFs, land ownership with males is 130 (98.48%) with land ownerships while females are 2 (1.52 %) with land ownership. It was noticed that in all the project area districts the land ownership mainly belongs to male members of the family. Among 109 PAFs in Morang district, the males are 97 while females are only 12 with the land ownership. Similarly, among 205 PAFs, the males are 186 with land ownerships while females are 19 with land ownership in Jhapa District. But in Sunsari district, among 132 PAFs, the males are 130 with land ownerships while females are 2 with land ownership.

Major environmental impacts anticipated from the project are as follow:

Beneficial Impacts

- Increase in employment opportunities for local people
- Enhancement of Technical Skills of Locals

Adverse Impacts

The key environmental adverse impacts due to construction and implementation of the project are:

Physical Environment

- Change in land use due to need of permanent and temporary land
- The possibility of erosion near the river bank.
- Impacts due to quarrying and stockpiling of materials Impacts due to air, water and noise Pollution
- Solid waste generation and management issues

Biological Environment

- Impact due to tree/poles felling in Sunsari District
- Effects on wildlife and birds and their habitats

Socio-economic and Cultural Environment

During the construction of the proposed transmission line, land and households will be affected permanently and temporarily.

- Impact on private land property
- Impacts on occupational Health and Safety of Workers
- Impacts due to Gender involvement and child labour during construction
- Impact on social structure, economy and cultural behavior
- Impacts due to increase in commodity prices
- Pressure on social service facilities and resources
- Impacts associated with cultural invasion and social disputes

Alternative Analysis

The alternative analysis for TL-3 was considered during its investigation stage. Based on the detailed investigations, various alternatives were considered such

as no project alternative, alternative project layouts based on the social and environmental consideration.
Each of these alternative options has been evaluated in brief for followings topics:

- No Project Alternative/ Non-Implementation Scenario of TL-3
- Alternative Transmission Line Capacity
- Transmission Line Alignment Alternatives
- No/Less Forest Alternative
- Design Alternatives
- Associated Risks on Different Alternatives
- Alternative to Technology, Operation, Procedures, Time Schedules and Raw Materials to be used

Based on these TL-3, alternative II has been selected to be best for environmentally and cost effectively.

Environmental and Social Management Plan

Along with the environmental monitoring work of this project, an environmental and social management action plan comprising organizational structure, staff coordination mechanism, reporting and budget for the implementation of environmental protection measures has been prepared.

The project will integrate the aspects mentioned in the environmental management plan as much as possible when finalizing the design of the project and will implement it during construction and operation phase. The project will implement necessary environmental protection measures throughout the pre-construction, construction and operation as well as maintenance period.
This ESIA report includes the contecnts of different Plans prepared for the project. The summary for each of the plans prepared are presented below:

a. Biodiversity Management Plan (BMP)

The objectives of of a Biodiversity Management Plan (BMP) is to mitigate and monitor the impact on the biodiversity. During the study, number of laws were reviewed that included, Constitution of Nepal, Policy and Acts related with Biodiversity and Forest, World Bank Policy ESS5. Local people wish for maintaining the loss of the forest and preservation of the birds residing in the Trees. They also wished for the project to ensure to give appropriate compensation to HHs belonging to the community forest. They also wanted the compensatory plantation needed to be done near the affected HHs. Any development project creates some sort of impact on the surrounding environment. If proper mitigation measures as mentioned in the IEE report and BMP report are applied the expected impact could be mitigated and/or compensated. The proposed TL-3 if implemented with appropriate mitigation measures will have an acceptable level of impact on vegetation. The mitigation measures/activities prescribed in this Report to minimize Project impacts is

realistic and feasible and is envisaged to manage the adverse Project impacts on flora and fauna to an acceptable level. The implementation of BMP in coordination with Division Forest Office during construction and operation of project-by-project proponents will minimize the impacts on ecological aspects.

The total cost of the BMP is 4,575,342/- (USD 34,401) that includes NPR 30,00,000/- (USD 22,556) for mitigation/monitoring and NPR 15,75,342 (USD 11,845) for compensatory plantation. The cost of forest loss is not the part of BMP and the cost is included in total project cost.

b. Gender Action Plan (GAP)

This Gender Action Plan (GAP) has been elaborated to gender-related measures into the TL-3 related activities, ensuring that gender-related risks are avoided or mitigated, and to pay special attention to women, considering that women are not a homogenous group, and the additional challenges that women from indigenous nationalities, Dalit caste and other marginalized groups may face. It further has identified gender-performance indicators and sex-disaggregated targets to be integrated into the project´s gender-responsive results framework. This GAP Report is a part of ESIA study for priority transmission line (TL3). The cost for GAP implementation and the administrative cost is NPR 165,20,000/- (USD 124,211).

c. Vulnerable and Indigenous Development Plan (VIPDP)

This VIPDP is designed for the social safeguard of the directly or indirectly Project- affected indigenous and vulnerable groups. Directly Project affected households will be addressed through the Project's RAP. This VIPDP will address the socio-economic development of indigenous and vulnerable persons and groups along the project alignment. The main objective of this VIPDP is to ensure that indigenous and other vulnerable groups become beneficiaries of the TL project interventions. VIPDP will adopt the participatory and collaborative approach for the program implementation. Affected people will be formed with the collaboration of respective Municipalities/Rural Municipalities. A group will be formed by the men and women of indigenous and vulnerable groups in each affected area. The Project Manager and social mobilizers will facilitate the group formation, project selection, and implementation. The Project will monitor VIPDP activities both internally and externally. Internal monitoring will focus on inputs and outputs and will be aimed at observing the short-term changes in different indicators.

The implementation of VIPDP will start after the approval of IEE, RAP, and VIPDP. The VIPDP cost estimates includes program costs, allowances and administrative costs for VIPDP implementation. The VIPDP is mainly focused on the social development of vulnerable and indigenous groups. The total estimated cost for VIPDP is NPR 49,040,000/- (USD 368,722/-).

d. Resettlement Action Plan (RAP)

The baseline study for socio-economic aspects of HHs hold relevant social parameters along the RoW and tower pads as per preliminary alignment. The transmission line TL 3 passes through 3 districts namely Jhapa, Morang and Sunsari. A total of 205 HHs in Jhapa, 109 HHs in the Morang and 132 HHs in the Sunsari district are to be affected by the proposed project. There are total of 26 structures will be affected by the TL-3 project. The total land required is 425.982 ha, out of which 3.488 ha. falls under community forest, 199.859 ha.is agricultural land, 209.97 ha. is government barren land and 12.66 ha. is river bed.

ESIA team observed the settlement pattern, available infrastructure, health and sanitation situation of the project area based on the field observation checklists. Informal interviews were conducted along with observation. These techniques helped the team to triangulate the data collected through FGD and HH survey. Photo documentation was also undertaken by the ESIA team to capture fully the whole survey process and observations.

The land valuation has been done in the report as per the rate given by the local bodies at the time of survey. A project-specific Grievance Redressal Mechanism (GRM) will be established to receive, evaluate and facilitate the resolution of people's concerns, complaints and grievances about the social and environmental issues during and before the RAP implementation. The implementation of RAP will be started with the initial land acquisition initiated by the NEA. It is assumed that after the approval of the IEE.

The majority of the PAF in the proposed TL3 area dependent on agriculture for livelihood. The TL3 resettlement plan is mainly focused on the restoration of the affected people's livelihood as land-to-land resettlement is not feasible. The restoration of the lost resources, particularly, forest resource is very important in this TL3 section. Apart from the above, TL3 resettlement plan and compensation packages need modifications keeping in consideration of the national resettlement policy framework.

A provision of total NPR 1,555,443,634.00 (USD 11,695,065.00) needed for the compensation of Houses and Structures, Land Acquisition, Allowances for Vulnerable and Indigenous People, RAP Implementation Monitoring and Evaluation [Table 10-1,considering 1 USD=133 based on the rate of 2024]. There is separate cost for VIPDP and GAP implementation and hence, it is not included in RAP.

ESMP Cost of the Project

Along with the environmental monitoring work of this project, an environmental and social management action plan comprising organizational structure, staff coordination mechanism, reporting and budget for the implementation of environmental protection measures has been prepared. The project will integrate the aspects mentioned in the environmental management plan as much as

possible when finalizing the design of the project and will implement it during construction and operation phase. The project will implement necessary environmental protection measures throughout the pre-construction, construction and operation as well as maintenance period. The implementation Environmental and Social Management Plan, on adopting measures to reduce adverse environmental effects, priority should be given to conducting the program through the local communities that will be affected when the proposal is implemented. The cost of environmental mitigation, monitoring and enhancement for this project will be as followed as mentioned in Table below:

ESMP Costs Summary

SN	Description	NRS	USD	Remarks
1	RAP Cost	1,555,443,634	11,695,065	It includes compensation of Houses and Structures Land Acquisition Allowances for Vulnerable and Indigenous People RAP Implementation Monitoring and Evaluation
2	VIPDP Program Costs	49,040,000	368,722	It includes the allowances as in RAP
3	GAP cost	16,520,000	124,211	Not the part of ESIA and is separate for GAP
4	BMP cost	4,575,342	34,401	Includes the cost of mitigation/monitoring as well as compensatory plantation
5	Capacity Building and E&S management Unit	29,250,000	219,925	Part of ESIA
6	Impact Mitatigation Cost	5,905,000	44,399	Part of ESIA
Total		**1,660,733,976**	**12,486,722**	

Conclusion and Recommendations

The Nepal Electricity Authority (NEA) is prioritizing the development of the three transmission lines and two new substations that include 400/132 kV New Anarmani Substation located at Haldibari RM ward 1, Jhapa District and 400/132 kV New Tingla Substation located at Tingla next to the existing 132/33 kV Substation in Solududhkunda Municipality ward 11, Solukhumbu District respectively. 400 kV Arun Hub (Sitalpati)-Inaruwa (95km) and Arun Hub-Tingla-Dudhkoshi (110km) will connect the electricity generated from Arun River Corridor and Solu River Corridor. Meanwhile, the TL-3: 400 kV Inaruwa-Anarmani (89.612 km) Transmission Line and substation will connect the Inaruwa substation to New Anarmani substation leading to supply electricity to the industrial area of Koshi Province and for Trade with India and Bangladesh. Currently, in Koshi Province, along the Arun River corridor, there is Upper Arun (1061 MW), Irkhuwa HEP, Sankhuwa HEP, etc with capacity of 3500 MW generation of the electricity. There is currently Arun Hub (Sitalpati) substation but no connection to the Main Grid in the Inaruwa substation. The Priority TL project will be helpful to increase the reliability of the power supply in the load center of Eastern Nepal and support the

regional power trade between Nepal, India, and Bangladesh through the proposed TL-3: 400 kV Inaruwa-Anarmani (89.612 km) Transmission Line and substation will fulfill the energy demand of the industrial area of Koshi Province, and it will make the system more reliable in the National Grid. The estimated average height of the tower will be 60 to 80 m and the types will be DA/DB/DC/DD. The average tower pad area will be 35 m X 35 m. The Right of Way (RoW) of the TL will be 23 m on each side from the centre line.

Taking into account, the nature of proposed project, its location, positive response of public, nature of the assessed environmental impact and the practical adverse impact mitigation measures that can be implemented, existing policies and laws, all aspects related to environmental management mentioned in this report are fully implemented. This project has been recommended for implementation along with the commitment to be made. And this project will continue under the rule of Nepal's constitution, policies, acts, rules, laws, etc. The project also promises to make the project environmentally friendly by removing or reducing all the possible environmental impacts that cannot be identified or estimated at the moment, but which may appear in the construction phase of the project and updating the ESIA report. The total cost for ESIA including RAP, VIPDP, GAP, BMP and cost of impact mitigation, Capacity building and E & S management unit is is NPR 1,660,733,976 (USD 12,486,722).

ACRONYMS AND ABBREVIATIONS

%	Percent
AP	Angle Points
BS	Bikram Sambat
CBS	Central Bureau of Statistics
CDC	Compensation Determination Committee
CDO	Chief District Officer
DCC	District Coordination Committee
DIA	Direct Impact Area
DoED	Department of Electricity Development
EPA	Environment Protection Act
EPR	Environment Protection Rules
ESIA	Environmental and Social Impact Assessment
ESS	Environmental and Social Safeguard
GESI	Gender Equality and Social Inclusion
GoN	Government of Nepal
Ha	Hectare
HHs	HHs
IIA	Indirect Impact Area
IEE	Initial Environmental Examination
IP	Indigenous People
KII	Key Informants Interview
Km	Kilometer
kV	Kilo Volt
kWh	Kilowatt Hour
M	Municipality
M	Meter
MoEWRI	Ministry of Energy, Water resources and Irrigation
MoFAGA	Ministry of Federal Affairs and General Administration
MW	Mega Watt
NEA	Nepal Electricity Authority
NPR	Nepalese Rupees
No.	Number
PAPs	Project Affected Persons
PAFs	Project Affected Families
RAP	Resettlement Action Plan
RM	Rural Municipality
RoW	Right of Way
TL	Transmission Line
VC	Vulnerable Community
VIPDP	Vulnerable and Indigenous People Development Plan
WB	World Bank
WECS	Water Energy Commission Secretariat
ZoI	Zone of Influence

DEFINITION OF TERMS

The definition of the key terminologies and concepts used in this report are as follows:

Affected Person (AP) and Affected Household (AH)

Refers to any person or persons, household, firm, private or public institution that, on account of changes resulting from the Project, will have its (i) standard of living adversely affected; (ii) house, land (e.g., residential, commercial, agricultural), fixed assets (irrespective of legal or ownership title) acquired, possessed, restricted or otherwise adversely affected, in full or in part, permanently or temporarily; and/or (iii) business, livelihood, place of work or residence or habitat adversely affected, with or without physical displacement. In the case of affected household (AH), it includes all members residing under one roof and operating as a single economic unit, who are adversely affected by the project.

Below Poverty Line

Affected Person is considered below poverty line if, his/her level of income is lower than the national poverty line which is Nrs. 19,262 per person per year.

Compensation

This is payment given in cash or in kind to Affected Persons at replacement cost or at current market value for assets and income sources acquired or adversely affected by the project.

Cut-off Date

Refers to the date after which people will not be considered eligible for compensation i.e. they are not included in the list of APs as determined by a census of persons displaced from assets and livelihoods.

Direct Impact Areas (DIA)

The term DIA consists of 46 m wide Transmission Line RoW encompassing 23 m on each side of the alignment measured from its center line. It further includes: Locations of access trails to reach the tower foundation and RoW and Locations of construction camps and storage yards for construction material.

Indirect Impact Areas (IIA)

The Term IIA refers to the area outside the DIA and is broadly categorized into two: i) High Indirect Impact Zone and ii) Low Indirect Impact Zone.

The High Indirect Impact Zone

Settlements within 250 m from the corridor of the Transmission line route is considered as the High Indirect Impact Zone.

The Low Indirect Impact Zone

Geographical boundaries of the Rural Municipalities /Municipalities situated across the transmission line route in general are the Low Indirect Impact Zone.

Entitlement

Refers to a range of measures, such as compensation in cash or in kind, income restoration support, relocation/transfer assistance, livelihood substitution, relocation support, etc., which are provided to the APs depending on the type and severity of their losses to restore their economic and social base.

Ethnic Minority

People with a group status having a social or cultural identity distinct from that of the dominant or mainstream society.

Indigenous Peoples (IP)

Groups with social or cultural identities distinct from that of the dominant or mainstream society ('Indigenous peoples' is a generic concept that includes cultural minorities, ethnic minorities, indigenous cultural communities, tribal people, natives, and aboriginals).

Land Acquisition

Process whereby land and properties are acquired for the purpose of the Project in return for compensation at replacement cost.

Non-title Holders

Those who have no recognizable rights or claims to the land that they are occupying.

Relocation

This is the physical displacement of the AP or structure from his/her pre-project place of residence and/or business or its original location.

Replacement Cost

Means the amount in cash or in kind to replace an asset in its existing condition, without deduction of transaction costs or depreciation and remaining values of salvageable materials, at prevailing market value, or its nearest equivalent, at the time of compensation payment.

Resettlement Action Plan

It is the social safeguards document that contains the policies and guidelines and time- bound action plan with budget, setting out the resettlement objectives and strategies.

Stakeholders

Individuals, groups, or institutions that have an interest or stake in the outcome of a project. The term also applies to those potentially affected by a project. Stakeholders include land users, central government, provincial and local governments, implementing agencies, project executing agencies, groups contracted to conduct project activities at various stages of the project, and other groups in the civil society which may have an interest in the project.

Severely Affected Person

This refers to APs who will: (i) lose 10% or more of their total productive assets and/or total income sources causing them to fall below the poverty line; and (ii) lose their residential house/ livelihood such that they have to relocate because of the project.

Third Party

An agency or organization to witness and/or verify "no coercion" clause in an agreement with APs for voluntary land acquisition.

Title Holder

APs who have formal legal rights to land, including any customary or traditional rights recognized under the laws of Nepal.

Vulnerable Groups

These are distinct groups of people who might suffer disproportionately or face the risk of being further marginalized due to the project and specifically include: (i) households that are headed by women with dependents, (ii) household heads with disabilities, (iii) households falling under the generally accepted indicator for poverty, (iv) elderly households who are landless and with no other means of support, and (v) landless households.

Female-headed Households

Households headed by women; the woman may be divorced, widowed, or abandoned or her husband can be working away from the municipality for long periods of time, but where the woman takes the decisions about the use of, and access to, household resources.

Elderly Population

The Social Protection Program Operational Procedure, 2016 defined Population above the age of 70 years is considered vulnerable group.

Single Women

The Social Protection Program Operational Procedure, 2016 defined unmarried or divorcee women are called single woman.

Social Exclusion

Describes the experience of groups that are systematically and historically disadvantaged because of discrimination based on gender, caste, ethnicity, or religion. Exclusion occurs in public (formal) insti- tutions such as the legal or education system, as well as social (informal) institutions such as communities and households.

Social Inclusion

The removal of institutional barriers and the enhancement of incentives to increase access by diverse individuals and groups to development opportunities. This requires changes in policies, rules, and social practices and shifts in people's perspectives and behavior toward excluded groups.

Gender

Refers to the socially constructed roles and identities of men and women as well as the relationships between them. These roles change over time and vary by culture. In Nepal, women face unequal power relations and gender-based barriers due to a patriarchal society.

Gender equality

Refers to how these factors determine the way in which women and men relate to each other and to the resulting differences in power between them (World Bank 2011).

Gender Based Violence

An umbrella term for any harmful act that is perpetrated against a person's will and that is based on socially ascribed (that is, gender) differences between males and females. Gender-based violence includes acts that inflict physical, mental, or sexual harm or suffering; threats of such acts; and coercion and other deprivations of liberty, whether occurring in public or in private life (IASC 2015).

Gender mainstreaming

A process that systematically integrates gender perspectives into legislation, public policies, programs and projects. This process enables making women's and men's concerns and experiences to be made an integral dimension of the design, implementation, monitoring and evaluation of policies and programs in all political, economic, and societal spheres with the goal of achieving gender equality (United Nations 2002).

Muslims

The Muslims in Nepal are also considered as vulnerable group.

Risk

The combination of the probability of an event and its negative consequences. UNISDR (2009). UNISDR Terminology on Disaster Risk Reduction. UNISDR: Geneva.

Strategic approach to mainstreaming

The use of diagnostics and analytics to identify the key gaps between males and females in a country or sector, and constraints to agency that will be targeted through operations to achieve clearly articulated results.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LISTS OF ANNEXURES

CHAPTER 1: PROJECT DESCRIPTION

1.0 INTRODUCTION

The Government of Nepal (GoN) has outlined an ambitious vision for economic development through the efficient use of the country's abundant water resources. This vision is encapsulated in a white paper promulgated by the Ministry of Energy, Water Resources, and Irrigation in May 2018. GoN has aim to generate 3000 MW by 2021, 5000 MW by 2023, and 15,000 MW (with 5000 MW for export) by 2028 on the supply side whereas, plan to raise annual per capita electricity consumption from 170 kWh to 700 kWh by 2023 and further to 1500 kWh by 2028. on the consumption side simultaneously, aligning with a commitment to achieving zero emissions by 2045.

According to the Transmission System Development Plan of Nepal (2018) proposed by Ministry of Energy, Water Resources and Irrigation (MoEWRI), power generation from different hydropower projects in the vicinity of Arun Hub region for Year 2040 is expected around 3450 MW. Nepal Electricity Authority (NEA) is prioritizing the development of the three transmission lines and two new substations (SS) that include 400/132 kV New Anarmani SS located at Haldibari RM ward 1, Jhapa District and 400/132 kV New Tingla SS located at Tingla next to the existing 132/33 kV Substation in Solududhkunda Municipality ward 11, Solukhumbu District respectively. There are three 400 kV double circuit transmission lines under Priority Transmission Line Project, which include:

- TL-1: 400 kV Arun Hub (Sitalpati)-Inaruwa (95km) and substations
- TL-2: 400 kV Arun Hub-Tingla-Dudhkoshi (110km) and substations
- TL-3: 400 kV Double circuit Inaruwa-Anarmani (89.612 km) and substation

Out of these three TLs, TL1 and TL2 will connect the electricity generated from Arun River Corridor and Solu River Corridor. Meanwhile, the third TL will connect the Inaruwa substation to New Anarmani substation that would enable electricity supply to the industrial area of Koshi Province. These TLs will also aid in the reliability of the electricity not only in Koshi Province but entire Nepal and trade with India and Bangladesh.

Proponent

Nepal Electricity Authority (NEA), Durbarmarg, Kathmandu, Nepal is the proponent of the TL-3, 400 kV double circuit Inaruwa-Anarmani (89.612 km) Transmission Line and substation **(**Ref.: **ANNEXURE-I)**

Nepal Electricity Authority (NEA)

Durbarmarg, Kathmandu, Nepal
Phone No.: 977 1 4220449
Fax: 977 1 4447969
Email: aitm400kvtlp@yahoo.com, neamd@nea.org.np

Nepal Electricity Authority (NEA), Durbarmarg, Kathmandu, Nepal has assigned the WAPCOS Ltd. India in association with ERMC (P) Ltd., Nepal to carry out and prepare the ESIA report of the proposed TL3- Arun hub-Inaruwa TL and SS. The address of consulting firm is:

WAPCOS Ltd. India in association with ERMC (P) Ltd. Nepal

76 C, Sector 18, Gurgaon - 122015, Haryana, India
Postal Code: Gurgaon - 122015
Phone No.: 0124-2397396
Fax: 0124-2397392
Email: environment@wapcos.co.in

Objectives of the ESIA study are as follows:

- Establish appropriate study area along transmission route to identify and assess physical, biological and social effects on the proposed project.
- Develop a comprehensive and environmentally relevant project description
- Prepare a description of the environment of the potentially affected/study area that includes the present relevant baseline information on the most important physical, biological, socio-cultural aspects of the project/study area.
- Assess the Project Alternatives.
- Describe and apply appropriate methodologies to identify project environment. cause/effect relationships, predict and evaluate environment and socio-cultural effects,
- Perform a rigorous assessment of the significance of bio-physical, socio-cultural and cumulative effects of the project.
- Identify and describe specific environmental mitigation measures for each significant impact
- Develop and describe Environmental Social Management Plan (ESMP) including the mitigatory measures
- Develop and describe Environmental Monitoring Program for implementation during project in construction and operation phases.

The environmental screening criteria in line with EPR 2020 for TL projects include:

- Brief Environmental Studies (BES)-Schedule 1, F, 1: All the projects up to 66 kV TL that require forest area;
- IEE-Schedule 2, F, 1A: 132 kVA or more than 132 kVA TL projects and
- EIA- Schedule 3, L: Implementation of Any project in National Park, Wildlife Reserve, Hunting Reserve.

The proposed TL project does not fall in any National Parks, Wildlife Reserves or Hunting Reserve. Similarly, this TL project is 400 kV double circuit, therefore, for the legal requirement in Nepal, it is necessary for preparation of Initial Environmental Examination (IEE) Report. However, for international financing purpose Environmental and Social Impact Assessment (ESIA) is required. ESIA document will be prepared in conformance with the World Bank (WB)'s requirements under the new Environmental and Social Framework (ESF), and its applicable provisions/ requirements of ESS 1 to ESS 8 and ESS 10 Performance Standards.

This report focuses on brief description of the policy, legal and administrative framework within which 400 kV double circuit Inaruwa-Anarmani (89.612 km) Transmission Line and substation project will be implemented. The proponent will fulfill the legal requirement of Government of Nepal (GoN) as well as The World Bank Environmental and Social Safeguard Policies and will be responsible for fulfilling provisions of all relevant acts while implementing the project. The ToR for IEE was approved by MoEWRI on 01.11.2022 (Ref.: **ANNEXURE II).**

During the preparation of the ESIA report of this proposed project, necessary information was collected through published and unpublished reports. For the secondary information, field study and different published maps were collected; whereas for the primary data information, HH (HH) questionnaires, checklists, sample surveys, measurement tests, laboratory tests, discussions and interaction meetings with the participation of key people at the project site were conducted. Appropriate methods were applied to analyze the primary and secondary information. Addition to that, the beneficial and adverse effects of the project were identified and estimated using experience of expert groups, checklists, and mapping. For significant evaluation of the impact, score/relative weight method, list of the protected species were used.

Taking into account, the nature of proposed project, its location, positive response of public, nature of the assessed environmental impact and the practical adverse impact mitigation measures that can be implemented, existing policies and laws, all aspects related to environmental management mentioned in this report are fully implemented. This project has been recommended for implementation along with the commitment to be made. And this project will continue under the rule of Nepal's constitution, policies, acts, rules, laws, etc. The project also promises to make the project environmentally friendly by removing or reducing all the possible environmental impacts that cannot be identified or estimated at the moment, but which may appear in the construction phase of the project and updating the ESIA report.

1.1 PROJECT OVERVIEW

Currently, there are Upper Arun (1061 MW), Irkhuwa HEP, Sankhuwa HEP, etc with a capacity of 3500 MW electricity generation along the Arun River corridorHowever, there is no connection between Arun Hub (Sitalpati) SS and the Main Grid in the Inaruwa substation. The proposed 400 kV double circuit Inaruwa-Anarmani (89.612 km) TL and substation is envisaged to evacuate the energy generated from planned hydropower projects in the Arun corridor making the system more reliable. The estimated average height of the tower will be 58.85 m and the types will be DA/DB/DC/DD. The average tower pad area will be 35 m X 35 m. The Right of Way (RoW) of the TL will be 23 m on each side from the centre line.

Upper Arun Hydroelectric Plant (HEP), Irkhuwa HEP, Sankhuwa HEP, etc. present along the Arun river corridor altogether has electricity generation capacity of 3500

MW, however, they are not connected to the Main Grid. The Priority project, TL-3: 400 kV Inaruwa-Anarmani (89.612 km) and SS will fulfill the energy demand of the industrial area of Koshi Province, and it will make the system more reliable by connecting at Inaruwa SS to the National Grid.

The estimated average height of the tower will be 70 m to 80 m and the tower types will be DA/DB/DC/DD in major portions. The average tower pad area will be 35 m X 35 m. The Right of Way (RoW) of the TL will be 23 m on each side from the centre line, starting from Inaruwa to New Anarmani substation. Quad Moose conductor has been proposed based on N-1 Contingency.

The project location is given in Figure 1-1 and 1-2.

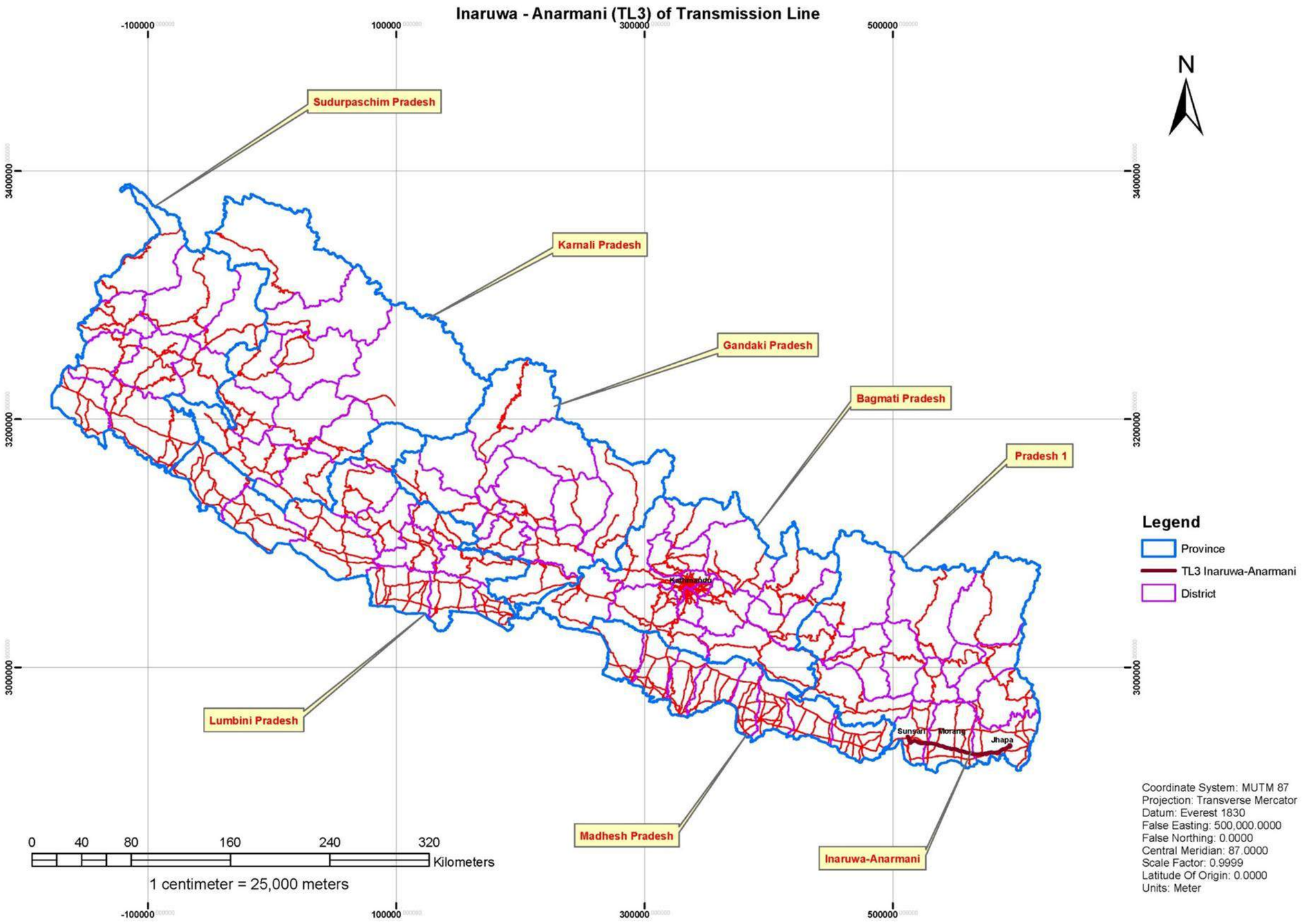


Figure 1.1: Project Location

(Source: ARC Map 10.8 and MoFAGA)

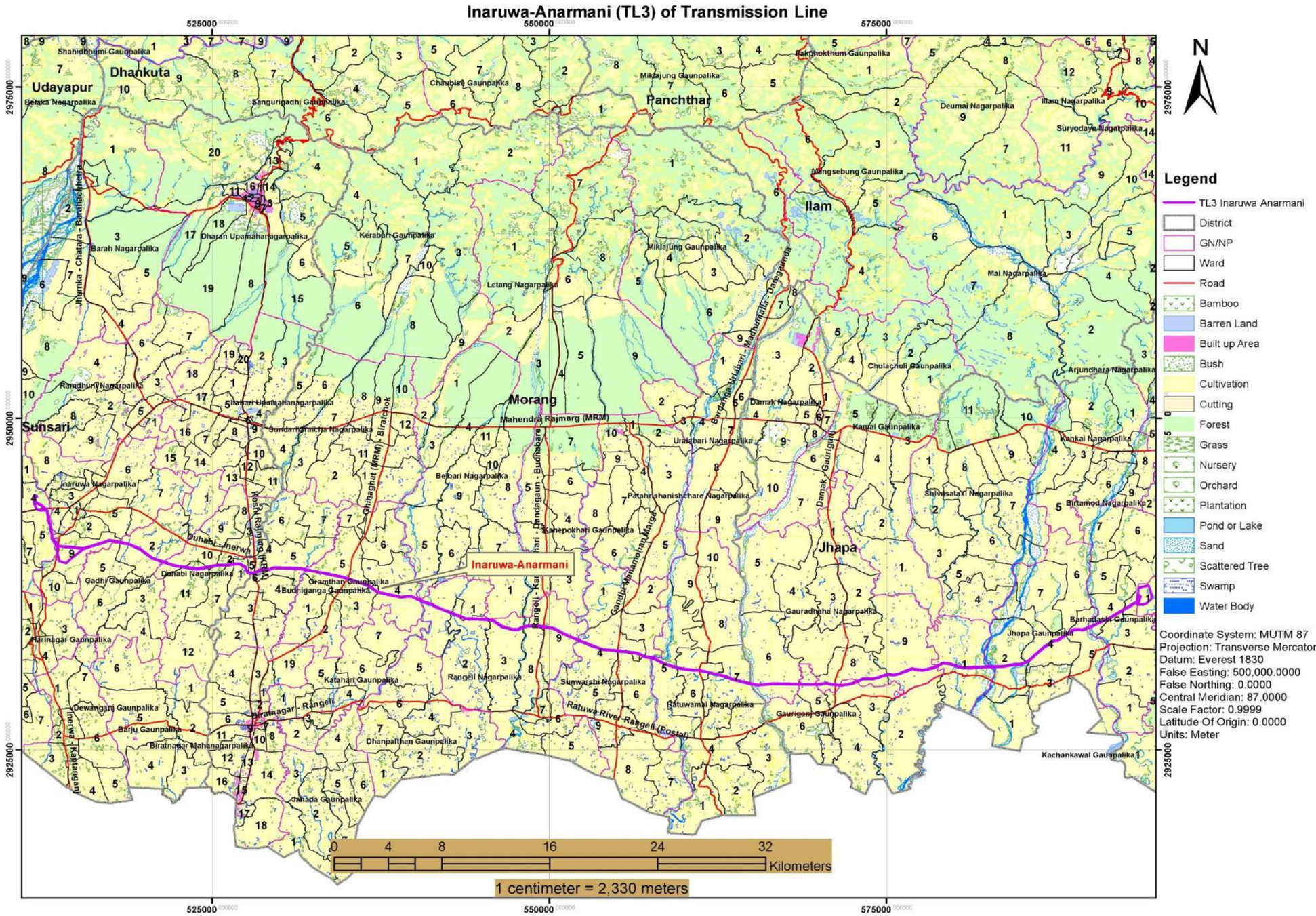


Figure 1.2: Project Location in Koshi Province Map

(Source: ARC Map 10.8 and MoFAGA)

1.2 PROJECT LOCATION

The Iaruwa-Anarmani tranmsmission line is located in Koshi Province of Nepal. This double circuit line will have Sitalpati sub-station in Arun Hub of Sankhuwasabha District and it passes through Inaruwa sub-station located at Sunsari District to Morang and then passes to New Anarmani sub-station at Jhapa District, Koshi Province, Nepal.

1.3 UNDERSTANDING OF THE PROJECT

The Priority TL project will be helpful to increase the reliability of the power supply in the load center of Eastern Nepal and support the regional power trade between Nepal, India, and Bangladesh through the following transmission line: TL-3: 400 kV Inaruwa-Anarmani (89.612 km) and substation. The proposed transmission line is as follows:

- TL-3: 400 kV double circuit Inaruwa to Anarmani (89.612 km), from Inaruwa, Bokraha Narsingh Rural Municipality, ward 4, Inaruwa substation, Sunsari District to Anarmani, Haldibari Rural Municipality, ward 1, Jhapa District. The settlements along the route include Bokraha Narsingh, Inaruwa, Duhabi, Budhiganga, Gramthan, Kanepokhari, Rangeli, Sunawarshi, Ratuwamai, Gauriganj, Gauradaha, Jhapa, Barhadashi and Haldibari.
- Elevation of the line varies from 84 m to 89 m, the total length of the Transmission line is about 89.612 km. The transmission line between Inaruwa to Anarmani is Terai region.
- The route passes from two community forests of Sunsari and there are no forests in the Morang and Jhapa districts. Most of the route passes from agricultural land and settlements (in zone of influence).

The protected area map of Nepal is given in Figure 1-3.

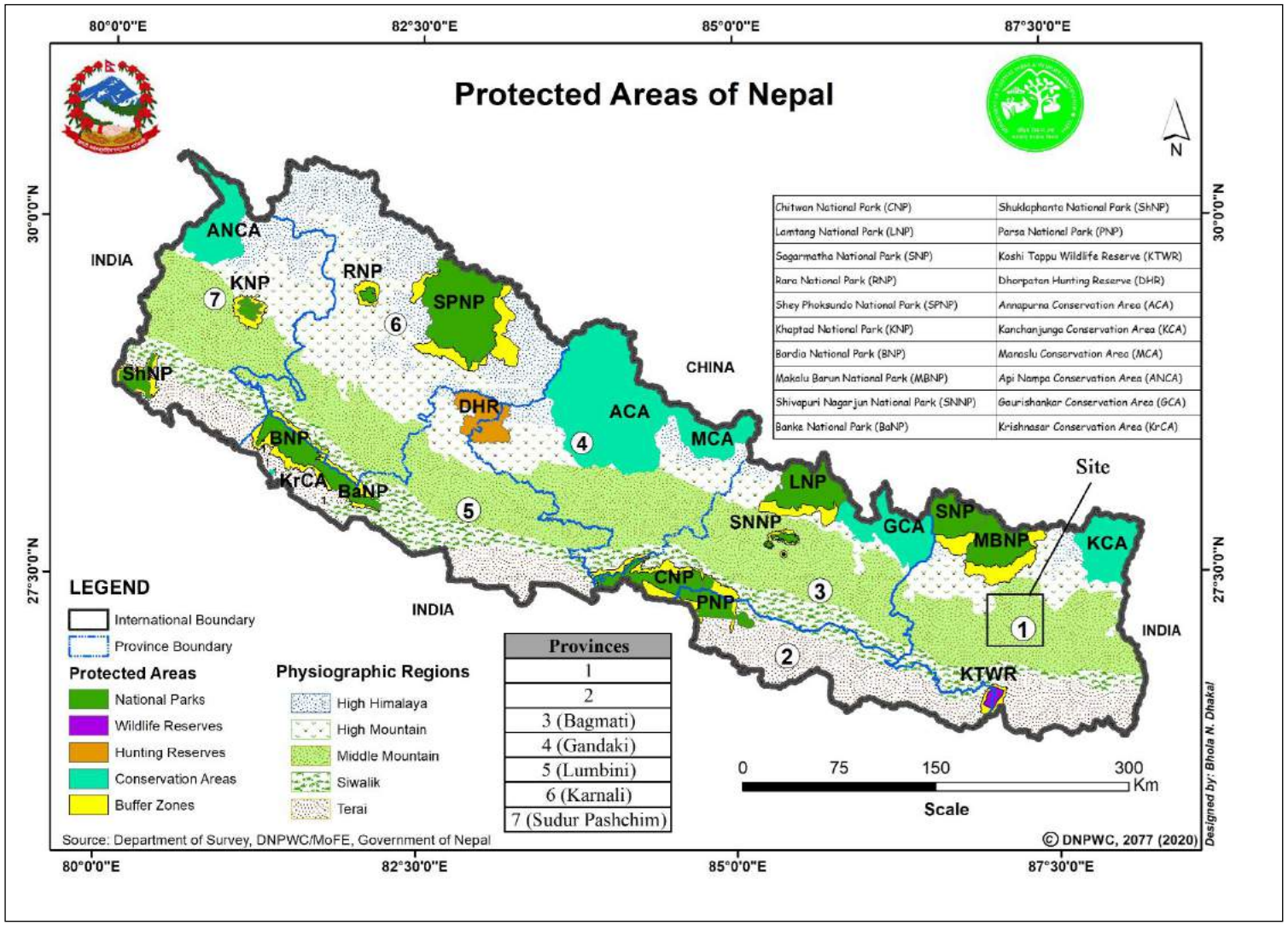


Figure 1.3: Protected Areas of Nepal

(Source: DNPWC, 2020)

1.4 PROJECT ACCESSIBILITY

The project area is assessable from Kathmandu via 351 km long black topped road to Inaruwa through Prithivi highway to Muglin, Madan Aashrit highway to Narayangarh and E-W highway or through BP Highway to Bardibas and E-W highway as in Figure 1-4.

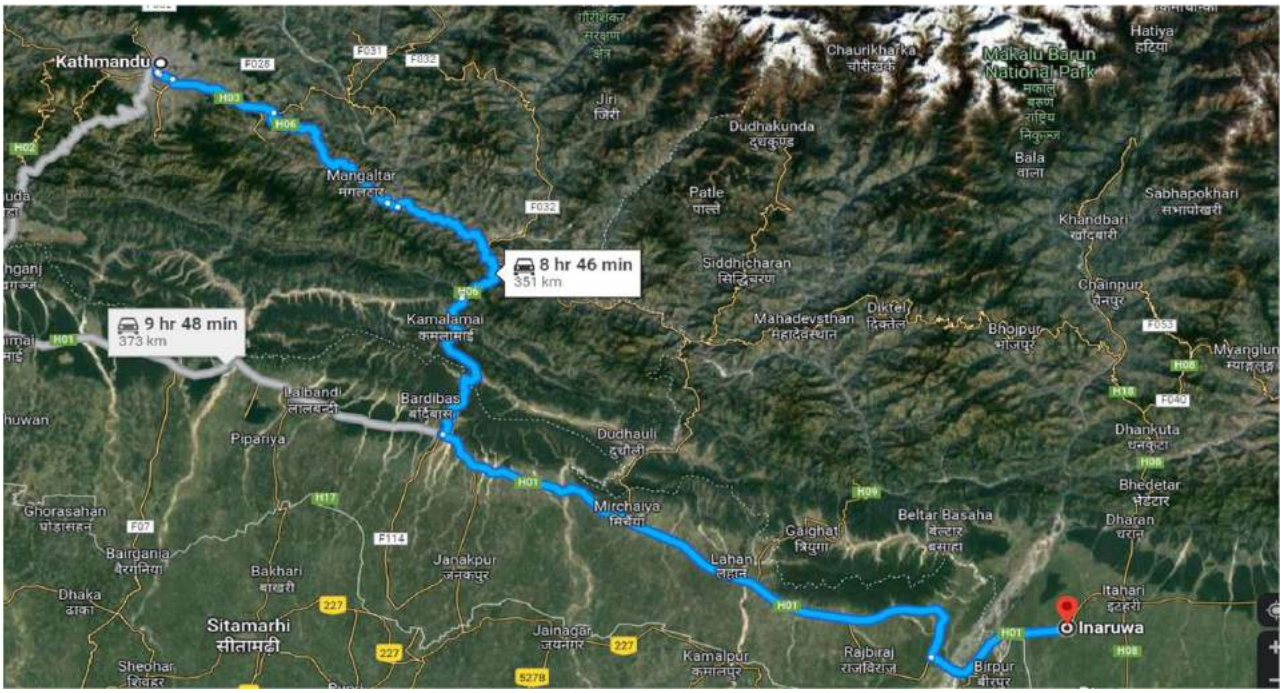


Figure 1.4: Project Accessibility from Kathmandu to Inaruwa Substation

(Source: Google Map 2022)

Similarly, there is shorter route through BP highway to Sindhuli and then Madan Bhandari Highway upto Chatara and then from Chatara to the Inaruwa substations for TL-3.

1.5 SALIENT FEATURES OF THE PROJECT

The salient features of the project are given in Table 1.1

Table 1.1: Salient Features of the proposed TL-3

Content	Description
Project Name	Inaruwa-Anarmani Transmission Line and substation (TL-3)
Contract	PSRSHD/NEA/TL/QCBS-2IDA, Credit No. 5728-NP
Proponent	Nepal Electricity Authority, Durbarmarg, Kathmandu, Nepal
Consultant	WAPCOS in association with ERMC
Location	

Province	**Koshi**		
Districts	Morang, Sunsari and Jhapa		
Local bodies	**Districts**	**Rural Municipality**	**Municipality**
	Sunsari	Bokraha Narsingh (Wards 4,5)	Inaruwa (Wards 4,9)
		Gadhi (Ward 2)	Duhabi (Ward 2)
	Morang	Budhiganga (Ward 5)	Rangeli (Wards 1,2,3,8,9)
		Gramthan (Wards 3,4)	Sunawarshi (Wards 3,4,6)
		Kanepokhari (Ward 1)	Ratuwamai (Wards 5,6,7)
	Jhapa	Gauriganj (Wards 1,3,5)	Gauradaha (Ward 6,8,9)
		Jhapa (Wards 2,4,5)	-
		Barhadashi (Wards 4,5)	-
		Haldibari (Ward 1)	-
Length of line	89.612 km		
Start Point (Inaruwa)	Barahakshetra Municipality, Ward 4 Inaruwa substation, Sunsari		
End Point (New Anarmani)	Haldibari-1, Jhapa		
Scope	• 89.612 km 400 kV Double Circuit TL • Four 400 kV Bay Extension at Inaruwa Substation • 400/132 kV New Anarmani Substation		
Tentative power transmission	2600 MW		
Transmission Voltage	400 kV		
No. of Circuits	Double Circuit		
Conductor	Quad moose		
Configuration	Vertical tower configuration		
Tower Type	Steel Lattice Tower (Self-supporting)		
DA	115		
DB	66		
DC	35		
DD	21		

Angle Towers	122
Total Towers	237
Height range of towers	60 to 80
Weight (kg/m)	33.6-64.3 Ton
Average Area of Tower Pad	35m X 35 m
Average Span	389.27 m
Minimum Span	142 m
Maximum Span	491 m
Earthwire	GSWE/OPGW
Foundation depth	3.5 m
Land Requirement	The total land requirements for the proposed project are 425.982 ha. The land to be acquired from community forest 3.488 ha, agriculture land 199.859 ha. barren GoN land 209.97 ha and river bed is 12.665.
Cost	142 Million USD
Construction Period	3 years

(Source: Feasibility Report, 2023)

1.6 PROJECT COMPONENTS

1.6.1 Towers

Types of towers based on their constructional features, in use on the power transmission lines are:

- Self-supporting towers
- Conventional Guyed towers
- Chainette Guyed towers

For all 237 towers, self-supporting steel lattice tower structure has been proposed. Self-supporting broad-based/ narrow based latticed steel towers are fabricated using tested quality mild steel or a combination of tested quality mild steel and high tensile steel. They usually have square/ rectangular base and four separate footings. They are also used for compact line design as in following figure. All towers have 6 cross arms in total 3 cross arm in either side that supports four moose conductors. Further, all towers are provided with twin peak- once for earthwire and one for OPGW.

The proposed tower types in TL-3 will be DA/DB/DC/DD. The average tower pad area will be 35 m X 35 m. There are 122 Angle Towers. Out of 237 Towers, DA will be 115, DB will be 66, DC will be 35 and DD will be 21.

1.6.1.1 Tower Height

The height of towers will range from 60 to 80 m. However, TL3 is proposed as double circuit therefore, the height of the tower will not exceed 80 meters. However, the maximum height of the towers for multi-circuit will not exceed above 98.53 m. The permission for the tower height has been granted by CAAN (Ref.: **ANNEXURE-III**). The maximum height of the tower for the following towers will be as given below in Table 1.2:

Table 1.2: Maximum Tower Height

SN	Tower no.	Tower Height (m)	Double Circuit Maximum height (m)
1	56	89.53	80
2	57	98.53	80
3	58	98.53	80
4	61	86.53	80
5	200	86.5	80
6	201	86.5	80

(Source: Feasibility Report, 2023)

1.6.1.2 Tower Configuration

The towers will be self-supporting lattice steel type, designed to carry Quad "MOOSE" line conductors with necessary insulators, optical fiber ground wire (OPGW) and steel earth wire and all fittings under all loading conditions. Normally the following types of double circuit towers shall be used for the proposed 400 kV transmission line as in Table 1.3 and Figure 1.5.

Table 1.3: Tower Configuration

Type of Tower	Deviation Limit	Typical Use
DA	0-2 deg.	a) To be used as tangent/suspension tower with suspension insulator strings
DB	2-15 deg.	• Angle towers with tension insulator strings • Also to be used for uplift force resulting from an uplift span up to 600 m under broken wire conditions • Also to be used for anti-cascading condition
DB	0 deg.	To be used as Section Tower
DC	15 to 30 deg.	• Angle towers with tension insulator strings • Also to be used for uplift force resulting from an uplift span up to 720 m under broken wire conditions

Type of Tower	Deviation Limit	Typical Use
		• Also to be used for anti-cascading condition
DC	0 deg.	To be used as Section Tower
DD/DDE	30 to 60 deg.	• Angle towers with tension insulator strings • Also to be used for uplift force resulting from an uplift span up to 900 m under broken wire conditions • Dead end with 0 deg. to 15 deg. deviation both on line side and sub-station side (slack span)
DD/DDE	0 deg.	• Complete dead end • For river crossing anchoring with longer wind span and 0 deg. Deviation on crossing span side and 0 deg. to 30 deg. deviation on other side

(Source: Feasibility Report 2023)

The typical Tower configuration is given below:

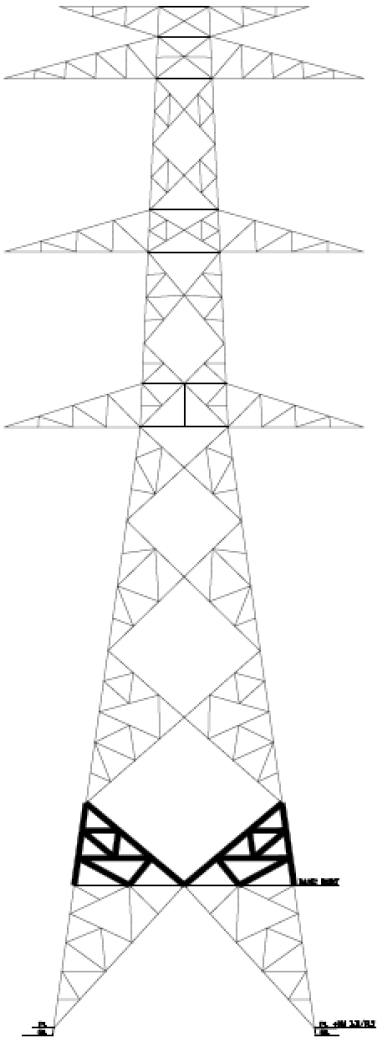


Figure 1.5: Tower Configuration

(Source: Feasibility Report, 2023)

1.6.2 Conductors and Earth Wires for the 400 kV TLs

Table 1.4 shows the main characteristics of the line conductors and of the earth wires for TL3.

Table 1.4: Conductors and Earth wires characteristics

Particulars	Details
Conductor Name	Quad Moose
Conductor Type	ACSR
Area	597 square meters
Aluminum	528.5 square meter

Particulars	Details
Steel	68.5 square meter
Bundle of conductor	4
Weight per meter	2.004 kg

(Source: Feasibility Report, 2023)

1.6.3 Minimum Clearance above Rivers/ Lakes/ Settlements/ Highway/ Cultivated land/ Road

The minimum clearance of power conductor over the highest flood level in case of rivers for a transmission line with nominal voltage of 400 kV is 9.5 m. There is need of 9.5 m, 12.5 m, 12.5 m, 9.5 m and 9.5 m clearance for crossing of settlement, road, highway, cultivated land, rivers or water bodies respectively. The details of the major crossing are in **ANNEXURE-IV.**

1.6.4 Clearances at Power Lines Crossing each Other.

The minimum clearance between the lowest power conductors of crossing line over the crossed line for line with nominal voltage of 400 kV areas under Table 1.5.

Table 1.5: Minimum Electrical Clearance as per Voltage Rating of Crossing Line

Voltage rating of crossing line (kV)/Other Lines	Minimum Vertical Clearance (m)
66	5.5
132	5.5
220	5.5
400	5.5
Telecommunication	4.55
Railways (Electrified)	8

(Source: Feasibility Report, 2023)

1.6.5 Disc Insulator

This TL will have Double “I” Suspension 2X 23 (240 kN), Single “I” suspension pilot 1 X 23 (120 kN), Quadruple tension 4 X 23 (640 kN) Disc Insulator will be used. The following types of suspension and tension insulator strings with long rod insulators are used for fixing of insulators to the towers of transmission lines.

- Single Suspension ‘I’ pilot - used on large deviation angle towers for restraining the jumper from coming closer to the tower body. Also used on transposition towers.
- Double Suspension ‘I’ string – River crossing or any other type of special suspension tower.

1.6.6 Earthwire

The earthwire of appropriate size is used to cater to predicted and design fault currents and lightning. The earthwire is GSEW/OPGW conductor type. Optic fiber ground wires are also used in another peak of tower. The height of ground wires shall be such that the line joining the ground wire to the outer most conductors shall make an angle with the vertical equal to the desired shield angle.

1.6.7 Grounding

Each tower shall be earthed such that tower footing resistance does not exceed 10 ohms. Each tower will be earthed after the foundation has been cast. Tower footing resistance of all towers will be measured in dry weather. Pipe type earthing installation will be as per ISO: 5613-1985(Part III / Section 2) and IS: 3043, 1991 for 400kV line. Counterpoise earth consists of four lengths of galvanized steel stranded wires, each fitted with a plug for connection to the tower leg at one end. Galvanized steel stranded wire preferably of the same size of the overhead ground wire is used for this purpose.

1.7 PROJECT FACILITIES AND REQUIREMENTS

The project facilities and requirements are described below while the construction machinery are included in **ANNEXURE-V**.

1.7.1 Human Resources

For the construction of this TL, total of 2,77,461 person/day are required. The details are given below in Table 1.6:

Table 1.6: Human Resource

SN	Human Resource	Types	Total Person-days
1	Site staff	Skilled	7,780
2	Design Engineer		54
3	Site Engineer		6,734
4	Quality Engineer		5,178
5	Safety Officer		3,795
6	Safety Steward		9,055
7	Surveyor		1,656
8	Supervisor		3,214
9	Foreman		11,964
10	Mason		1,695
11	Mounter		30,490
12	Fitter		33,311
13	Operator		1,039
14	Technician		64

SN	Human Resource	Types	Total Person-days
15	Survey Assistant	Semi-Skilled	1,656
16	Labour		57,795
17	Watchman		13,787
18	Labour	Unskilled	78,194
Total			2,77,461

(Source: Feasibility Report, 2023)

Apart from the human resources required for the construction works, additional human resources E&S management and monitoring and safeguard implementation will be required as proposed below:

- Environmental Safeguard Specialist – 18 person-months.
- Social Development and Safeguard Specialist - 18 person-months.
- Gender Equality and Social Inclusion Specialist – 9 person-months.
- Vulnerable and Indigenous People Specialist- 6 person-months.
- Biodiversity Expert- – 18 person-months.

1.7.2 Construction Power Requirement

During the construction phase, 4 DG sets of 500 kVA are required to provide the electric power or various purpose.

1.7.3 Water Requirement

During the construction phase, 22098.45 Kiloliters of water from underground and pipeline supply as well as from the nearby rivers/streams will be used.

1.7.4 Substation

There will be new substation at Anarmani and 4 bays extension at Inaruwa substation. There details are as follows:

New Anarmani

For 400 kV

- Type: GIS
- Busbar scheme: One and half breaker
- *Complete substation works with two* 400 kV line bay
- Two inter connecting 400/132 kV transformer bay

For 132 kV

- Type: AIS
- Busbar scheme: Double busbar
- *Complete substation works with two* 132 kV line bay
- Two inter connecting 132 kV transformer bay

Inaruwa Substation

- Type: GIS
- Busbar scheme: One and half breaker
- Bay Extension complete works with four 400 kV line bay

1.7.5 Construction Material Requirement

The requirement of construction material and the quantities of different items for the proposed TL project is given in Table 1.7.

Table 1.7: Construction Material

S.No.	Item Description	Unit	Amount
Transmission Line			
1	Tower Details		
1.1	Fabrication, galvanising and supply of various types of towers and tower parts, tower/leg extensions (complete) excluding stubs and bolts and nuts but including hangers, D-shackles, pack washer etc.		
i)	High Tensile Steel	MT	12104.00
ii)	Mild Steel	MT	1625.00
1.2	Fabrication, galvanising and supply of stubs with cleats for various types of towers and tower extensions; gantries (complete) with pack washers excluding supply of bolts and nuts.		
i)	High Tensile Steel	MT	929.00
1.3	Supply of Bolts and Nuts for towers and gantry structures including Step Bolts, spring washers, etc.		
i)	Hexagonal Bolts and Nuts	MT	757.00
ii)	Bolts and Nuts for stubs	MT	24.00
2.0	Design, manufacture and supply of the following line material		
2.1	Conductors		
i)	ACSR MOOSE Conductor (597.03 Sq.mm)	km	2243.50
2.2	GS Earthwire		
i)	GS 7/3.66 mm size	km	93.70
2.3	Insulators		
i)	Insulator Disc 120KN	No.	169042.00
ii)	Insulator Disc 160KN	No.	120557.00
2.4	Hardware Fittings		
i)	Single Suspension Pilot Insulator String for Quad ACSR MOOSE conductor (suitable for 120 KN Insulators)	Sets	73.00
ii)	Single Tension Insulator String for Quad ACSR MOOSE conductor (suitable for 160 KN Insulators)	Sets	2546.00
iii)	Double 'I' suspension Insulator String for Quad ACSR MOOSE conductor (Suitable for 120 KN insulators)	Sets	1412.00
iv)	Quadruple Tension Insulator String for Quad ACSR MOOSE conductor (suitable for 160 KN Insulators)	Sets	1160.00
2.5	Accessories for Conductor and Earthwire		
a)	Accessories for ACSR MOOSE Conductor		

S.No.	Item Description	Unit	Amount
i)	Mid span compression joint for conductor	Nos	1247.00
ii)	T-connector	Nos	0.00
iii)	Repair Sleeve for Conductor	Nos	429.00
iv)	Quad Spacer Damper for Conductor	Nos	31339.00
v)	Quad Rigid Spacer for Conductor	Nos	0.00
b)	Accessories for 7/3.66mm GS earthwire		
i)	Mid span compression joint	Nos	49.00
ii)	Flexible Cu. Bond	Nos	742.00
iii)	Vibration Damper	Nos	487.00
iv)	Earthwire Suspension Clamp	Nos	115.00
v)	Earthwire Tension Clamp	Nos	127.00
3.0	Fibre Cable and Accessories		
3.1	OPGW Cables and Accessories		
3.1.1	24 Fibre (DWSM) OPGW Fibre optic cable	km	95.50
3.1.2	Installation Hardware set for 24 Fibre (DWSM) OPGW		
i)	Suspension Assembly	Set	115.00
ii)	Tension Assembly		
a)	Dead end Assembly	Set	3.00
b)	Tension Assembly (For Joint Box locations)	Set	21.00
c)	Pass through assembly	Set	109.00
d)	Tension Assembly at suspension tower (For Joint Box	Set	0.00
iii)	Vibration Damper	No.	487.00
iv)	Down Lead Clamp Assemblies	No.	765.00
3.1.3	Joint Box (24 Fibre)	No.	20.00
3.1.4	FODP 96F : Indoor Type, rack mounted with FCPC coupling	No.	
3.1.5	Fibre Optic approach cable: 24 Fibre (DWSM)	km	3.00
4	Work Associated with Tower Foundations for various types of		
4.1	Excavation in various types of soils		
i)	Dry Soil	Cum	48534.80
ii)	Wet Soil	Cum	279445.00
4.2	Concreting (including all associated works related to foundation not covered in excavation and reinforcement steel works)		
i)	Concreting (1:1.5:3)	Cum	72450.00
	Rebar	MT	7109.16
	Cement	MT	29704.50
	Sand	cum	30429.00
	Aggregate	cum	62307.00
	Water	Kltr	17388.00
ii)	Lean Concrete (1:3:6)	Cum	4233.00
	Cement	MT	956.66
	Sand	cum	1955.65
	Aggregate	cum	3911.29
	Water	Kltr	761.94
5	Protection of tower footing (supply and installation)		

S.No.	Item Description	Unit	Amount
a)	Random rubble stone masonary including excavation (1:4 cement mortar)	cum	5000.00
	Cement	MT	795.00
	Stone	cum	5500.00
	Sand	cum	2250.00
	Water	Kltr	500.00
b)	Stone bound in galvanising wire netting including excavation (Gabion)	cum	7500.00
	Stone	cum	7500.00
	GI Wire	kg	153375.00
	Inaruwa substation		
1	Pre-Engineered GIS Building		
1.1	Supply, fabrication of M.S. (Mild Steel) Structural steel as per TS (Technical Specification) to complete the works		
1.1.1	columns	MT	57.00
1.1.2	supplementary facade columns	MT	7.50
1.1.3	horizontal wall beams	MT	35.00
1.1.4	crane beams	MT	35.00
1.1.5	roof beams	MT	20.00
1.1.6	roof purlins	MT	50.00
1.1.7	wall purlins	MT	66.00
1.1.8	Lateral fapade bracings, up to crane beam level	MT	11.00
1.1.9	Lateral fapade bracings, from crane beam level to roof level	MT	10.00
1.1.10	Roof bracings	MT	10.00
1.1.11	junctions, connections, plates, base plates, etc.: + 15% main sections	MT	43.00
1.2	Other Miscellaneous item such as roof panels/wall panels etc. as per TS to complete the works		
1.2.1	Roof Panel	Sq.Mtr	1300.00
1.2.2	Wall Panel	Sq.Mtr	2600.00
1.2.3	Floor (ceramic and anti-skid)	Sq.Mtr	1200.00
2	Excavation in all types of soil and rock including backfilling disposal etc. for general levelling	Cum	9945.00
3	Filling to final level arrangement with borrowed material	Cum	12675.00
4	Concrete (1:4:8)	Cum	203.78
	Cement	MT	34.44
	Sand	cum	95.98
	Aggregate	cum	192.16
	Water	Kltr	30.99
5	Concreting (1:2:4)	Cum	146.25

S.No.	Item Description	Unit	Amount
	Rebar	MT	14.35
	Cement	MT	47.09
	Sand	cum	65.52
	Aggregate	cum	131.04
	Water	Kltr	26.33
6	Concreting (1:1:2)	Cum	1326.00
	Rebar	MT	130.11
	Cement	MT	426.97
	Sand	cum	594.05
	Aggregate	cum	1188.10
	Water	Kltr	238.68
7	Miscellaneous Structural steel used for rails , plactes for rail fixing, gratings, gratings supports etc for transformer /reactor foundation, etc	MT	9.75
8	External fence masonry, 30 cm thick, equivalent to average 36 cm thickness	cum	292.50
	Cement	MT	46.51
	Stone	cum	321.75
	Sand	cum	131.63
	Water	Kltr	29.25
9	Stone filling (40mm) over grating of Transformer /Reactor Foundation (5 x 35 mc 400kV + 2 x 20 mc 132kV)	cum	41.93
10	GIS BUILDING Civil Works		
10.1	Excavation foundations (including Control Building)	cum	1014.00
10.2	PCC for lean concrete under foundations		
10.2.1	Concrete (1:4:8)	Cum	64.35
10.2.2	Cement	MT	10.88
10.2.3	Sand	cum	30.31
10.2.4	Aggregate	cum	60.68
10.2.5	Water	Kltr	9.79
10.3	RCC for mat foundation reinforced concrete		
10.3.1	Concreting (1:1.5:3)	Cum	253.50
10.3.2	Rebar	MT	24.87
10.3.3	Cement	MT	103.94
10.3.4	Sand	cum	106.47
10.3.5	Aggregate	cum	218.01
10.3.6	Water	Kltr	60.84
11	CONTROL BUILDING Civil Works		
11.1	Filling with borrowed material (including GIS Building)	cum	468.00
11.2	PCC for lean concrete under foundation	cum	17.55
11.2.1	Concrete (1:4:8)	Cum	64.35
11.2.2	Cement	MT	10.88
11.2.3	Sand	cum	30.31
11.2.4	Aggregate	cum	60.68
11.2.5	Water	Kltr	9.79
12.1	RCC for reinforced concrete		

S.No.	Item Description	Unit	Amount
12.2	Mat foundation 80 cm th.	cum	68.25
12.3	columns foundation reverse beams/walls	cum	101.40
12.4	columns	cum	7.80
12.4.1	Concreting (1:1.5:3)	Cum	231.47
12.4.2	Rebar	MT	22.71
12.4.3	Cement	MT	94.90
12.4.4	Sand	cum	97.22
12.4.5	Aggregate	cum	199.06
12.4.6	Water	Kltr	55.55
13	Plaster (1:4)	Sqm	588.90
13.1	Cement	MT	2.31
13.2	Sand	cum	6.66
13.3	Water	Kltr	2.59
13	FOUNDATIONS of GANTRIES and ELECTRICAL		
	400kV section		
14	Excavation in all types of soil and rock	cum	1989.00
15	PCC for lean concrete under foundations		
15.1	Concrete (1:4:8)	Cum	136.50
15.1	Cement	MT	23.07
15.1	Sand	cum	64.29
15.1	Aggregate	cum	128.72
15.1	Water	Kltr	20.76
16	RCC for reinforced concrete	cum	448.50
16.1	Concreting (1:1.5:3)	Cum	597.98
16.2	Rebar	MT	58.68
16.3	Cement	MT	245.17
16.4	Sand	cum	251.15
16.5	Aggregate	cum	514.26
16.6	Water	Kltr	143.52
17	Miscellaneous Structural steel	MT	7.22
18	Filling with borrowed material	cum	1365.00
19	Losing water well, diam. 300 mm, 10 m deep, filled with gravel 30-50 mm dimensions, as drainage for cable trenches, step 20 m	N°	3.90
20	Supplying and laying of drainage piping along internal roads and buildings,		
20.1	250mm dia	RM	175.50
20.2	300mm dia	RM	273.00
20.3	Asphalt road 4.0 meter width (including all crossings) as per technical specification and approved drawing	Sq. m.	1911.00
20.4	Construction of two rails-cum-road including all items such as excavation, compaction, rolling, watering, WBM, etc	Sq. m.	43.88
20.5	Switchyard Gate excluding concrete	No	0.20

S.No.	Item Description	Unit	Amount
21.1	80mm Dia GI Pipe	RM	48.75
21.2	25mm Dia GI Pipe	RM	19.50
	Anarmani Substation		
1	400kV Switchyard section		
1.1	400kV M.S. (Mild Steel) Structural steel including Foundation Bolts	MT	400.00
1.2	400kVFastners and step bolts.(Nuts, Bolts and Washers)	MT	10.00
2	132kV Switchyard section		
2.1	132kV M.S. (Mild Steel) Structural steel including Foundation Bolts	MT	240.00
2.2	132kV Fastners and step bolts.(Nuts, Bolts and Washers)	MT	6.00
3	Pre-Engineered GIS Building		
3.1	Supply, fabrication of M.S. (Mild Steel) Structural steel as per TS (Technical Specification) to complete the works		
3.1.1	columns	MT	57.00
3.1.2	supplementary facade columns	MT	7.50
3.1.3	horizontal wall beams	MT	35.00
3.1.4	crane beams	MT	35.00
3.1.5	roof beams	MT	20.00
3.1.6	roof purlins	MT	50.00
3.1.7	wall purlins	MT	66.00
3.1.8	Lateral facade bracings, up to crane beam level	MT	11.00
3.1.9	Lateral facade bracings, from crane beam level to roof level	MT	10.00
3.1.10	Roof bracings	MT	10.00
3.1.11	junctions, connections, plates, base plates, etc.: + 15% main sections	MT	43.00
4	Other Miscellaneous item such as roof panels/wall panels etc. as per TS to complete the works		
4.1	Roof Panel	Sq.Mtr	1300.00
4.2	Wall Panel	Sq.Mtr	2600.00
4.3	Floor (ceramic and anti-skid)	Sq.Mtr	1,200.00
4.4	Architectural finishing (Doors, Windows,)	LS	1.00
4.5	Water supply, sewage, rainwater draining	LS	1.00
5	SWITCHYARD Civil Works (400kV and 132kV sections)		
5.1	Earthmoving (Excavation and Backfilling)		
5.1.1	Excavation in all types of soil and rock including backfilling disposal etc. for general levelling	Cu.Mtr.	41310.00
5.1.2	Filling to final level arrangement with borrowed material		
5.1.3	Filling in dry earth, mixed with gross gravel or crushed rubble	Cu.Mtr	14580.00

S.No.	Item Description	Unit	Amount
5.1.4	Embankment, 35 cm thick, in 2 layers rolled and compacted	Cu.Mtr	19035.00
5.1.5	Final surface layer, 15 cm thick, in stone spreading, including antiweed treatment in switchyard	Cu.Mtr	7695.00
5.1.6	Excavation in all types of soil, including backfilling disposal etc. for perimetral fence, drainage piping, drainage channel, cable trenches, etc	Cu.Mtr.	11340.00
6	Providing and laying of Plain Cement Concrete (PCC) (1:4:8)		
6.1	for perimetral masonry fence foundation	Cu.Mtr.	324.00
6.2	for drainage channel to water outlet (switchyard and access road)	Cu.Mtr.	125.55
6.3	for cable trenches	Cu.Mtr.	72.90
6.4	for levelling of drainage piping internal roads lateral	Cu.Mtr.	324.00
	Cement	MT	143.05
	Sand	cum	398.68
	Aggregate	cum	798.20
	Water	Kltr	128.75
7	Providing and laying of Plain Cement Concrete (PCC) (1:2:4)		
7.1	for local draining dewatering piping	Cu.Mtr.	162.00
7.2	for internal road culverts	Cu.Mtr.	356.40
7.3	for access road culverts	Cu.Mtr.	89.10
7.4	Concreting (1:2:4)	Cum	607.50
	Rebar	MT	59.61
	Cement	MT	195.62
	Sand	cum	272.16
	Aggregate	cum	544.32
	Water	Kltr	109.35
8	Providing and laying of Reinforced Cement Concrete Design Mix (M20 cubic resistance) including precast, shuttering, grouting of pockets and underpinning but excluding formworks and steel reinforcement.		
8.1	for perimetral masonry fence foundation	Cu.Mtr.	2916.00
8.2	for drainage channel to water outlet (switchyard and access road)	Cu.Mtr.	1458.00
8.3	for cable trenches	Cu.Mtr.	405.00
8.4	for road precast culverts	Cu.Mtr.	729.00
	Concreting (1:1.5:3)	Cum	5508.00
	Rebar	MT	58.68
	Cement	MT	245.17
	Sand	cum	251.15
	Aggregate	cum	514.26
	Water	Kltr	143.52
9	Steel Reinforcement (Fe 500) - 85 kg/Cu.Mtr average value	MT	437.40

S.No.	Item Description	Unit	Amount
10	Miscellaneous Structural steel used for rails , plactes for rail fixing, gratings, gratings supports etc for transformer /reactor foundation, etc	MT	40.50
11	External fence masonry, 30 cm thick, equivalent to average 36 cm thickness	Cu.Mtr.	1215.00
12	Stone filling (40mm) over grating of Transformer /Reactor Foundation (5 x 35 mc 400kV + 2 x 20 mc 132kV)	Cu.Mtr.	174.15
13	Supplying and laying of drainage piping along internal roads and buildings,		
13.1	250mm dia	RM	729.00
13.2	300mm dia	RM	1134.00
14	Asphalt road 4.0 meter width (including all crossings) as per technical specification and approved drawing	Sq. m.	7938.00
14.1	Construction of two rails-cum-road including all items such as excavation, compaction, rolling, watering, WBM, etc	Sq. m.	182.25
14.2	Switchyard Gate excluding concrete	No	0.81
15.1	80mm Dia GI Pipe	RM	202.50
15.2	25mm Dia GI Pipe	RM	81.00
16	External sewerage system including all item such as excavation, piping, pipe fittings, manholes, trap, chamber etc.		
16.1	External diameter 250 mm	RM	405.00
17	Miscellaneous Structural steel used for internal safety fences	MT	24.30
18	GIS BUILDING Civil Works		
18.1	Excavation foundations (including Control Building)	Cu.Mtr.	4212.00
18.2	PCC for lean concrete under foundations	Cu.Mtr.	267.30
	Concreting (1:2:4)	Cum	267.30
	Cement	MT	45.17
	Sand	cum	125.90
	Aggregate	cum	252.06
	Water	Kltr	40.66
18.3	RCC for mat foundation reinforced concrete	Cu.Mtr.	1053.00
	Concreting (1:1.5:3)	Cum	1053.00
	Rebar	MT	103.33
	Cement	MT	431.73
	Sand	cum	442.26
	Aggregate	cum	905.58
	Water	Kltr	252.72
19	Reinforcement Steel for above RCC - 90 kg/Cu.Mtr (average value)	MT	97.20
20	CONTROL BUILDING Civil Works		

S.No.	Item Description	Unit	Amount
20.1	Excavation foundations (already included in GIS Building section)		Cu.Mtr.
20.2	Filling with borrowed material (including GIS Building)	Cu.Mtr.	1944.00
20.3	PCC for lean concrete under foundation	Cu.Mtr.	72.90
	Concreting (1:2:4)	Cum	72.90
	Cement	MT	12.32
	Sand	cum	34.34
	Aggregate	cum	68.74
	Water	Kltr	11.09
20.4	RCC for reinforced concrete		
20.4.1	Mat foundation 80 cm th.	Cu.Mtr.	283.50
20.4.2	columns foundation reverse beams/walls	Cu.Mtr.	421.20
20.4.3	columns	Cu.Mtr.	32.40
20.4.4	beams (33kV room and roof level)	Cu.Mtr.	82.62
20.4.5	33kV room and roof slab	Cu.Mtr.	81.00
20.4.6	roof surrounding	Cu.Mtr.	18.63
20.4.7	external steel platform foundation, and footpath	Cu.Mtr.	40.50
20.4.8	Internal RCC stairs	Cu.Mtr.	1.62
	Concreting (1:1.5:3)	Cum	961.47
	Rebar	MT	94.34
	Cement	MT	394.20
	Sand	cum	403.82
	Aggregate	cum	826.86
	Water	Kltr	230.75
21	Reinforcement Steel for above RCC - 130 kg/Cu.Mtr average	MT	124.74
22	Structural steel for external platform, handrails, supports	MT	19.44
23	Architectural/Finishing Works		
23.1	External masonry 36 cm thick	Cu.Mtr	125.55
23.2	Internal masonry 20 cm thick	Cu.Mtr	52.65
	Subtotal	Cu.Mtr	178.20
	Cement	MT	28.33
	Stone	cum	196.02
	Sand	cum	80.19
	Water	Kltr	17.82
24.1	External plastering	Sq.Mtr	348.30
24.2	External painting	Sq.Mtr	348.30
24.3	Internal plastering	Sq.Mtr	874.80
24.4	Internal Painting	Sq.Mtr	874.80
	Plaster (1:4)	Sqm	2446.20
	Cement	MT	9.61

S.No.	Item Description	Unit	Amount
	Sand	cum	27.67
	Water	Kltr	10.76
	FOUNDATIONS of GANTRIES and ELECTRICAL		
25	400kV section		
26	Excavation in all types of soil and rock	Cu.Mtr.	8262.00
27	PCC for lean concrete under foundations	Cu.Mtr.	567.00
	Concrete (1:4:8)	Cum	567.00
	Cement	MT	95.82
	Sand	cum	267.06
	Aggregate	cum	534.68
	Water	Kltr	86.24
28	RCC for reinforced concrete	Cu.Mtr.	1863.00
	Concreting (1:1.5:3)	Cum	1863.00
	Rebar	MT	182.81
	Cement	MT	763.83
	Sand	cum	782.46
	Aggregate	cum	1602.18
	Water	Kltr	447.12
29	Reinforcement Steel for above RCC	MT	162.00
30	Miscellaneous Structural steel	MT	29.97
31	Filling with borrowed material	Cu.Mtr.	5670.00
32	132kV section		
33	Excavation in all types of soil and rock	Cu.Mtr.	4406.40
33	PCC for lean concrete under foundations	Cu.Mtr.	469.80
	Concrete (1:4:8)	Cum	469.80
	Cement	MT	79.40
	Sand	cum	221.28
	Aggregate	cum	443.02
	Water	Kltr	71.46
34	RCC for reinforced concrete	Cu.Mtr.	1336.50
	Concreting (1:1.5:3)	Cum	1336.50
	Rebar	MT	131.14
	Cement	MT	547.97
	Sand	cum	561.33
	Aggregate	cum	1149.39
	Water	Kltr	320.76
35	Reinforcement Steel for above RCC	MT	113.40
36	Miscellaneous Structural steel	MT	44.55
37	Filling with borrowed material	Cu.Mtr.	2592.00

(Source: Feasibility Report, 2023)

1.7.6 Access Road Requirement

The access is necessary for reaching at particular tower position during the construction phase.

1.7.7 Construction Material Availability

The construction material is available at different places along the river. However, the required material will be borrowed/ extracted by the contractor by following the regulations of the GoN. During the survey, following locations were identified for availability of the construction material (Ref: Table-1.8).

Table 1.8: Construction Material Availability

S.N.	Description	Location Detail
1	Sand, Aggregate and Water are available between tower No. 1 to tower No.58	517427, 2965187 Patnali Khola
2	Sand, Aggregate and Water are available between tower No. 59 to tower No.74	533135, 2950453 Budhi Khola
3	Sand, Aggregate and Water are available between tower No. 75 to tower No.107	563241, 2956248 Madhumalla
4	Sand, Aggregate and Water are available between tower No. 108 to tower No.122	566177, 2955925 Mawa Khola
5	Sand, Aggregate and Water are available between tower No. 123 to tower No.236	570349, 2953574 Ratuwa Khola

(Source: Feasibility Report, 2023)

1.7.8 Labor Camps

Twenty one labor camps have been proposed for construction purpose. The details of the camps are given in Table 1.9.

Table 1.9: Details of Labor Camps

S.N.	Description	Location Detail	Local Level
1	Identified location for the labour camp for the construction of tower No. 1 to tower No. 8	512252, 2942446	Bhokraha-4 Sunsari
2	Identified location for the labour camp for the construction of tower No. 9 to tower No. 20	514716, 2939618	Inaruwa-9, Sunsari
3	Identified location for the labour camp for the construction of tower No. 21 to tower No. 27	517811, 2941960	Barah-8, Sunsari
4	Identified location for the labour camp for the construction of tower No. 28 to tower No. 38	520554, 2938765	Gadhi-2, Sunsari
5	Identified location for the labour camp for the construction of tower No. 39 to tower No. 50	525424, 2938220	Duhabi-10, Sunsari
6	Identified location for the labour camp for the construction of tower No. 51 to	527056, 2938285	Duhabi-2, Sunsari

S.N.	Description	Location Detail	Local Level
	tower No. 58		
7	Identified location for the labour camp for the construction of tower No. 59 to tower No. 67	531400, 2938018	Budhiganga-5, Morang
8	Identified location for the labour camp for the construction of tower No. 68 to tower No. 80	535497, 2937075	Gramthan-5, Morang
9	Identified location for the labour camp for the construction of tower No. 81 to tower No. 90	538184, 2936098	Gramthan-4, Morang
10	Identified location for the labour camp for the construction of tower No. 91 to tower No. 100	542200, 2934880	Rangeli-1 Morang
11	Identified location for the labour camp for the construction of tower No. 101 to tower No. 111	545884, 2934031	Rangeli-2 Morang
12	Identified location for the labour camp for the construction of tower No. 112 to tower No. 122	550148, 2933494	Rangeli-8, Morang
13	Identified location for the labour camp for the construction of tower No. 123 to tower No. 138	556439, 2931612	Sunbarshi-4, Morang
14	Identified location for the labour camp for the construction of tower No. 139 to tower No. 156	559683, 2930489	Ratuwamai-5, Morang
15	Identified location for the labour camp for the construction of tower No. 157 to tower No. 168	567164, 2929295	Gauradaha-6, Jhapa
16	Identified location for the labour camp for the construction of tower No. 169 to tower No. 182	573364, 2929668	Gaurigunj-8, Jhapa
17	Identified location for the labour camp for the construction of tower No. 183 to tower No. 192	577069, 2930397	Gauradaha-9, Jhapa
18	Identified location for the labour camp for the construction of tower No. 193 to tower No. 202	580834, 2930513	Gaurigunj-1, Jhapa
19	Identified location for the labour camp for the construction of tower No. 203 to tower No. 210	583795, 2930624	Jhapa-2, Jhapa
20	Identified location for the labour camp for the construction of tower No. 211 to tower No. 225	587519, 2932556	Jhapa-3, Jhapa

S.N.	Description	Location Detail	Local Level
21	Identified location for the labour camp for the construction of tower No. 226 to tower No. 236	591466, 2934215	Barahdashi-4, Jhapa

(Source: Feasibility Report, 2023)

1.7.9 Waste Disposal Areas

The waste disposal sites have been selected near the RoW where environmental or social issues are not likely to be accrued. The locations details are given in Annex VII.

1.7.10 Land Requirements

The total land required for the proposed project are 425.98 ha. The land to be acquired from community forest 3.49 ha, agriculture land 199.86 ha., barren GoN land 209.97 ha and river bed is 12.67. The detail break-up of land is given in Table1.10.

Table 1.10: Total land required for the project.

Objectives	Project Structures	Land Types (Ha.)				Total in Ha.
		Forest Area	Agriculture Land	Barren Land	River Bed	
		Community Forest	Private	GoN	GoN	
Permanent	Tower Pad	1.37	25.09	0	3.97	30.43
	Substation	0	7.04	0	0	7.04
Land Use Restriction	RoW	2.12	167.73	209.97	8.70	388.52
Total		3.49	199.86	209.97	12.67	425.98

(Source: Feasibility Report, 2023)

1.7.11 Loss of Private Land

The district wise private land required for the proposed project is given in Table 1-11 The total private land needs to be acquired is 199.86 ha. It includes land in RoW and land required for tower pads.

Table 1.11: District wise land requirement of Private Land

SN	Districts	Land Acquisition	
		Tower Pad	RoW
1	Jhapa	8.77	74.16
2	Morang	5.54	49.67
3	Sunsari	10.78	43.90

SN	Districts	Land Acquisition	
		Tower Pad	RoW
Total		**25.09**	**167.73**

(Source: Feasibility Report, 2023)

1.7.12 Construction schedule

The construction is estimated to be completed in 3 years and details are given in Figures 1.6 and 1.7 respectively. Both the construction schedules explains the construction planning as following steps:

- Check Survey
- Clearing right of way
- Excavation
- Setting of stubs
- Casting of foundations
- Erection of towers
- Stringing of conductor and Ground wires
- Final checking and Commissioning

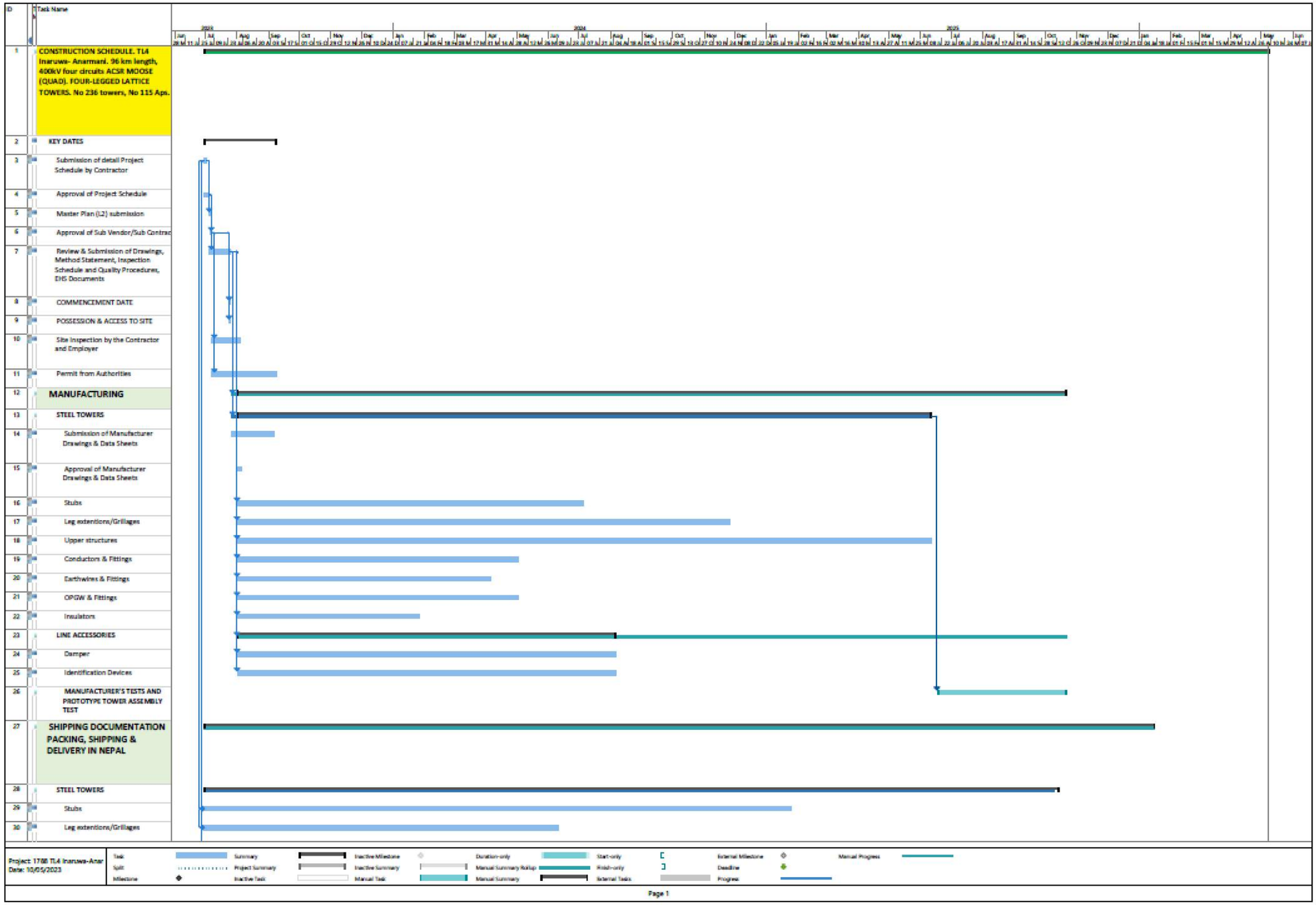


Figure 1.6: Construction Schedule A

Source: Feasibility Report, 2023

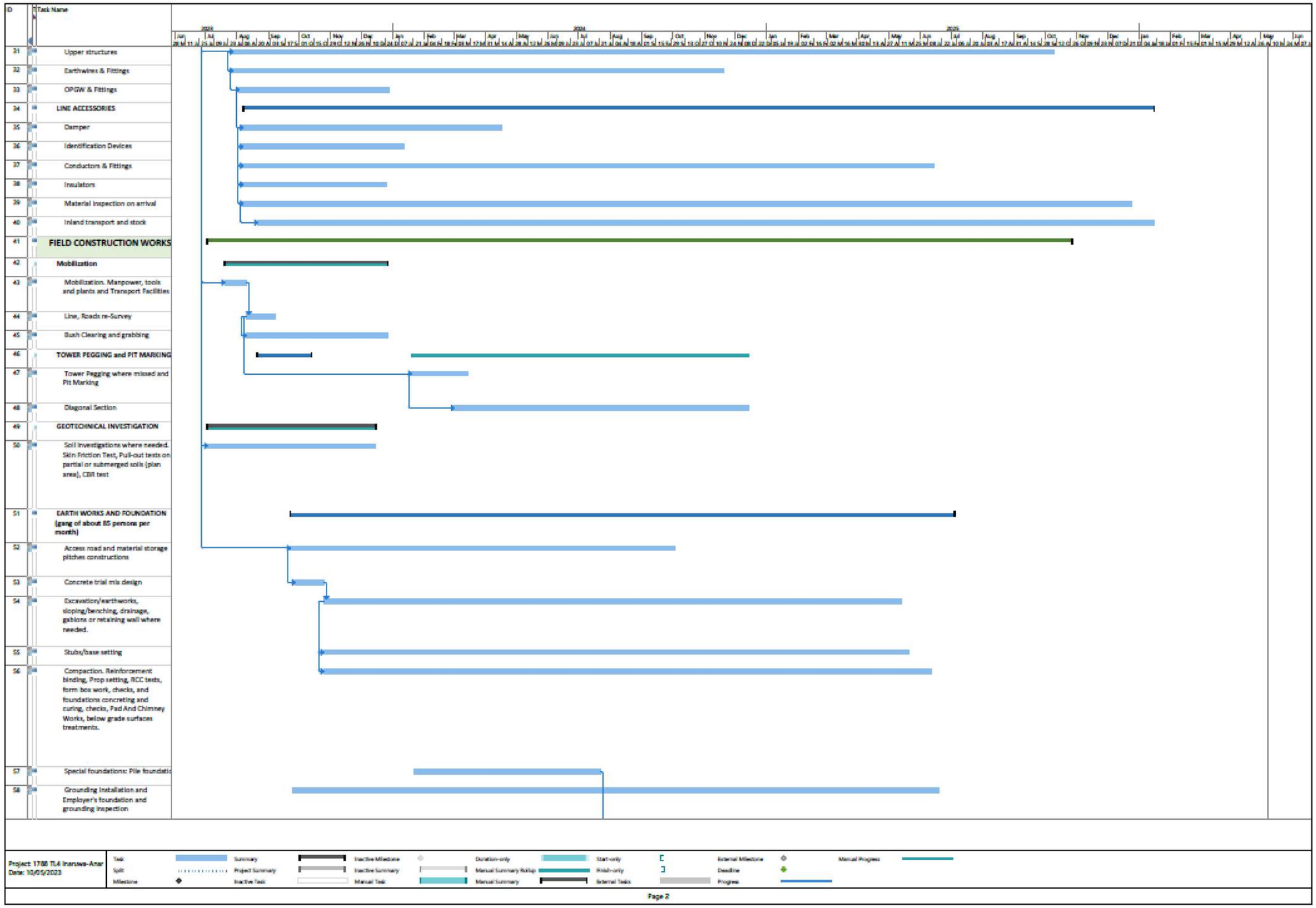


Figure 1.7: Construction Schedule B

(Source: Feasibility Report 2023)

CHAPTER 2: LEGAL AND INSTITUTIONAL FRAMEWORK

2.1 THE ENVIRONMENTAL ASSESSMENT PROCESS IN NEPAL

The achievement of the right to social and environmental security depends critically on appropriate institutional and legal frameworks. An overview of the relevant national and international legal instruments, institutional and legislative frameworks, and environmental and social policies is given in this section of the ESIA, which the project must abide by. Below is a summary of the institutional, legal, and policy framework that applies to the project.

The statutory provisions of the Environmental Protection Act, 2019 (EPA) and Environmental Protection Rules, 2020 (EPR-rule 3) strengthen the integration of environmental conservation with development activities. The prospective contractor must adhere to the mitigation measures outlined in the ESMP document, and this report will be a mandatory component of the bidding document.

2.2 ENVIRONMENTAL AND SOCIAL LEGISLATION OF NEPAL

2.2.1 The Constitution of Nepal

The Constitution of Nepal, 2015 specifically addresses environmental and social sustainability. The following table highlights the provisions of the Constitution, which guarantees everyone the right to a clean, healthy environment, as well as the preservation, promotion, and sustainable use of natural resources during the TL's construction and operation.

Table 2-1: Environmental and social rights of citizens declared in the Constitution of Nepal

Article	Rights guaranteed
18	Right relating equality not to discriminate citizens on grounds of origin, religion, race, caste, tribe, sex, economic condition, language, region, ideology or on similar other grounds.
25	Right relating to property and provides the basis for compensation and procedures relevant to requisition
30	Right to a clean and healthy environment and right to obtain compensation in accordance with law
34	Right to fair labour practice including appropriate remuneration, facilities and contributory social security
37	Right to housing and claims that citizens cannot be evicted from the residence, except in accordance with law
40	Right of Dalit, their health and social security, right to use, protect and develop their traditional occupation, knowledge, skills and technology
42	Right to social justice relevant to minorities, indigenous and marginalized communities
43	The Right to social security of different categories of marginalized

Article	Rights guaranteed
	communities and individuals, who cannot take care of themselves and citizens belonging to the tribes on the verge of extinction, in accordance with law

In addition to the aforementioned Articles, Article 51 (Entry g, h, and l) addresses provisions pertaining to the preservation, conservation, and sustainable use of natural resources (forests, wildlife, birds, vegetation, and other forms of biodiversity). This is achieved by reducing environmental risks associated with physical and industrial development and by implementing the necessary measures to eliminate or lessen any negative effects that may still exist on the environment, the natural world, or biological diversity.

2.2.2 National Plans, Strategies and Policies

The project will be required to comply with relevant existing and environmental and social laws and regulations in Nepal throughout the life of the project. The policy, legal and institutional framework under which the project will be undertaken is outlined below.

Table 2-2: Key Provisions and Relevance of National Plans, Strategies, Policies, Acts/Rules and Regulations to ESIA

S.N.	Plans, Policies, Strategies Rules/ Regulations	Key provisions	Relevance to TL ESIA
Plans			
1.	15th 5 years' Development Plan of Nepal (2019-2024)	Enhancement in socio-economy with fast alleviation of poverty by high economic growth in next 5 years based on growth in agriculture, industrial and services sector with a slogan of "Generating Prosperity and Happiness"	TL development and connectivity is vital for the economic growth and overall development.
2.	Nepal National Biodiversity Action Plan, (2014-2020)	The overall goal is to significantly enhance the integrity of Nepal's ecological systems by 2020, thereby contributing to human well-being and sustainable development of the country. This is to be achieved through implementation of a number of sector specific and cross-sectoral strategies and priority actions	The Action Plan emphasizes that governance and legal/regulatory implementation is a major underlying factor behind deforestation and forest degradation.

S.N.	Plans, Policies, Strategies Rules/ Regulations	Key provisions	Relevance to TL ESIA
Strategies			
3.	Nature Conservational Natural Strategic Framework for Sustainable Development (2015-2030)	The Strategy stresses out the needs to mitigate the current and potential future effects of the pressure of infrastructure development on the habitats of endangered flora and fauna based on the landscape concept.	The Strategy identifies legal and regulatory issues applicable for nature conservation, sustainable development and bio-diversity protection.
4.	Sustainable Development Goals, (SDG) 2016-2030	SDG 7- aims for affordable and clean energy SDG-9 aims for resilient infrastructure SDG 11- aims for inclusive, safe, resilient and sustainable human settlements SDG13: Climate action SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	The SDG provisions are equally applicable for linear infrastructures like TLs as they have a bearing with clean energy. Climate action and biodiversity conservation. The implementation of the project needs to ensure for inclusivity in terms of GESI along with safe, resilient and sustainable human settlements.
Policies			
5.	Nepal National Environment Policy, 2076 (2019)	The policy established the framework for the protection, control, and minimization of pollution, environmental mainstreaming, environmental justice, participation, sustainable development, good governance, and capacity development.	The policy is aimed to ensure rights of the people to live in clean and healthy environment controlling pollution, managing solid waste, and enhancing greenery.
6.	Forest Policy, (2015)	The forest policy emphasizes the implementation of community and private forestry development, programs, national parks and conservation areas management programs, soil	The policy stresses conservation of endangered species and emphasizes to avoid forest destruction or chopping down the tree while constructing infrastructures during implementation of

S.N.	Plans, Policies, Strategies Rules/ Regulations	Key provisions	Relevance to TL ESIA
		and watershed conservation program, management and development of medicinal plants and conservation of biological diversity.	project other than forest sector.
7.	Land Use Policy, 2072 (2015)	The objectives of the policy are to categorize or classify entire lands of the country into various Land Use Zones (LUZs), level wise division (Federal, Provincial and Local), and to ensure the use of Land and Land Resources(LLRs) on the basis of land use plans (LUPs) for protection of agricultural land and maintain beautiful, well-facilitated settlement and sustainable urbanization, forests areas including natural heritages, biodiversity and historical, cultural and religious, archaeological and areas of strategic importance	It ensures the participation of government and public agencies as well as the private sector by linking productivity, environmental balance and conservation, social and economic prosperity and poverty alleviation.
8.	Labour Policy, 2062 (2005)	Labour Policy stresses out guaranteeing out the minimum social and professional security by for all citizens of the country without discrimination	The Policy encouraged investments in labour-intensive employment sectors with economic development potentials, TL development is one of such sectors.
9.	Land Acquisition, Resettlement and Rehabilitation Policy for Infrastructure Development Projects, 2071 (2015)	The policy requires that expenses related to land acquisition, compensation and the implementation of resettlement and rehabilitation plans should be considered as project costs, underlining that compensation amount should be calculated on the market rate.	Policy outlines the needs to conduct an economic and social impact assessment of the development projects.
10.	Public-Private Partnership	The objectives of this policy are focused on serving to	The policy covers 6 development areas for

S.N.	Plans, Policies, Strategies Rules/ Regulations	Key provisions	Relevance to TL ESIA
	Policy, 2072 (2015)	public interests in developing of infrastructures at the same time creating environment for private investment and use of private sector experience, managerial skills, competencies and technical skills for infrastructure development	partnerships including infrastructure and transport.
11.	Draft National Occupational Safety and Health Policy, 2073 (2017/18) The Policy was publicly available since 2073 B.S. (2017/18)	Occupational health and safety have been addressed in professional manner to avoid potential casualties within working space and including construction sites and to reduce risk and hazardous activities that may affect to project site workers.	The goal of the policy is to make workplace and working environment less risky and occupation safety standard and to ensure to safety to the workers.
12.	National Health Policy, 2076 (2019)	Universal health coverage including prevention, promotion, treatment, rehabilitation and palliation,	All kinds of pollution to be reduced that may impact general public and program to be implemented and developed along with relevant agencies in the basis of scientific planning.
Acts			
13.	Environment Protection Act, 2076 (2019)	The law contains several provisions to internalize environmental assessment system and to maintain a clean and healthy environment by minimizing the adverse impacts on human beings and other life forms and physical objects.	The act highlights that any development project, before its implementation has to pass through environmental assessment, which will be either BES, IEE or EIA depending upon the location, type and size of the projects. The Act has included three tiers of provisions (Section 3.2.a) on conducting 'environmental study as brief environmental study (BES), IEE and EIA.
14.	Forest Act, 2076	Section 49 of the Act prohibits	Section 42of the act has made

S.N.	Plans, Policies, Strategies Rules/ Regulations	Key provisions	Relevance to TL ESIA
	(2019)	reclaiming lands, setting fires, grazing, removing or damaging forest products, felling trees or plants, wild animals hunting and extracting boulders, sand and soil from the National Forest without the prior approval.	three provisions for using of forest areas: (i) the project should be of national priority sub-Section (1), (ii) there is no alternative other than to use the forest area sub-Section (1/2), and (iii) the project should not have significant impact on environment sub-Section (1)
15.	Local Government Operation Act, 2074 (2017)	The Act provides the functions, rights and duties of local government such as Municipalities, rural municipalities and their wards.	This act empowers the local bodies for the conservation of soil, forest, and other natural resources and implements environmental conservation activities.
16.	Soil and Water Conservation Act, 2039 (1982)	Provisions to construct and maintain dams, embankment, terrace improvements, diversion channels and retaining walls, protect vegetation in landslide-prone areas and undertake a deforestation programs, and regulate agricultural practices pertinent to soil and watershed conservations	Section 13 of the act empowers the authority to prohibit the commission of any acts that may cause soil-erosion or soil cutting in a land where any of the acts has been done under Section 4 and in vicinity of such land.
17.	Plant Protection Act 2064 (2007)	legal provisions for preventing the introduction, establishment, prevalence and spread of pests while importing and exporting plants and plant products, promoting trade in plants and plant products by adopting appropriate measures for their effective control	the act may impose the prohibitions/restrictions in the import of plant or plant product, transport from one district to another district of any plant or plant product.
18.	Aquatic Life Protection Act, 2017 (1960)	recognition of the value of wetlands and aquatic animals.	Section 3 of the act renders no person shall knowingly use any kind of electric current, explosive substance or poisonous substance with

S.N.	Plans, Policies, Strategies Rules/ Regulations	Key provisions	Relevance to TL ESIA
			intention of catching and killing any aquatic animal in any water.
19.	Control of International Trade of Endangered Wild Fauna and Flora Act, 2074 (2017)	The act prohibits on Trade or Transaction of Threatened or Vulnerable wild fauna or flora or specimen thereof	The act ensues that no person shall purchase, sell, possess, use, plant, rear, captive breed, transport, import, export, or cause to be done so a threatened or vulnerable wild fauna or flora or a specimen, except of the cases when a license obtained
20.	Water Resources Act, 2049 (1992)	to make legal arrangements for determining beneficial uses of water resources, preventing environmental and other hazardous effects thereof and also keeping water resources free from pollutions.	Section 19 of the act clearly mentions that no one shall pollute water resource by way of using or putting any litter, industrial wastes, poison, chemical or toxic to the effect that the pollution tolerance limit of the water resource as prescribed pursuant to Sub-section (1) is exceeded.
21.	Land Acquisition Act, 2034 (1977)	The Act is the main legislation to guide the involuntary acquisition of land in the country.	Government can acquire land at any place in any quantity by giving the compensation pursuant to the Act for the land required for any public purpose or for the operation of any development project initiated by government, authorized institution (sections 3 and 4).
22.	Land Use Act, 2076 (2019)	Section 4.1 of the act classifies lands into 10 categories such as agricultural, residential, industrial, commercial, mining and mineral, forest, river, stream, pond and wetland, public use, cultural and archaeological, and others.	The act provisions for the need for economic development and infrastructure building, among others to ensure that land is properly used and managed and that land set aside for one purpose is not used for other.
23.	Labour Act,	The Act has been passed for	Section 11 (3) of the Labour

S.N.	Plans, Policies, Strategies Rules/ Regulations	Key provisions	Relevance to TL ESIA
	2074 (2017)	provisions for the rights, interest, facilities and safety of workers and employees working in various sectors and thus ensures the good working conditions and welfare of the workers.	Act provides for the employment contract and the matters to be covered under the employment contract *and the* Act requires the employment contract to include (a) remuneration, (b) benefits, and (c) terms of the employments of the Employee and such other matters as prescribed. Section 64 (1) states that the main employer must obtain the employees from licensed labour supplier.
24.	Child Labour (Prohibition and Regulation) Act, 2056 (2000)	The Child Labour (Prohibition and Regulation) Act 2000 is the main legal expedient to prohibit engaging children in factories, mines or similar risky activities and to make necessary provisions with regard to their health, security, services and facilities while engaging them in other activities.	Under the Section 3 of the Act, child having not attained the age of 14 years is strictly prohibited to be engaged in works as a labourer. Equally, under Section 4, engagement of child in works as a labourer against his/her will by way of persuasion, misrepresentation or by subjecting him/her to any influence or fear or threat or coercion or by any other means is prohibited. Under Section 6, in case any Enterprise, engaging a child in works, must get an approval from the concerned labour office or any authority or official prescribed by that office and form the fathers, mother or guardian of the child.
25.	Act related to Children, 2075 (2018)	The act provisions the children's fundamental rights provided in the constitution, into a legislative provision, which then allows children to exercise their rights legally.	any child under the age of 14 are not allowed working in hazardous labour or the worst form of child labour

S.N.	Plans, Policies, Strategies Rules/ Regulations	Key provisions	Relevance to TL ESIA
Rules/Regulations			
26.	Labour Rules, 2075 (2018)	The Labour Rules demands the Employment Contract to cover (a) nature of employment, (b) primary work of the Employee and his/her position, (c) statement that the Employees' Service Rule will be integral part, (d) date, time, place of contract and its effective date, (e) Other important terms and conditions related to the work or service of the Employee	The Labour Rules regulate the Employee work schedule, providing rest period for certain female employees with submitting of certain certificates, determining the percentage of disability, associated with accident in the workplace, other issues relevant to sickness or accident while working, associated with occupational safety and health, etc.
27.	Water Resources Regulation, 2050 (1993)	Measures are to be taken for the conservation of aquatic life and water-environment and for mitigating social and economic effects of the project in the concerned area.	It is mandatory under Rule 17(e) that appropriate measures should be taken to lessen the adverse effects due to the project on the overall environment

Some of the policies which have high bearing to the project are discussed in detail in the following section:

2.2.3 Policy on Land Acquisition, Resettlement and Rehabilitation for the Infrastructure Project Development' (PLARRIPD) (2015)

Government of Nepal (GoN) has promulgated the policy in 2015‘called 'Policy on Land Acquisition, Resettlement and Rehabilitation for the Infrastructure Project Development' (PLARRIPD) (2015) with following key principles:

- Appropriate and adequate compensation for the loss of assets or income is a fundamental right of all project affected persons. Physically displaced people must be relocated with basic amenities such as school, health posts and other facilities.
- All affected persons should be assisted to restore at least their pre-project income and livelihood sources.
- The absence of legal title to land should not be a bar for compensation, resettlement, and rehabilitation assistance.
- In cases where people from the opportunity-deprived groups like Dalit, Indigenous, Janajatis, and single women get affected by any infrastructure

development project, additional inclusive programs should be formulated to uplift their socio-economic status.

- Requires livelihood restoration plan to retain the living standard of the seriously affected people and families belonging to poor, Dalit, Janajati, or marginalized indigenous groups, single woman, differently abled, and senior citizens will be given additional assistances according to the provisions incorporated in resettlement plan
- Employment opportunity to the seriously project affected HHs and Vulnerable groups (Dalit, Janajati or marginalized Indigenous, single women, helpless, disabled, senior citizen etc.) based on their skills and capabilities.
- Requires easy, simple, and transparent consultations with project affected peoples with duly considering the presence of people from sensitive groups like poor, landless, senior citizens, women, children, indigenous, differently abled, and people with no legal rights of the lands in which they live
- Cash compensation at full market value (equivalent to replacement value) for all acquired land if the provision of replacement land is not feasible; with the stipulation that a person who becomes a marginal landholder as a result of land acquisition should be provided with replacement land of equivalent productivity or value;
- Cash compensation at replacement cost for the loss of all structures (residential, business and other structures), with no deduction for depreciation or for salvageable materials; or provision of a replacement house;
- Cash compensation for private trees based on the annual value of the produce;
- Compensation for the loss of income from rented buildings;
- Cash compensation for the loss of standing crops; and
- Compensation to registered tenants and sharecroppers, equivalent to 50% of the compensation for the concerned area of land and lost crops.

2.2.4 Local Governance Operation Act, 2017

Local Governance Operation Act, 2017 gives the local government full authority towards local development. The act gives full authority to the rural/municipality to operate the resources within its boundary.

2.2.5 Land Reform Act, 1964

Another key legislation in Nepal related to land acquisition is the Land Reform Act (LRA) 2021 (1964). This Act establishes th' tiller's right on the land, which he is tilling. The LRA additionally specifies the compensation entitlements of registered tenants

on land sold by the owner or acquired for the development purposes. The most recent Act Amendment (2001) in this act established a rule that when the State acquires land under tenancy, the tenant and the landlord will each be entitled to 50 percent of the total compensation amount. Tenants are verified through a record of tenancy at the Land Revenue Office. Article sets ceiling on land ownership according to geographical zones. Article 25 (1) of this act deals with tenancy rights that also exists.

2.2.6 Electricity Act, 2049

Electricity Act of Nepal mandates to develop electric power by regulating the survey, generation, transmission and distribute the survey, generation, transmission, and distribution of electricity and to standardize, and safeguard the electricity services.

Meanwhile the regulation (Electricity Regulation 2050 BS) states the provision related to licenses related to electricity survey, and distribution, to issue license for survey (format and template for license applications etc).

2.2.7 Land Acquisition Act, 1977

The Land Acquisition Act (LAA), 2034 (1977), first promulgated in 1961 (Land Acquisition Act, 2018) is the core legal document to guide tasks related to land acquisition and resettlement activities in Nepal. There is a provision in Clause 3 of the Act to acquire land for any public purpose, subject to the award of compensation. According to Clause 4, institutions seeking land acquisition may also request GON to acquire the land under the regularity provisions subject to be compensated by such institutions' resources. Clause 27 of the Act provides provisions for land acquisition through the mutual agreement with the plot owners, where the process of land acquisition as per Act is not required. The Act grants the plot owner the right to choose between a mutual agreement process, or the formal process for land acquisition as per the Act. Where Clause 27 is enacted, and the plot owner not satisfied with the compensation agreement offered. Clause 18 (sub-clause 2) states that the owner can file a complaint with the Ministry of Home. While acquiring land, GoN forms a Land Acquisition and Compensation Fixation Committee (LACFC) under the chairmanship of Chief District Officer (CDO) of the restrictive districts as per the Clause 13 of the Act. The other members to be included in the Committee comprise of the Chief of Land Revenue Office (LRO), an Officer assigned by CDO, representative from District Coordination Committee (DCC), Concerned Project Manager, and RM/R representative.

The Project Chief functions as the Member Secretary of the Committee. In addition, it has become the practice to include representatives from the Affected Persons (APs). This practice of fixing compensation is known as Community Consensus Valuation (CCV). LACFC determines the amount of compensation considering the following factors: current price of land value, value of standing crop, houses, walls, sheds or

other structures, loss incurred as a result of shifting residence or place of business, and consider relevant acts and periodic guidelines of GoN. According to Clause 6, if the land has to be acquired for institutions other than the local governance bodies and institutions fully owned by the government, the Committee has to consider the following in fixing the compensation amount: (i) Price of land prevailing at the time of notification of land acquisition; (ii) Price of standing crops and structures; and (iii) Loss incurred by the AP by being compelled to shift his or her residence or place of business in consequence of the acquisition of land.

The Clause 9 sub-section 3 of the Act mentions that the duration of compensation days will be determined by LACFC. Clause 37 of the Act illustrates that the Committee may extend the period of additional three months, if compensations are not collected by those affected. After termination of extended three months period the amount will be deposited to the Government account.

The compensation to be provided for land acquisition should generally be in cash as per current market value. However, there is also a provision under Clause 14 to compensate land for-land provided government land is available in the area. The Act also envisages the possibility of two separate rates of compensation, distinguishing between families who lose all their land and those who lose only some part of their landholdings. As stipulated in the Clause 10 there is provision for the affected HHs to take the crops, trees and plants from land and salvageable from the structures. Clause 39 indicates options to allow the affected HHs to take all salvageable assets without deduction of any costs from the affected HHs. Legal tenants of the land are entitled for 25% of compensation amount of the acquired land. If the tenant has built house also with the consent of the landowner, then he shall be entitled for full compensation of such house (Clause 20). Unpaid government taxes, if any, could be deducted from the compensation amount (Clause 21).

Any grievances and objections will be referred to the Grievances Redress Committee (GRC) as per Clause 11 of the Land Acquisition Act, 2034 (1977). The Act assigns the CDO as the sole responsibility to chair land acquisition activities and to address the grievances related to the Resettlement Plan (RP) implementation activities.

2.2.8 National Foundation for Upliftment of Aadibasi/Janjati Act, 2002

Specific policy initiatives for the welfare and advancement of IPs (Adivasi/Janajati) were initiated in 1997, when a National Committee for Development of Nationalities (NCDN) was set up. In 2002, the Nepal Parliament passed a bill for the establishment of an autonomous foundation named “National Foundation for Upliftment/Development of Indigenous Nationalities” which came into existence in 2003 replacing the NCDN. The NFDIN Act 2002 established the first comprehensive policy and institutional framework pertaining to Adivasis/Janajatis. The act defines indigenous groups or Adivasi-Janajati in Nepali as "a group or community having its

own territory, own mother tongue, traditional rites and customs, distinct cultural identity, distinct social structure and written or unwritten" history". The government, through NFDIN, has identified and officially recognized 59 such indigenous communities. This list was updated in 2009 to include 81 groups for official recognition but yet to be approved by the GoN. The indigenous people in Nepal are not homogenous and there is vast disparities existed in terms of socio-economic standing among them. Therefore, Nepal Federation of Indigenous Nationalities (Adivasi/Janajati) (NEFIN) has grouped 10 of the 59 Adivasis/Janajatis as "endangered", 12 "highly marginalized", 20 "marginalized", 15 "disadvantaged" as" advanced" or better off on the basis of a composite index consisting of literacy, housing, landholdings, occupation, language, graduate and above education, and population size.

This Foundation has been working for the preservation of the languages, cultures, and empowerment of the marginalized ethnic nationalities. More specifically, the Foundation has following objectives:

- To make overall development of the Aadibasi/Janjati by formulating and implementing the social, educational, economic and cultural programs.
- To preserve and promote the language, script, culture, literature, arts, history of the Aadibasi/Janjati.
- To preserve and promote the traditional knowledge, skill, technology and special knowledge of the Aadibasi/Janjati and to provide assistance in its vocational use.
- To encourage the Aadibasi/Janjati to be participated in the mainstream of overall national development of the country by maintaining a good relation, goodwill, and harmony between different Aadibasi/Janjati, castes, tribes and communities.
- To provide assistance in building an equitable society by making social, economic, religious and cultural development and upliftment of Aadibasi/Janjati.

2.2.9 Right to Information Act, 2007

The aim of this act is to make the functions of the state open and transparent in accordance with the democratic system and to make responsible and accountable to the citizen. It intends to make the access of citizens simple and easy to the information of public importance held in public bodies and to protect sensitive information that could make adverse impact on the interest of the nation and citizen.

The clause 3 of the act ensures Right to Information. It says that every citizen shall, subject to this Act have the right to information and they shall have access to the

information held in the public Bodies unless confidentiality has been maintained by laws.

The clause 4 of the act describes the Responsibility of a Public Body to disseminate information. It mentions that each Public Body has to respect and protect the right to information of citizen. Public Body shall have following responsibilities for the purpose of protecting right to information of citizen:

- to classify and update information and make them public, publish and broadcast,
- to make the citizens' access to information simple and easy,
- to conduct its functions openly and transparently,
- to provide appropriate training and orientation to its staffs,

Public Body may use different national languages and mass media while publishing, broadcasting or making information public. A Public Body shall arrange for an Information Officer for the purpose of disseminating information held in its office.

The clause 7 of the act prescribes the Procedures of Acquiring Information. It states that a Nepali Citizen, who is interested to obtain any information under this Act, shall submit an application before concerned Information Officer by stating reason to receive such information

2.2.10 National Directive, Guidelines, Manuals and Standards

The National EIA Guidelines (1993) provide several mechanisms for identification of projects requiring EIA, processes selecting alternatives, and mitigation measures including monitoring and evaluation.

The Occupational Safety and Health Guidelines, 2074 (2017) provide a valuable framework for discussions and concrete actions in order to improve the safety and health of workers.

The Use of Forest Land for National Priority Infrastructure Guidelines (2017) provide directives on compensatory plantation to be carried in the equivalent area as directed by respective forest office and that to be maintained for 5 years by the proponent and handover to the district forest office.

The Gender Equality and Social Inclusion Operational Guidelines, 2074 (2017) formulate the policies to protect women, poor, vulnerable and excluded people, recognizing their rights. Federal government is responsible for women rescue programme, children policy and integrated social protection as well as for labour employment and social security, forest and environment such as health related issue, health related standard and regulation, coordination, and migration analysis.

The aforementioned national policy framework, which indicates the necessity for the assessment and efficient management of the environmental and social impacts

related to the construction of the TL across multiple sectors and fields of expertise, is aligned and complied with by this ESIA based on all the national documents mentioned above.

2.3 INTERNATIONAL POLICY FRAMEWORK

2.3.1 Relevant International Conventions

Nepal is a signatory to numerous international treaties and conventions. Only those pertinent to sustainable development were examined in this review, and they are significant because they tackle important transboundary or global environmental and social issues like pollution, climate change, biodiversity conservation, social inequality, and environmental justice principles. The international treaties and their provisions that are pertinent to social and environmental issues during the construction process and that apply to the TL project's ESIA are briefly reviewed in the table below.

This work has been governed by numerous treaties and agreements, as well as international regulations which are listed in the table below.

Table 2-3: List of related International Conventions/Protocols

Selected International Conventions/Protocols
Convention on Biological Diversity (CBD), 1992
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), (1973 amended 1979)
Plant Protection Convention, 1952 (Second Amendment, 1997)
World Heritage Convention, 1975
United Nations Framework Convention on Climate change (UNFCCC), 1992.
UN Paris Agreement, 2015
United Nations Convention to Combat Desertification (UNCCD), 1994.
Strategic Approach to International Chemicals Management, 2006
Concerning Indigenous and Tribal Peoples in Independent Countries, 1991 Convention (No.169)
Convention on the Rights of the Child, 1989
International Labour Organization Convention, 1998
The United Nations Declaration on the Rights of Indigenous Peoples, UNDRIP, 2007
Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), 1979.
UN Declaration on the Elimination of Violence against Women, 1993

The aforementioned international protocols and conventions offer direction for global best practices and concentrate on environmental protection and promotion, social issues, including the International Labor Organization's set of conventions and gender-based violence (GBV), as well as the preservation of natural resources and biological diversity.

2.3.2 World Bank Environmental and Social Framework and Standards

The WB's primary goals are to end extreme poverty and advance shared prosperity. The WB's commitment to sustainable development and the necessary conditions for bank-financed projects are outlined in the WB ESF. The projects' effects on society and the environment are evaluated and managed using the Bank's ESF. In order to achieve this, the Bank has established particular ESSs that are intended to prevent, lessen, alleviate, and compensate for the negative effects on the environment and society. The projects supported by the WB are required to meet the 10 ESSs as relevant to the project.

Table 2.4 provides a comparison of the ESSs with national legislative framework and requirements. ESSs create mechanisms for the integration of environmental and social issues into decision making. They provide a set of specialized tools to support development. No financial intermediaries are involved in the TL project so ESS9 is not applicable. The comparative analysis of national regulatory frameworks with ESS1 to ESS8, and ESS10, found that the requirements in regulatory frameworks were aligned with ESSs, however the issues of GHG emission calculation, resource efficiency, community health and safety, and workers' GRM have not been adequately addressed. These aspects are considered in different themes of impact assessment in line with international best practices, but not mandatory under existing regulatory frameworks. The foundation for environmental justice, participation, sustainable development, good governance, capacity building, and pollution prevention, control, and minimization is now set under the Nepal National Environmental Policy - 2076 (2018). The policy established the rules and regulations for preventing pollution of the air, water, and land as well as noise pollution from electric and magnetic fields, chemicals, and radioactive materials. Additionally, it makes it easier to establish and run quality assessment centers in large cities and industrial states, as well as to prepare emission field maps and apply pollution control guidelines. Other tactics put in place to carry out the strategy include encouraging the use of clean energy vehicles, safely disposing of hazardous and non-recyclable waste etc.

The above discussion on the prevailing Acts and Regulations in Nepal indicates a progressive development of legal framework related to involuntary resettlement of the people affected by the development projects. However, there still exists some confusion, gaps and overlapping of the provisions in various Acts and Regulations between WB ESS and Relevant Nepali Laws, Regulations and Policies which is discussed in table below.

Table 2-4: Gaps in WB ESS and Relevant Laws Regulation Policies of Nepal for Infrastructure Projects

World Bank ESS	Relevant Nepal Laws, Regulations and Policy Issuances	Gaps vis-à-vis WB ESS
1. Assessment and Management of Environmental and Social Risks and Impacts	National Environmental Impact Assessment Guidelines (1993) Environment Protection Act (EPA) (2019) Environment Protection Regulations (EPR) (2020)	• Scope of EIA may not cover all WB ESS. • EPA/EPR does not allow use of other types/forms of assessments. • Does not emphasize hierarchy of measures in ES risk management planning
2. Labour and Working Conditions	Labour Act (2017)	• Current OHS provisions are not adequate (No separate legislation on OHS. Current OHS mandate is provided only in Chapter 12 of the Labour Act)
	Child Labour Act (2001)	• Lack of industry-specific standards DoLOS [1] has so far issued only one directive: OHS Directive for Brick Workers)
3. Resource Efficiency and Pollution Prevention and Management	National Ambient Air Quality Standards (2003),	Need guidance for integration relevant to resource efficiency
	Water Resources Act (1992) Water Resources Rules (1993)	
	Drinking Water Regulation (1998), Drinking Water Quality Standards	
	Water Quality Guidelines for the Protection of Aquatic Ecosystem	Need instructions for incorporation in infrastructure projects
4. Community Health and Safety	The EPA/EPR identifies the direct and indirect human health impact as one of the components in assessing the effect of development projects.	• There is limited coverage as scope of ESIAs do not necessarily include community safety issues.
	EPA Section 13 and 15: Nobody shall create pollution in such a manner as to cause	• Public health legislations do not specifically impose requirements for

[1]Department of Labour and Occupational Safety

World Bank ESS	Relevant Nepal Laws, Regulations and Policy Issuances	Gaps vis-à-vis WB ESS
	significant adverse impacts on the environment or likely to be hazardous to public life and people's health. Labour Act (2017)	development and infrastructure projects.
5. Land Acquisition, Restriction on Land Uses and Involuntary Resettlement	Land Acquisition Act (1977) Guthi Corporation Act (1976)	• Does not allow for PAP consultation in the compensation options
	Land Reform Act (1964) Land Revenue Act (1977)	Priority in employment • Valuation of lost assets considers depreciation and hence not at replacement cost • Leasing of land is not allowed for temporary easements. Compensation for any temporary use of land is limited to damage compensation.
6. Biodiversity Conservation and Sustainable Management of Living Natural Resources	The Aquatic Animal Protection Act (1960) National Park and Wildlife Conservation Act (1973)	• Natural habitats are not specifically required to be assessed in the EIA
	Forest Act (2019) and Forest Regulation (2022)	• Does not specifically require Biodiversity Management Plan even where biodiversity impact is found significant in the EIA
7. Indigenous Peoples	National Foundation for the Development of Indigenous Nationalities Act (2002) Local Government Operation Act (2017) ILO Convention 169 (2007)	• Does not require —Free, Prior and Informed Consent for projects in Indigenous Population (IP) territories • Does not require focus on social assessment of IP Population • Does not require preparation of IP Plan
8. Cultural Heritage	EPA (2019) Section 9-10	• Does not include intangible cultural heritage
	EPR (2020)	• Does not provide guidance for the development of Cultural Heritage Plan
	Ancient Monument Act (1956)	• Does not provide guidance

World Bank ESS	Relevant Nepal Laws, Regulations and Policy Issuances	Gaps vis-à-vis WB ESS
		for the application of globally recognized practices in the study, documentation and protection of cultural heritage • Does not provide instruction for adoption of chance find procedures
9. Financial Intermediaries	Not applicable. Projects undertaken through financial intermediaries are subject to the same processes and procedures as any other projects.	

Note: Key Gaps between Nepal Land Acquisition System and WB's ESS 5 are presented in RAP report.

2.3.2.1 WBG General EHS Guidelines, 2007

This guideline offers a method for managing major emission sources, together with detailed instructions for effect assessment and monitoring. The EHS standards also offer guidance on mitigating potential effects on community health and safety during the creation of new projects, at the end of their life-cycle, or as a result of extension or modification of already-existing project facilities. The guideline outlines a broad strategy for managing EHS concerns at the project or facility level. According to the guideline, EHS considerations must be incorporated into corporate and facility-level business processes in a structured, hierarchical manner, emphasizing the risks and hazards related to EHS projects. When impact avoidance is not practical, the risk management solutions will also include engineering and managerial controls to lessen the likelihood and severity of undesirable outcomes.

2.3.2.2 Workers' accommodation: processes and standards. A guidance note by IFC and the EBRD, 2009

The European Bank for Reconstruction and Development (EBRD) and the International Finance Corporation (IFC) collaborated to create the 2009 guideline note Workers' accommodation: practices and standards. The memo offers helpful advices on norms and regulations pertaining to worker accommodations. Its goal is to provide guidance to businesses, consultants, and other relevant parties who have to deal with worker housing concerns.

While there are certain worldwide norms and guidelines on food safety, waste management, and water cleanliness, there are no globally applicable restrictions for

workers' accommodations. The performance standards on labor concerns that customers are expected to meet include appropriate standards for the building and operation of worker housing. The Standard includes organizing and evaluating worker housing needs in compliance with global, national, and local regulatory frameworks. Along with general living facilities, room/dorm facilities, sanitary and cooking facilities, food safety, and medical and recreational/social facilities, the guideline also lays out the standards and principles that apply to the construction of worker accommodations. The document includes a checklist that may be used to access the general regulatory framework of established accommodations, evaluate the impact of worker accommodations on communities, determine the necessity of worker accommodations, develop criteria for worker accommodations, manage worker accommodations, etc.

CHAPTER 3: BASELINE ENVIRONMENTAL AND SOCIAL CONDITIONS

3.1 INTRODUCTION

Before the start of any Environmental and Social Impact Assessment (ESIA) study, it is necessary to identify the baseline levels of relevant environmental parameters which are likely to be affected as a result of the construction and operation of the proposed project. A similar approach has been adopted for conducting the ESIA study of the proposed transmission line. The ESIA study has been conducted as per the WB guidelines. Based on the specific inputs likely to accrue in the proposed transmission line and towers, aspects to be covered in the ESIA study were identified. Thus, planning of baseline survey commenced with the shortlisting of impacts and identification of parameters for which the data needs to be collected.

The baseline data has been collected/ generated for following aspects

- Physiochemical Environment
- Ecological Environment
- Socio-Economic Environment

3.2 STUDY AREA

The ESIA study has been conducted to assess the impacts of proposed transmission line within the impact areas (Ref.: Figure 3.1). Before assessment the baseline environmental and social data has been collected within the impact area. The impact areas are discussed in following sections. The project construction and operation activities and related direct and indirect implications on the natural and social environments is identified in the delineation of the project impact area. The key direct Environmental and Social impacts of the project relate to the construction of tower at an interval of certain meter along the transmission line route to support the conductors. Similarly, the stringing of conductor will require clearing of the land below the conductor including vegetation, crops and built structures to avoid damage to the conductor. Though required total clearing width is limited to the safety height underneath the position of hanging conductor in the construction phase, built structures and tall trees needs to be removed within the entire zone of the transmission line Right of Way (RoW) for safety during the operation phase.

For this project, the RoW width as per national and international practice is 46 m that include, 23 m on either side from the center of the transmission line route. Within the RoW, wherever required trees will be removed however in valleys where the trees and vegetations does not disturb are not chopped down. The operation phase activities are confined within the RoW for the maintenance of the RoW corridor and maintaining operational safety from the trees or any other objects to the overhanging

conductors. Thus, the impacts on ecological environment will be mainly during the construction phase.

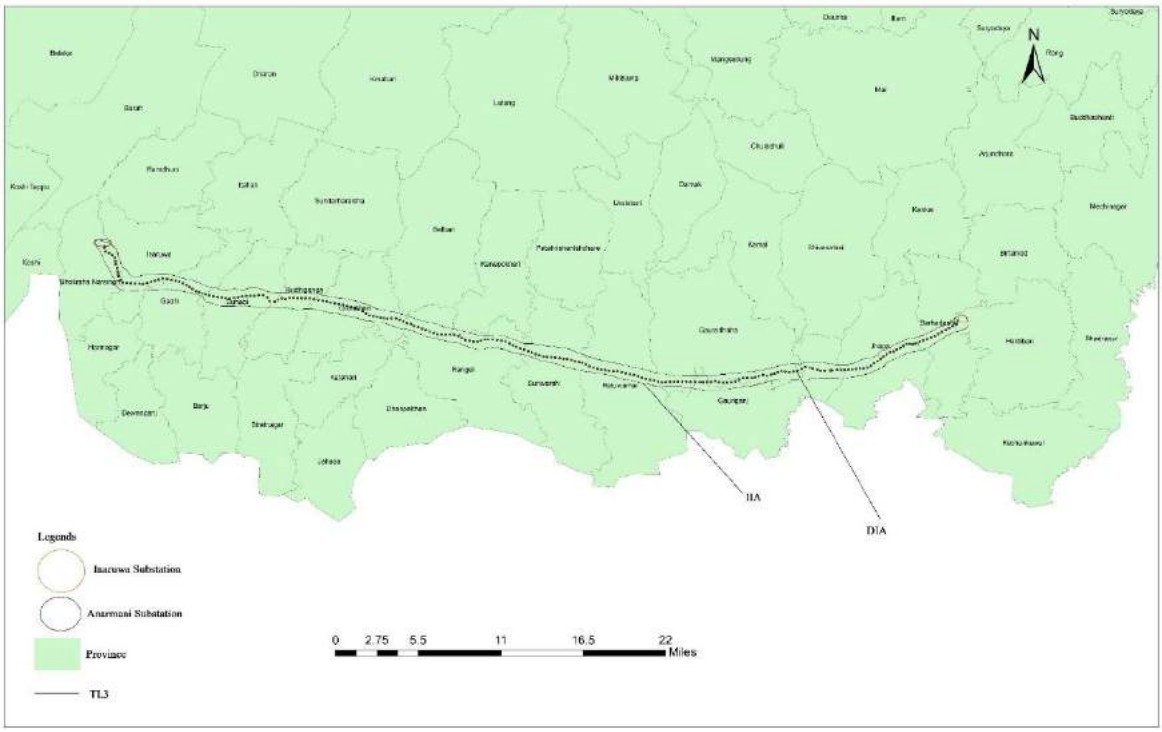


Figure 3.1: Impact Areas of TL-3

(Source: ARC Map 10.8 and Department of Survey Nepal)

Direct Impact Areas (DIA): The term DIA consists of 46m wide TL RoW encompassing 23m on each side of the alignment measured from its center line. It further includes: Locations of access trails to reach the tower foundation and RoW and Locations of construction camps and storage yards for construction material.

Indirect Impact Areas (IIA): The Term IIA lies outside the DIA and is broadly categorized into two: i) High Indirect Impact Zone and ii) Low Indirect Impact Zone.

The High Indirect Impact Zone includes:

- Settlements within 250M from the corridor of the Transmission line route in particular are the High Indirect Impact Zone.

The Low Indirect Impact Zone includes:

- Geographical boundaries of the Rural Municipalities /Municipalities situated across the transmission line route in general are the Low Indirect Impact Zone.

3.2.1 Physico-chemical environment

The information on the physico-chemical environment were collected from the published literatures, available reports, DPR, maps, geological reports, geological

maps (Department of Mines and Geology), Climatological Records of Nepal (Department of Hydrology and Meteorology or nearby Airport Station), 1:25000 Topographic Maps (Survey Department) etc. as well as through the information available on websites of different department/ institutes.

The field level investigations along the corridor route of the transmission line were carried out in May, 2022. The transmission line corridor was covered by walking throughout its length. The field investigations were focused on the characterization of the micro and macro landforms, tower pad geological conditions, erosion and landslides adjoining to the tower pad locations, proximity of the tower locations to the nearby streams/rivers, land uses and watershed conditions based on direct observation and documentation of observation.

Physiographic and geomorphic information were depicted from the 1:25000 topographic maps and verified and examined by direct observation of the RoW and tower pad locations. Information on geology of the project area is based on the DMG Geological Maps of Nepal, which were verified through direct observations within the RoW and at tower pad locations.

Though, meteorological information are based on the published literatures of the Department of Meteorology and Hydrology (DHM), consultation with the local people were held to understand the local weather and climatic conditions and distribution and intensity of rainfall along the transmission line corridor along with data obtained from the nearby Airports. The 1:25,000 topographic maps are the base maps considered for the analysis of the project area and for understanding of landuse pattern. Recent Google images and field observations of site were also used for the assessment of landuse pattern along the corridor. Information on the erosion and landslides are derived from the site investigations and mappings.

Air, water, and noise quality are based on the environmental monitoring of these parameters by sampling and analysis of samples and laboratory analysis for interpretation of results.

The ambient air quality was measured with a low volume sampler -IQAIR (Air Visual Pro Air Quality Monitor). A sound level meter (LUTRON SL-4011) was used to measure ambient noise quality. Field surveys was conducted at ten different locations within the project area.

The sound levels were recorded for both day and night, with the sound level meter which collects the data for every 2 minutes over a period of 3 hours at each location.

The water samples were collected at five different locations. The water samples were compared with NDWQS 2079 (National Drinking Water Quality Standard, 2079). The five soil samples were also collected in the study area from different locations. The

soil samples were collected below the ground at a distance of 10-20 cm from the topsoil. The samples were then preserved in airtight plastic bags and analyzed.

3.2.1.1 Geology and Geomorphology

The study area of TL-3 lies in the flat land of the Indo-Gangetic Plain. This zone is characterized by the dominance of the fine grain alluvial sediments like sand alternating with the clay layers (Ref.: **ANNEXURE VI**).

The composition of the unconsolidated deposit is same as that of sediment of Bhabar zone in the northernmost part. However, the size of sediment is smaller towards southward direction and there is slight topographic breakage from Bhabar to Middle Terai. This zone has developed several marshy lands wherein artesian conditions exist in some areas. The general geology is shown in Figure 3.2.

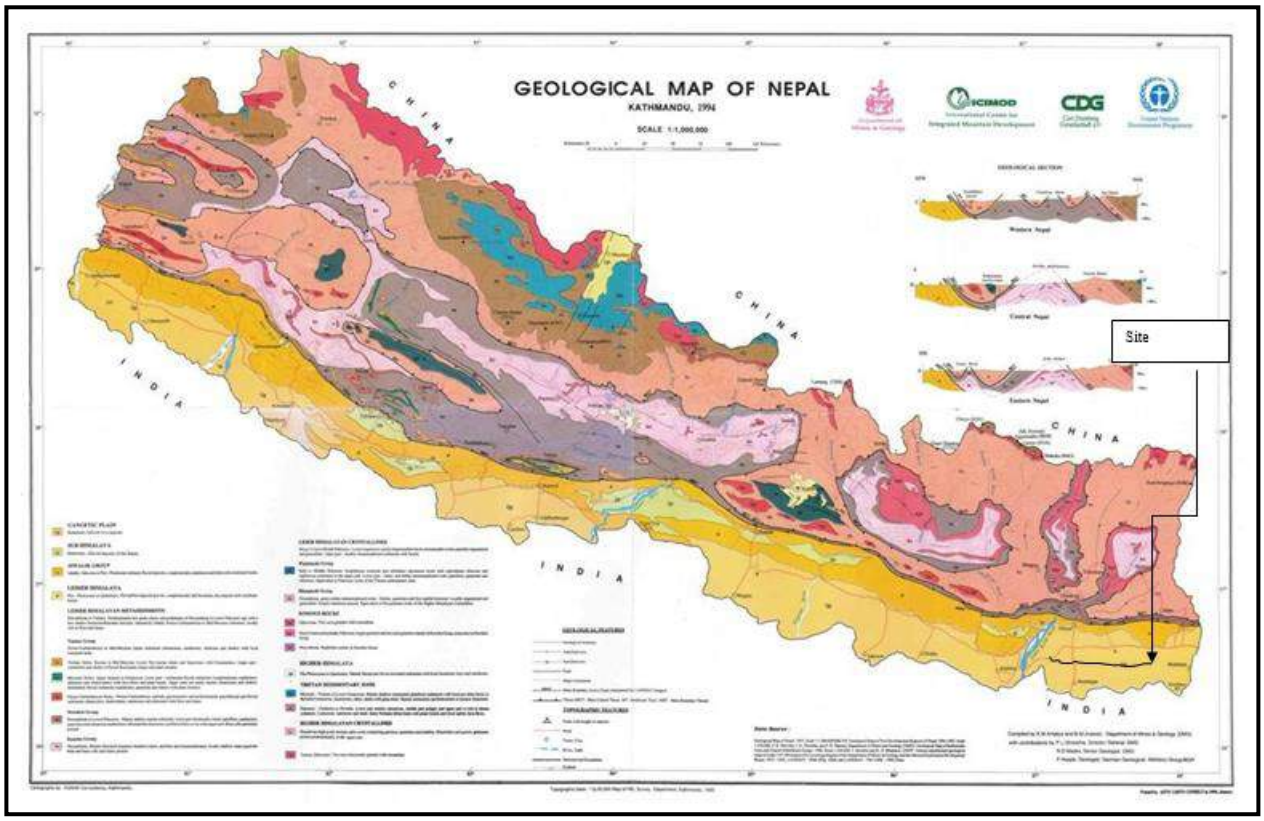


Figure 3.2: General Geological Map of Nepal

(Source: Dahal, 2006)

3.2.1.2 Topography and Land Use

The elevation of TL-3 varies from 84 to 89 m and along the Terai plain. Thea area constitutes 80% of cultivated area, 19 % is barren land and only 1% belongs to forest land (Ref. Figure 3.3).

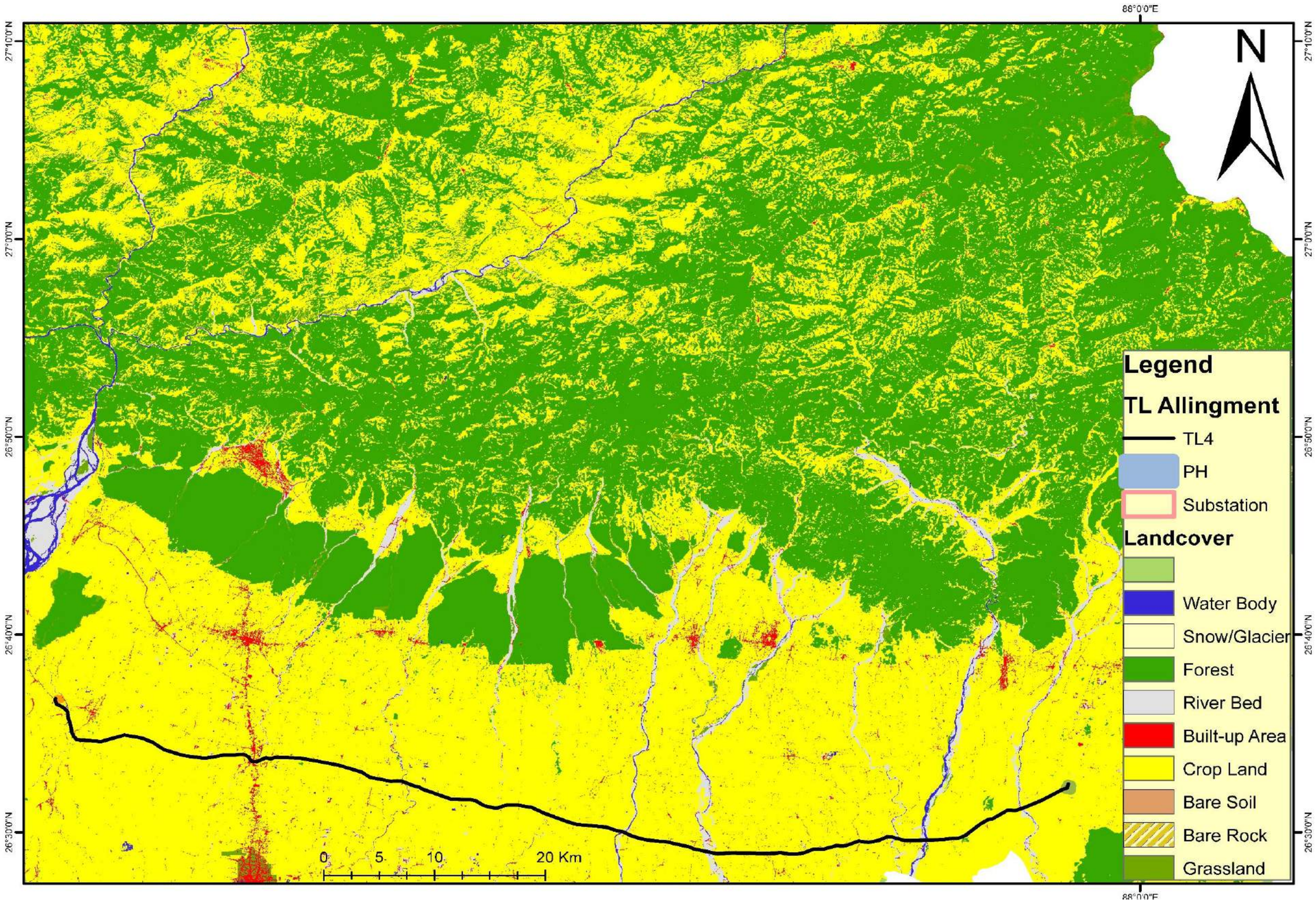


Figure 3.3: Land use map

3.2.1.3 Land Slide and Soil Erosion

There are no landslide prone areas except between the AP 16 and AP27 as shown in Figure 3.4 mainly due to lose mudstones and sandstones.

Figure 3.4: Landslide prone area near AP16/AP17

3.2.1.4 Climate

The proposed alignment of TL-3 ranges from tropical to temperate climate. The annual average minimum and maximum temperatures of for TL-3 ranges from 4.4^0C to 36.5^0C with average of 24.4^0C. During the winter season there is dense fog and in rainy season, flood is a problem in Southern part of the Koshi Province. The average relative humidity is 64% and annual precipitation ranges from 1150 mm to 2400 mm.

3.2.1.5 Water Quality

The water samples were collected at seven different locations. The sampling location given in Table 3.1 and shown in Figure 3.5. The water samples were compared with NDWQS 2079 (National Drinking Water Quality Standard, 2079).

Table 3-1: Water Sample Collection locations along the TL-3

S. No	Name of sampling location	Coordinates
1.	Anarmani Substation	26.541131°, 87.941650°
2.	Kankai River	26.493566°, 87.826250°
3.	Biring River	26.519872°, 87.903752°
4.	Ratuwa River	26.482797°,87.651455°
5.	Budi Khola	26.559895°, 87.283495°
6.	Inaruwa Substation	26.612821°, 87.119529°
7.	Sunsari River	26.639400°, 87.111383°

The water sample from Anarmani Substation had all parameters within the limits of NDWQS 2079. In the Kankai river water sample, the value of Iron and Total Coliform counts were higher while rest of the the parameters were as per the limits of NDWQS 2079. The sample from Biring river had higher Mercury while other parameters were as per the limits of NDWQS 2079. The sample from Ratuwa river had higher coliform while all parameters within the limits of NDWQS 2079. The water sample from Budi river had all parameters within the limits of NDWQS 2079 while that of Inaruwa substation had higher Iron content. It was noticed that the water sample of Sunsari river had higher total coliform while other parameters were as per the limits of NDWQS 2079.

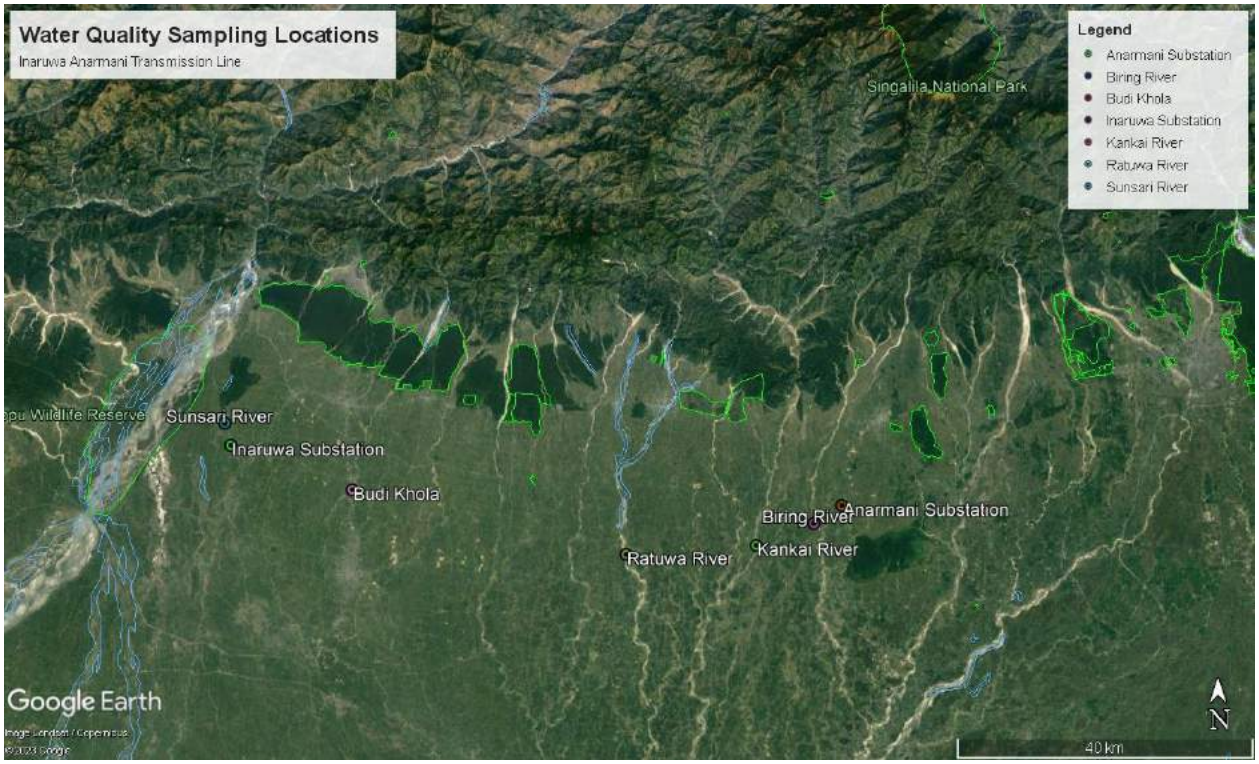


Figure 3.5: Water quality sampling locations

The water samples from Sunsari and Ratuwa, it is observed that all other parameters except the Total coliform were as per the limits of NDWQS 2079. The laboratory report of water quality analysis and National Drinking Water Quality Standard, 2079 is enclosed as **ANNEXURE VII (a).**

3.2.1.6 Soil Quality

Soil samples were collected in the study area from different locations. The details of sampling locations are given in Table 3.2 and shown in Figure 3.3. The soil samples were collected below the ground at a distance of 10-20 cm from the topsoil. The samples were then preserved in airtight plastic bags and analyzed.

Table 3-2: Soil sample collection locations along the TL-3

S. No	Name of sampling location	Coordinates
1.	Inaruwa Substation	26.612821°, 87.119529°
2.	Anarmani Substation	26.541131°, 87.941650°
3.	Inaruwa forest	26.598713°, 87.129001°

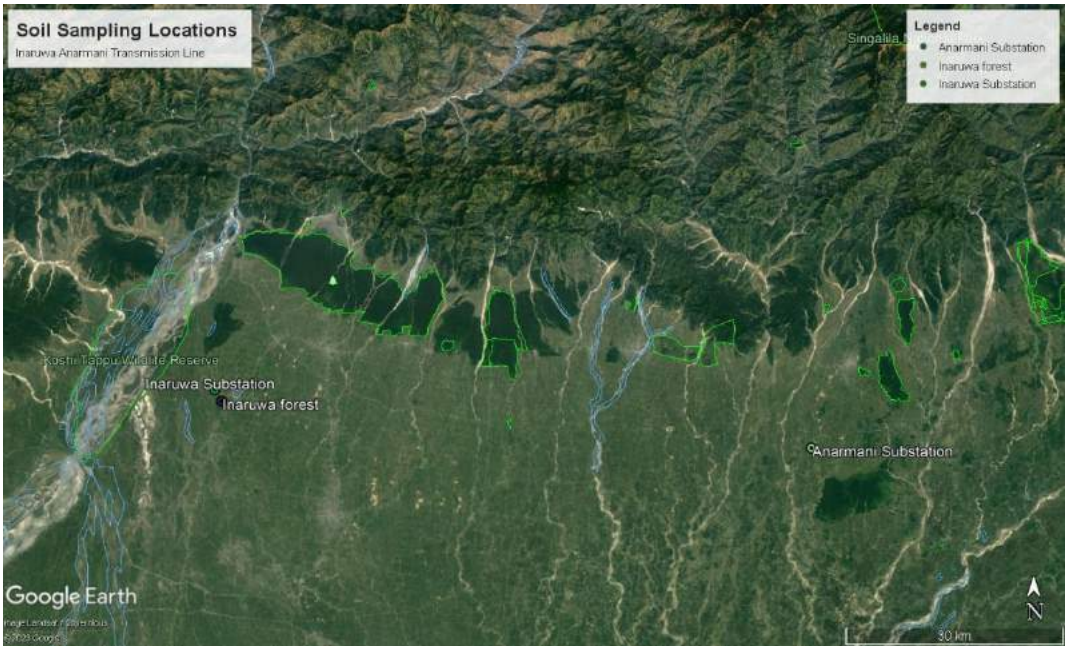


Figure 3.6: Soil sampling locations

The results of soil sampling analysis are given in Table 3.3., wheras the laboratory report of soil quality analysis is enclosed as **ANNEXURE VII (a).**

Table 3-3: Results of soil sampling analysis

S. No	Parameters	Sampling locations		
		Inaruwa Substation	Anarmani Substation	Inaruwa forest
1.	pH	5.21	5.20	8.12
2.	Electrical Conductivity (µS/cm)	58	55	42
3.	Total Kjedahl Nitrogen (%)	0.29	0.22	0.12
4.	Available Phosphorus (mg/kg)	42.68	17.54	4.90
5.	Total Potassium (mg/kg)	761.13	6459.1	124.5
6.	Texture:			
	Clay (%)	6	10	12
	Sand (%)	14.36	20.29	21.58
	Silt (%)	79.63	69.61	66.41
	Soil Type	Silt Loam	Silt Clay Loam	Silt Loam

3.2.1.7 Ambient Air Quality (AAQ)

The project area for TL-3 lies along the settlements with very less of the forest area. Another source of air pollution is cow dung and waste of crops burning, which is more in TL-3 sites and also in Sunsari District for TL-3 (Ref.: Figure 3.7).

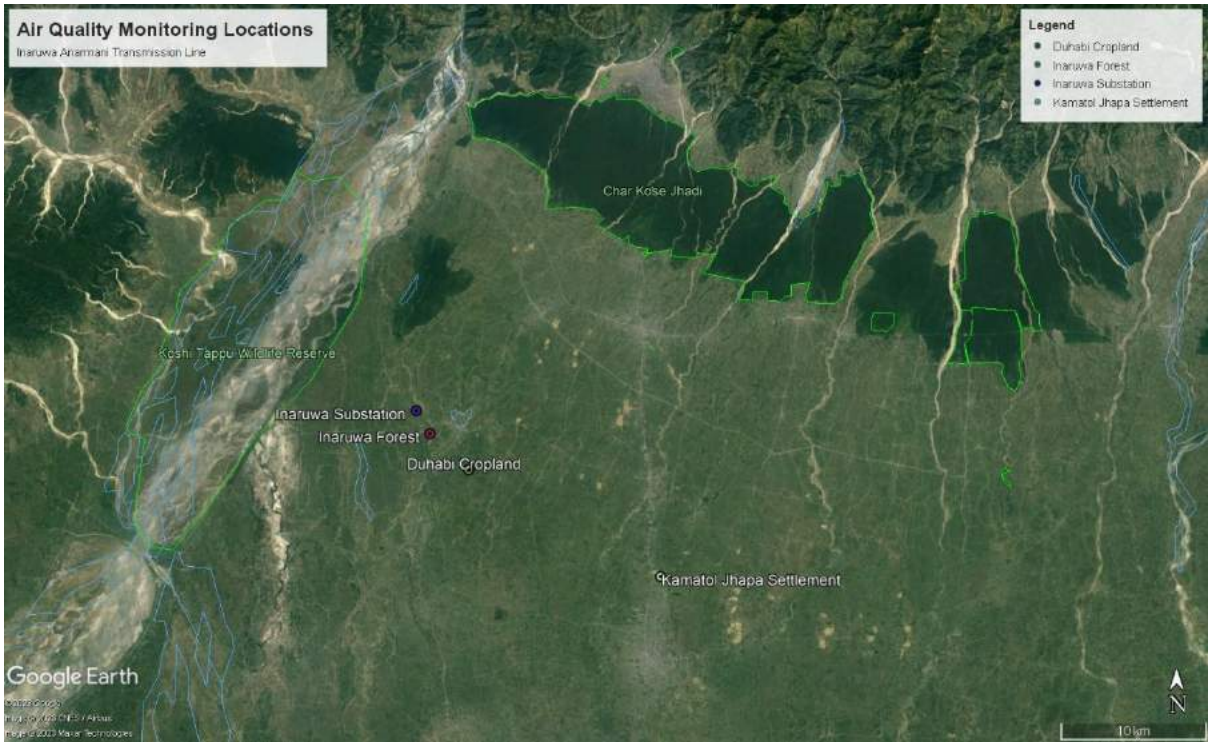


Figure 3.7: AAQ sampling locations

The ambient air quality was measured with a low volume sampler -IQAIR (Air Visual Pro Air Quality Monitor). The sampling location are given in Table 3.4 and shown in Figure-3.7. The average values were taken in the interval of one minute up to 6 hours. The sample were taken twice a week for four consecutive weeks per season for one season at four stations. The parameters monitored includes PM_{10} µg/m^3, $PM_{2.5}$ µg/m^3, SO_2 µg/m^3, NO_2 µg/m^3 and CO µg/m^3. The average values of the results at different stations is given in Table 3.5 to 3.8. According to the National Ambient Air Quality Standard of 2012, the maximum permissible concentrations of air pollutants are 120 µg/m^3 for PM_{10}, 40 µg/m^3 for $PM_{2.5}$, 70 µg/m^3 for SO_2, and 80 µg/m^3 for NO_2, all averaged over a 24-hour period. Our study measured the air quality in the project area, and the results showed that the measured values were within these normal limits. However, it is worth noting that the measurement for $PM_{2.5}$ was slightly higher than the prescribed limit. Despite this marginal increase, the overall findings indicate a satisfactory air quality in the project area.

Table 3-4: Details of AAQ sampling locations

S. No	Name of sampling location	coordinates
1.	Inaruwa Substation	26.612821°, 87.119529°
2.	Inaruwa Forest	26.598713°, 87.129001°
3.	Duhabi cropland	26.576550°, 87.155656°
4.	Kamatol Jhapa Settlement	26.510913°, 87.876544°

Table 3-5: Air Quality at Inaruwa Substation (26.612821°, 87.119529°)

SN	Parameters	Week1		Week 2		Week 3		Week 4	
		1st 7 AM to 1 PM	2nd 3 PM to 9 PM	1st 3 PM to 9 PM	2nd 6 AM to 12 PM	1st 9 AM to 3 PM	2nd 4 PM 10 PM	1st 4 PM to 10 PM	2nd 4 PM 10 PM
1	PM_{10} µg/m^3	97.31	91.27	90.34	87.51	82.65	80.11	102.4	101.1
2	$PM_{2.5}$ µg/m^3	60.81	63.8	63.3	61.23	57.86	41.86	61.1	69.1
3	SO_2 µg/m^3	2.88	2.86	2.81	2.54	2.27	2.01	2.3	2.5
3	NO_2 µg/m^3	6	3.7	3.58	3.18	2.79	2.38	5.1	4.2
4	CO µg/m^3	0.38	0.66	0.7	0.71	0.71	0.72	0.11	0.9

The values of PM_{10} are below the National Standards for all the four weeks at Inaruwa Substation. However, the values of, $PM_{2.5}$ are all more than the prescribed limits of 40 µg/m3. The higher values of $PM_{2.5}$ is a cause of concern. Breathing in unhealthy levels of, $PM_{2.5}$ can increase the risk of health problems like heart disease, asthma, etc. The values of SO_2, NO_2 and CO are much below the prescribed limits. Thus, the area is not prone to vehicular pollution, absence of industries and the absence of any other source of burning of fossil fuels.

Table 3-6: Air Quality at Inaruwa Forest: 26.598713°, 87.129001°

SN	Parameters	Week1		Week 2		Week 3		Week 4	
		1st 9 AM to 2 PM	2nd 3 PM to 9 PM	1st 6 AM to 12 PM	2nd 3 PM to 9 PM	1st 9 AM to 3 PM	2nd 4 PM 10 PM	1st 4 PM to 10 PM	2nd 9 AM to 3 PM
1	PM_{10} µg/m^3	97	90	89	86.1	83	75	78	71
2	$PM_{2.5}$ µg/m^3	60	64	66	40	29	34	32	43
3	SO_2 µg/m^3	20	23	21	31	21	28	20	30
3	NO_2 µg/m^3	9	8	15	11	13	14	18	13
4	CO µg/m^3	600	654	669	700	236	865	1100	460

The values of PM_{10} are below the National Standards for all the four weeks at Inaruwa Forest. The values of PM2.5 are also within the prescribed limits of 40 µg/m^3 except for the 1st week of monitoring. The lower values of PM_{10} and $PM_{2.5}$ are mainly due to forest area. The values of SO_2, NO_2 and CO are much below the prescribed limits. Thus, the area is not prone to vehicular pollution, absence of industries and the absence of any other source of burning of fossil fuels. Though, the values of CO much below than the prescribed limits of 10,000 µg/m^3 but the values of CO are much higher than the Inaruwa substation area.

Table 3-7: Air Quality at Duhabi cropland: 26.576550°, 87.155656°

SN	Parameters (µg/m^3)	Week1		Week 2		Week 3		Week 4	
		1st 10 AM to 3 PM	2nd 3 PM to 9 PM	1st 10 AM to 3 PM	2nd 3 PM to 9 PM	1st 10 AM to 3 PM	2nd 3 PM to 9 PM	1st 10 AM to 3 PM	2nd 3 PM to 9 PM
1	PM_{10}	96	89	89	86.1	83	75	78	71
2	$PM_{2.5}$	61	60	60	39	29	34	32	43
3	SO_2	21	23	21	31	24	28	20	30
3	NO_2	11	8	15	11	13	14	18	12
4	CO	620	650	669	700	240	850	1100	500

The values of PM_{10} are below the National Standards for all the four weeks at Duhabi cropland. The values of $PM_{2.5}$ are also within the prescribed limits of 40 µg/m^3 except for the 1st week of monitoring. The lower values of PM_{10} and $PM_{2.5}$ are mainly due to forest area. The values of SO_2, NO_2 and CO are much below the prescribed limits. Thus, the area is not prone to vehicular pollution, absence of industries and the absence of any other source of burning of fossil fuels.

Table 3-8: Air Quality at Kamatol Jhapa Settlement 26.510913°, 87.876544°

SN	Parameters (µg/m^3)	Week 1		Week 2		Week 3		Week 4	
		1st 7 AM to 1 PM	2nd 3 PM to 9 PM	1st 3 PM to 9 PM	2nd 6 AM to 12 PM	1st 9 AM to 3 PM	2nd 4 PM to 10 PM	1st 4 PM to 10 PM	2nd 9 AM to 3 PM
1	PM_{10}	97	91	89	88	89	78	100	103
2	$PM_{2.5}$	46	65	60	39	56.1	42.5	45	62
3	SO_2	20	21	22	19	13	27	26	35
3	NO_2	10	13	22	12	16	13	18	17
4	CO	800	521	563	741	570	693	500	500

The values of PM_{10} are below the National Standards for all the four weeks at Kamatol Jhapa Settlement. However, the values of $PM_{2.5}$ are all more than the prescribed limits of 40 µg/m^3. The higher values of $PM_{2.5}$ is a cause of concern. Breathing in unhealthy levels of $PM_{2.5}$ can increase the risk of health problems like heart disease, asthma, etc. The values of SO_2, NO_2 and CO are much below the prescribed limits. Thus, the area is not prone to vehicular pollution, absence of industries and the absence of any other source of burning of fossil fuels. The National Ambient Air Quality Standard 2012 are enclosed as **ANNEXURE VII (b).**

3.2.1.8 Ambient Noise Level

The ambient air quality was measured with a low volume sampler -IQAIR (Air Visual Pro Air Quality Monitor). A sound level meter (LUTRON SL-4011) was used to measure ambient noise quality. Field surveys was conducted at ten different locations within the project area.

The sound levels were recorded for both day and night, with the sound level meter which collects the data for every 2 minutes over a period of 3 hours at each location.

The sampling location are given in Table 3-9 and shown in Figure 3.8. The sound levels measured were converted to equivalent values and then compared with the National Ambient Air Quality Standard, 2012, which sets limits for noise in silent zones at 50 dBA during the day and 40 dBA during the night. Similarly, in the Rural Residential Area, the limits are 45 dBA during the day and 40 dBA during the night. Interestingly, our study found that the measured sound levels were within these normal limits, indicating a satisfactory noise environment in the project area. The Noise Level Standards of Nepal (2069) is enclosed as **ANNEXURE VII (b).**

Table 3-9: Location for collection of the noise level along the TL-3

S. No	Name of sampling location	Coordinates
1.	Anarmani Substation	26.541131°, 87.941650°
2.	Dear Duhabi Bridge	26.613008°, 87.118781°
3.	Duhabi cropland	26.576550°, 87.155656°

S. No	Name of sampling location	Coordinates
4.	Inaruwa forest	26.598713°, 87.129001°
5.	Inaruwa Substation	26.612821°, 87.119529°
6.	Kamatol Jhapa Settlement	26.510913°, 87.876544°
7.	Kankai river	26.493339°, 87.820425°
8.	Morang Budiganda RM Cropland	26.563222°, 87.297032°
9.	Near Ratuwamai RM, Jhapa	26.487825°, 87.633773°
10.	Ratuwa river	26.482795°, 87.652696°

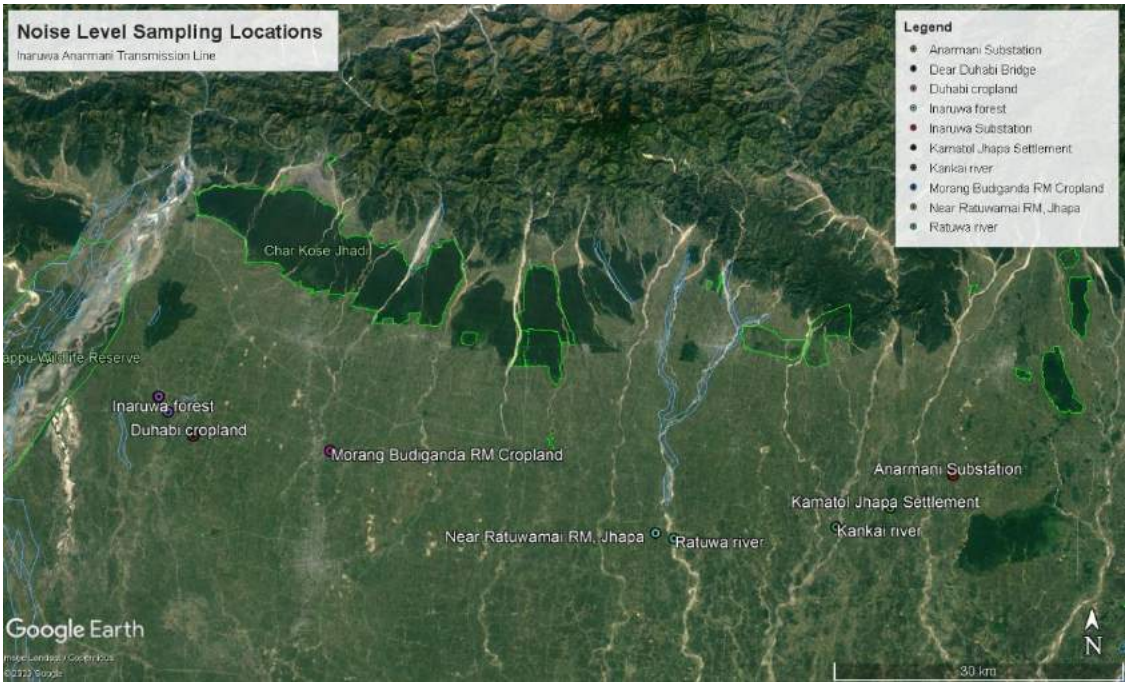


Figure 3.8: Noise level sampling locations

Noise level is expressed in Leq (decibels).

$L_{eq} = 10\log_{10}(1/N\Sigma f_i \times 10^{0.1 \times Li})$; Where,

N = number of discrete sound level measured

f_i = fraction of the time

L_i= Sound level at the i^{th} time

The noise levels at different location along TL3 are given in Table 3.10. As per standard the limits for noise in silent zones is 50 dBA during the day and 40 dBA during the night. Similarly, in the rural residential areas, the limits are 45 dBA during the day and 40 dBA during the night. Interestingly, our study found that the measured sound levels were within these normal limits, indicating a satisfactory noise environment in the project area.

Table 3-10: Noise level at different locations along TL-3

SN	Location Name	GPS Point	Sound Quality Leq(dBA)	National Ambient Air Quality Standard 2012
1	Anarmani Substation	26.541131°, 87.941650°	51	Silent Zone, Day: 50

SN	Location Name	GPS Point	Sound Quality Leq(dBA)	National Ambient Air Quality Standard 2012
2	Dear Duhabi Bridge	26.613008°, 87.118781°	43	Night: 40 Rural Residential Area, Day: 45 Night: 40
3	Duhabi cropland	26.576550°, 87.155656°	46	
4	Inaruwa forest	26.598713°, 87.129001°	41	
5	Inaruwa Substation	26.612821°, 87.119529°	50	
6	Kamatol Jhapa Settlement	26.510913°, 87.876544°	52	
7	Kankai river	26.493339°, 87.820425°	45	
8	Morang Budiganda RM Cropland	26.563222°, 87.297032°	42	
9	Near Ratuwamai RM, Jhapa	26.487825°, 87.633773°	45	
10	Ratuwa river	26.482795°, 87.652696°	51	

3.2.2 Biological Environment

A baseline biodiversity survey was carried out in May 2022 in first phase to collect data of fauna and flora. In April, 2023, the census of the Tree/Poles to be cut down were also done. There were several other visits to consider the minimum loss of the flora and fauna. The Bird Conservation Nepal (BCN) carried separate field work to cross check if there are any important bird area or migratory routes along the TL alignment.

The baseline setting for ecological aspects have been covered in this Chapter following floral and faunal accounts of the area. Flora is categorized into three groups as herbs, shrubs and trees. Fauna is divided into two groups i.e. terrestrial fauna included - mammal's reptiles, amphibians and birds.

3.2.2.1 Terrestrial vegetation study

In Nepal, distribution of natural forests generally follows attitudinal zones. Below 1,000 m there is tropical forest, predominantly of *Shorea robusta. Acacia catechu, Dalbergia sissoo* forests replace *Shorea* along rivers. In the foothills in western Nepal, Shorea is replaced by Terminalia forests. Sub-tropical forests occur between 1,000-2,000 m which includes *Pinus roxburghii, Alnus nepalensis, Schima wallichii and Castanopsis sp.*

3.2.2.2 Forest Types along the Project Alignment

Tropical forest is found in the project area for TL-3 (Ref.:Figure 3.9). Tropical forest is characterized by warm and humid climate. The major life forms include many kinds of deciduous species largely dominated by Sal *(Shorea robusta*). Other associated

species include- *Acacia pennata, Adina cordofolia, Bauhinia malbarica, Careya arborea, Mallotus philippinensis, Terminalia bellirica, Terminalia chebula, Terminalia myriocarpa, Bambusa aurundinacea, Eucalyptus citriodora* etc. Some of the commonly occurring medicinal plants in this forest are *Achyranthus aspera, Adhatoda vasica, Elephantopus scaber, Oroxylum indicum, Osyris wightiana, Aloe vera, Syzygium cumini, Vitex negundo, Cassia fistula, Woodfordia fructicosa, Sida cordata, Ricinus communis, Aegle marmelos, and Zizyphus mauritiana*.

There are two community forest in Sunsari District along the RoW, Milan Community Forest and Hanuman Community Forests. Most of the alignment pass through cultivated field and river banks. The details are given in Table 3.11. Most of the TL-3 alignment pass from the cultivated land, therefore, the enumeration of plants in the TL-3 transmission line route was done based on the Angle Points at different intervals. Most sections of the proposed alignment pass through cultivable land. Different tree species such as Masala (*Eucalyptus camaldulensis*), Sisau (*Dalbergia sissoo),* Kadam (*Neolamarckia cadamba*), Simal (*Bombax ceiba*), Teak (*Tectona grandis*) are present in the project alignment. In addition, species like Mango (*Mangifera indica*), Lychee (*Litchi chinensis*), Bar (*Ficus benghalensis*), Bayar (*Ziziphus mauritiana*), Pipal (*Ficus religiosa*) and groves of Bamboos (*Dendrocalamus hamiltoni*) are common on the private land in the project areas.

There is an abundance of grasses such as *Saccharum spontaneum* in the edge of streams.

Table 3-11: Sample Plot and Forest Composition

Sample plot	Forest		Forest composition	Vegetation type	Transmission Line
AP-6	Sunsari Milan		Dalbergia mixed forest	Tropical forest	Inaurawa - Anamrmani
Ap-7	Hanuma ne		Dalbergia mixed forest	Tropical forest	Inaurawa - Anamrmani

(Source: Field Survey May, 2022)

Figure 3.9: Tropical Forest in Sunsari.

3.2.2.3 Forest Survey

Assessing the floral diversity in the study areas for floristic survey of vegetation were undertaken. Most of the TL-3 alignment passes through the forest land. The plot on every 1 km distance was prepared using equal interval from which we eliminated all sample plots which lies on other category than forest, grassland, other wooded land and barren land. This was done for survey of the vegetation. However, details census was also done to get the detail information on the loss of Trees and Poles. The sampling was done in May, 2022. However, total census of the Trees was done in April 2023. The plant species recorded in the areas from Arun Hub to Inaruwa are given in Table 3.12.

Table 3-12: Plant species recorded in the areas from Arun Hub to Inaruwa

Botanical name	Local name	Habitat
Alternanthera brasiliensis Hort	Aitin	Shrub
Albizia procera (Roxb.) Benth.	White siris	Tree
Phyllanthus emblica L.	Amala	Tree
Achyranthes aspera L.	Apamarga	Herb
Acacia pennata (L.)Willd.	Arari	Shrub
Justicia adhatoda L.	Asuro	Shrub
Myrsine seguinii H.Lev.	Bakalpate	Tree
Sida cordata (Burm.f.) Borss.Waalk.	Bala	Shrub
Potentilla fulgens Wall. ex Hook.	Banmula	Herb

Botanical name	Local name	Habitat
Ficus bengalensis L	Bar	Tree
Persicaria barbata (L.) H.Hara	Bareputul	Herb
Terminalia bellirica (Gaertn.) Roxb.	Barro	Tree
Aegle marmelos (L.) Corre	Bel	Tree
Chilocostus specious (J. Konig)C. Specht	Betlauri	Herb
Semecarpus anacardium L.	Bhalau	Tree
Ziziphus oenopolia (L.) Mill.	Airee	Tree
Mallotus pallidus (Airy Shaw) Airy Shaw	Airy Shaw	Shrub
Crotalaria pallida Aiton	Bimfang	Herb
Cuscuta reflexa Roxb.	Binajari	Parasitic
Barleria cristata L.	Bluebell	Shrub
Poa annua L.	Bluegrass	Grass
Astilbe rivularis Buch.-Ham. ex D. Don	Budo okha	Herb
Urena lobata L.	Caesarweed	Shrub
Oxalis corniculata L.	Chari Amilo	Herb
Elephantopus scaber L.	Dadari	Herb
Phoebe lanceolata (Nees) Nees	Dalchine	Tree
Daphne bholua Buch.-Ham. ex D.Don	Daphne	Shrub
Woodfordia fruticosa (L.) Kurz.	Dhayero	Shrub
Ficus semicordata Buch.-Ham. ex Sm.	Drooping fig	Tree
Cynodon dactylon (L.) Pers	Dubo	Grass
Spirodela polyrrhiza (L.) Schleid.	Duckweed	Herb
Angiopteris evecta G. Frost.)Hoffm.	Gaikhure	Tree
Physalis peruviana L.	Gangathopa	Shrub
Ephedra gerardiana Wall. ex Stapf	Gerard's jointfir	Herb
Aloe vera (L.) Burm f.	Ghyukumari	Herb
Calotropis gigantea (L.) Dryand.	Gogando bimtang	Shrub
Artemisia dubia L. ex B.D.Jacks.	Gokhag-ansu	Herb

Botanical name	Local name	Habitat
Stephania glandulifera Miers	Gudargano	Climber
Rosa indica L.	Gulaf	Shrub
Tinospora sinensis (Lour.) Merr.	Gurjo	Climber
Hippochaete debilis (Roxb. ex Vaucher) Ching	Haal goda	Herb
Drymaria cordata (L.) Willd. ex Schult.	Hachiyo	Herb
Cissus quadrangularis L.	Hadjora	Climber
Rumex nepalensis Spreng	Halhale	Herb
Lannea coromardelica (Houtt.) Merr.	Halude	Tree
Terminalia chebula Retz	Harro	Tree
Betula alnoides Buch.-Ham. ex D.Don	Himalayan Birch	Tree
Abies spectabilis (D.Don) Mirb.	Himalayan Fir	Tree
Trichosanthes tricuspidata Lour	Indrani	Climber
Araucaria bidwillii Hook.	Kade Sallo	Tree
Citrus junosTanaka	Kali jyamir	Tree
Tctaria coadunata (Wall.ex J.Sm) C.Chr.	Kali unu	Climber
Eupatorium adenophorum Spreng.	Kalijhar	Herb
Callistemon citrinus (Curtis) Skeels	Kalki Phool	Shrub
Rubus ellipticus Sm	Kande ainselu	Shrub
Myrica esculenta Buch.-Ham. ex D. Don	kaphal	Shrub
Haldina cordifolia (Roxb.) Ridsdale	Karam	Tree
Persea odoratissima (Nees) Kosterm.	Kaulo	Tree
Gossypium hirsutum L.	Kawas	Shrub
Acacia catechu (L.f.) Wild.	Khayar	Tree
Polygonum molle D. Don	knotgrass	Grass
Musa × paradisiaca L.	Kola	Shrub
Asparagus racemosus Willd	Kurilo	Herb
Populus deltoides Marsh.	Lahare Pipal	Tree
Clerodendrum infortunatum L.	Lakhanaat	Shrub

Botanical name	Local name	Habitat
Panicum sumatrense Roth	Little millet	Grass
Amaranthus spinosus L.	Lude/Genhar	Herb
Rubia manjith Roxb. ex Fleming	Majitho	Climber
Gonatanthus pumilus (D.Don) Englerand Krause	Mane	Herb
Hydrocotyle sibthorpioides L.	Manemumi	Herb
Hymenachne amplexicaulis (Rudge) Nees	Marsh grass	Grass
Eucalyptus citriodora Hook.	Masala	Tree
Eriobotrya elliptica Lindl	Maya	Tree
Pyrus pashia Buch-Ham.ex.Don.	Mel	Tree
Trigonella foenumgraecum L.	Meth	Climber
Cassia fistula L.	Mukhra laudhi	Tree
Azadirachta indica A.Juss.	Nimbilai	Tree
Juglas regia L.	Okhar	Tree
Entada phaseoloides (L.) Merr.	Pangro	Climber
Nephrolepis auriculata (L.) Trimen	Pani amala	Herb
Bergenia ciliate (Haw.) Sternb.	Pashanbheda	Herb
Bryophyllum pinnatum Lam.	Patharchatta	Tree
Micheliachampaca L.	Payanlo champ	Tree
Machilus duthiei King	Persea americana	Tree
Zingiber cassumunar Roxb.	Phachhyang	Herb
Clematis buchananiana DC.	Pinesa lahara	Climber
Ficus religiosa L.	Pipal	Tree
Acmella calva (D.C.)Jansen	Pire Jhar	Herb
Ocimum gratissimum L.	Ramtulsi	Herb
Albizia julibrissin Durazz.	Rato Siris	Tree
Rhododendron arboreum Sm.	Rhododendron	Shrub
Sapindus mucorossi Gaerth.	Rithha	Tree

Botanical name	Local name	Habitat
Shorea robusta Gaertn.	Sal	Tree
Canna edulis Ker. Gawl	Sarbada	Herb
Alstonia scholaris (L.) R. Br.	Sayotonabimfang	Tree
Inula cappa (Buch.-Ham. ex D.Don) DC	Sheep's Ear	Shrub
Euphorbia royleana Boiss.	Sijau	Shrub
Lindera neesiana (Wall. ex Nees) Kurz	Siltimu	Tree
Bombax ceiba L.	Simal	Tree
Vitex negundo L.	Simali	Shrub
Dalbergia sissoo Roxb.	Sissoo	Tree
Sesamum orientale L.	Siwing	Herb
Lindera nacusua (D. Don) Merr.	Spicebush	Shrub
Lithocarpus elegans (Blume) Hatus. ex Soepadmo	Spike Oak	Tree
Santalum album L.	Srikhanda	Tree
Valeriana jatamansi Jone	Sugandhwa	Herb
Caesalpinia bonduc (L.) Roxb.	Sugrong bithai	Shrub
Argemone maxicana L.	Sungure Kada	Herb
Lantana camara L.	Sutkeri kada	Shrub
Cyathea spinulosa Wall.ex Hook.	Thulo unu	Tree
Artemisia indica Willd.	Titepat	Herb
Oroxylum indicum (L.) Kurz	Totala	Tree
Taraxacum officinale Weber	TukiPhoo	Herb
Carica papaya L.	Tul-mul	Shrub
Alnus nepaulensis D.Don.	Utis	Tree
Drymaria cordata (L.) Wild.ex Roemerand Schultes	Vijalo	Herb
Selinum wallichianum (DC.) Raizada and H.O. Saxena	Wallich milk parsley	Herb
Careya arborea Roxb.	Wild guava	Tree

Botanical name	Local name	Habitat
Flemingia strobilifera (L.) W.T.Aiton	Wild hops	Shrub
Spermacoce alata Aubl	Winged false buttonweed	Herb
Dioscorea deltoidea Wall. ex Griseb.	Yam	Climber

(Source: Field Survey, 2022/2023)

Total tree loss

Total tress loss in TL-3 is 105 and poles loss will be 194. The net volume and wood loss has been calculated as follows for RoW and Tower Pad separately. The net volume and wood loss has been calculated as follows and detail is in Table 3.13. The details of the Forest loss is given in **ANNEXURE-VIII**.

Table 3-13: Loss of Tress/Poles and Wood Volume

Sunsari Milan Community Forest (RoW)							
No. of trees	Gross Volume (cubic feet)	Net Volume (cubic feet)	Wood (cubic feet)	No of Poles	Gross Volume (cubic feet)	Net Volume (cubic feet)	Wood (cubic feet)
2	0.00	0.00	0.17	47	13.12	0.37	0.60
Sunsari Milan Community Forest (Tower)							
No. of trees	Gross Volume (cubic feet)	Net Volume (cubic feet)	Wood (cubic feet)	No of Poles	Gross Volume (cubic feet)	Net Volume (cubic feet)	Wood (cubic feet)
25	373.16	10.57	3.07	55	146.53	4.15	1.61
Hanuman Community Forest (RoW)							
No. of trees	Gross Volume (cubic feet)	Net Volume (cubic feet)	Wood (cubic feet)	No of Poles	Gross Volume (cubic feet)	Net Volume (cubic feet)	Wood (cubic feet)
23	558.55	15.82	2.87	31	47.19	1.34	0.55
Hanuman Community Forest (RoW)							
No. of trees	Gross Volume (cubic feet)	Net Volume (cubic feet)	Wood (cubic feet)	No of Poles	Gross Volume (cubic feet)	Net Volume (cubic feet)	Wood (cubic feet)
55	1888.22	53.47	8.29	61	130.89	3.71	1.18

Note- Besides these there is also loss of Seedling and Sapling.

Biomass study

The quantitative data from the total count of forest was used for the analysis of frequency, density, basal area, relative basal area, crown coverage, and wood volume. The data such as basal area, volume, timber, fuel wood (Growing Stock) as

well as tree species, diameter of tree and poles in cm, height of tree and poles in m, grade of tree (first, second, third and fourth) were entered in the Excel sheet.

Different layers of collected data from different sources were processed and analyzed through an integrated approach. Qualitative data were analyzed in descriptive manner and quantitative data were analyzed by using appropriate models and appropriate statistical tools such as GIS and Excel software.

The following formula is used to calculate the basal area (BA), biomass, volume and carbon storage of the standing trees, poles and sapling:

Volume Equations (Forest Regulation 2079 Annexure 9 related to Rule 19 sub rule 2 and Rule 131, sub section a and b; pages 201 to 206).

Stem Volume (V) = EXP [a+b*Ln(d)+c*Ln(h)],

Where, d = dbh in cm,
h = height in m,
a,b,c are constant values.

Branch Volume Formula = Stem Volume*R-value

R-value (R<10, R10-40, R40-70, R70+) =
Branch Volume/Stem Volume
Gross Timber Volume = Stem Volume * Ratio
Ratio (R-top) = Tree volume above 10 cm Top Dia/Stem Volume

For R value calculations:

1. R value for Diameter class less than 10 cm;
Formula:R<10= small (s)
2. R value for Diameter class between 10-40 cm;
Formula: R10-40 = [(d-10)*m+(40-d)*s]/30
3. R value for Diameter class between 40-70 cm;
Formula: R40-70 = [(d-40)*b+(70-d)*m]/30
4. R value for Diameter class more than 70 cm;
Formula: R70+ = big (b)
Ratio = Exp [(a1+b1*Ln(d)]
Where, a1 and b1 are constants.

3.2.2.4 Terrestrial Fauna

Most of the section of the alignment is located on cultivable land only in Sunsari, there are community forests that are very close to settlement area. No critical faunal habitat areas were observed along the alignment during the preliminary field visit. The presence of some common faunal species in the project area include fox (*Vulpes bengalensis*), golden jackal (*Canis aureus*), Indian hare (*Lepus nigricollis*), jungle cat (Felis chaus) etc.

According to Ram and Acharya, 2020, there are approximately 230 individuals' Asian elephants traveling across the lowlands of Nepal.Asian elephant (*Elephas maximus indicus*) is one of the longest distance travelling migratory animal of the Indian subcontinent.

It is the subspecies of Elephas maximus, listed as "endangered" in IUCN Red List of Endangered Species. It is also under the CITES Appendix I, and Nepal's protected

species under NPWC Act, 1973. They are herbivorous, gray wrinkled skin with long trunk and sail-like ears mammals of order Proboscidea.

Jhapa district is one of the most human elephant conflict (HEC) zone and one of the major routes of elephant migration from India. This district is used by hundreds of Indian wild elephants each year for migration, and some of them migrate far away towards south in Jalthal forests.

TL-3 Inaruwa to Anarmani Substation lies at Anarmani (26.54106809, 87.94160980), Ward No. 1 of Haldibari Rural Municipality. This could be the migratory route of Asian elephants not from the sub station area, about 15 km eastern part seems to be the route, where about 50 years before two elephant were heading to North.

The desktop review and preliminary site visit helped in an assessment of potential listed species and that these are shown along with their CITES, IUCN or Endemic status under Table 3-14.

Table 3-14: **Faunal species recorded from study areas**

S. N	Species	Family	Local Name	IUCN Red-List (v2018-2)	Nepal Red List Category	NPWLC Protected Status
	Mammals					
1.	*Mabuya carinata*	Scinidae	Bhanemungro	Least Concerned	N/A	Not Protected
2.	*Mus musculus*	Muridae	Duhure Gharmuso	Least Concerned	Least Concerned	Not Protected
3.	*Herpestes edwardsii*	Herpestidae	Thulo Nyaurimuso	Least Concerned	Least Concerned	Not Protected
4.	*Semnopithecus schitaceus*	Cercopithecidae	Langur	Least Concerned	Least Concerned	Not Protected
5.	*Herpestes edwardsii*	Herpestidae	Thulo Nyaurimuso	Least Concerned	Least Concerned	Not Protected
6.	*Canis aureus*	Canidae	Syal	Least Concerned	Least Concerned	Not Protected
7.	*Amphiesma stolatum*	Colubridae	Har-Hara	Least Concerned	N/A	Not Protected
8.	*Oryctolagus cuniculus*	Leporidae	Kharayo	Least Concerned	Least Concerned	Not Protected
9.	*Macaca mulata*	Cercopithecidae	Badar	Least Concerned	Least Concerned	Not Protected
	Reptiles					
10	*Ptyas mucosa*	Colubridae	Dhaman	Least	N/A	Not

S. N	Species	Family	Local Name	IUCN Red-List (v2018-2)	Nepal Red List Category	NPWLC Protected Status
.				Concerned		Protected
11	*Naja naja*	Elapidae	Goman	Least Concerned	N/A	Not Protected

(Source: Field Survey, 2022/2023)

3.2.2.5 Terrestrial Wildlife

Similarly, the data for wildlife, birds and aquatic life were used for the estimations of abundance, range, typical habitats for feeding, breeding and nesting requirements within the project area. Both primary and secondary data were used for the collection of information. Primary data were collected from direct observation along walking trails of the project area. Observation on the walking trail was performed mainly in the early morning and evening. Each walking trail was visited two times and each visit lasted for about five hours. Field guidebooks containing photographs of wild animals were shown during consultation to collect information. Data recorded from the field were compared with the available secondary literature, reviewed. Field guidebooks Shah (2004) for herpetofauna, Grimmet et al. (2003) for birds and Baral and Shah (2006) for mammals were followed. Secondary data were collected through consultations and literature reviews. Consultations were conducted with local people, forest-goers or cattle grazers, community forest user group etc. The review of relevant literatures including information related to wildlife, amphibians and reptiles were studied.

Direct Field Observation

The mammals of the project area were surveyed by direct field observation using line transect. Two-hundred-meter-long, line transects were be placed in different habitat such as forests, open grasslands, shrubs etc., and the information was recorded. Wild animals seen on either side of the trail were noted. Besides that, burrows, pugmarks/footprints, droppings/pellets, ground digging and uprooting, tree scratching and marking, remains (skin, fur, feathers, bones, horns/antlers and carcasses), nests, holes and burrows, etc. were also considered for updating the data. In addition, call counts, cries, smell/odor, leftover food, trampling of plants, flowers and fruit bunches were also recorded (Sutherland, 1997).

Elephant's Route Survey

About 12 stations were surveyed with a combing a distance of about 4.48 km. The objectives of survey were to search recent footmarks, droppings, and routes etc. of Asian elephants from Anarmani substation to Biring River. A team of 24 persons well conversant with the study area were involved in the study. A sample questionnaire were prepared and given to survey team to identify the historic evidence of Asian elephant routes etc. The walk-through survey was started in the morning at 8.30 hrs and ended at 17:00 hrs. The survey team accompanied the instruments like Camera, GPS etc. The plot on every 1 km distance was prepared using equal interval from which we eliminated all sample plots which lies on other category than forest,

grassland, other wooded land and barren land. And among total sample plots we studied sample plots only which contain 2 sample plots.

Assessment of Avi Fauna

The methodology adopted for Bird survey is as follows:

1. Species likely to be impacted by construction activities and the footprint of the transmission line.

2. Species likely to be impacted by collision or electrocution with or by the transmission line.

Line transect surveys recorded bird sightings i.e. direct observation and indirect (e.g. nests and bird calls) along a fixed pre-determined survey route. The survey routes were determined by choosing locations that cover all identified important habitats within a 250 m strip on either side of the TL alignment. Local villagers from nearby settlement were interviewed to document their knowledge and sighting experience regarding local fauna.

Indirect Observation

Indirect observations such as droppings and footprints of the animals found in site and nearby forest, area was observed. The habitat pattern, available habitat along the TL route of the project area based on the field observations, reported literature, interaction with locals etc.

Informal interviews were conducted along with observations. These techniques helped the team to triangulate the data collected through KII. Photo documentation were also undertaken by the team.

Interviews with Local People

The key informant about biodiversity is officials at Ministry Province Ministry of Forests, and Environment (Ref. Figure 3.10). They were consulted before the site visit to obtain permission for the study and to get more secondary information on the flora and fauna.

Figure 3.10: Meeting at Province Ministry of Forests and Environment.

3.2.2.6 Economically important plant species

Nepal has a rich vegetation with a wide variety of plant species, because of the extreme variations in geographical and climatic conditions. Plants have been used since ancient times for various purposes viz medicines, firewoods, timbers. During field survey, economically important plant species were observed along the RoW TL-3, details are given in Table 3.15.

Table 3-15: Economically important plant species along the RoW

Species	Uses	Parts used
Bombax ceiba	Medicine and firewood	Whole plant
Acacia catechu	Medicine	Leaf
Zizyphus mauritiana	Medicine	fruit
Nephrolepis spp.	Medicine	Whole plant
Dalbergia sisoo	Wood	Whole plant
Neolamarckia cadamba	Medicine	flower
Leucas zeylanica	Used as bio insecticides	Leaf
Argemone maxicana	Oil	Whole plant
Bambusa Schreb.	Food	Young shoot
Rubus spp.	Food, as medicine of gastritis other purposes	Fruit and young stem
Eucalyptus	Wood	Whole plant
Artemisia dubai	Used as bio insecticides	Leaf
Ocimum gratissimum	Medicine	Whole plant

Species	Uses	Parts used
Cassia fistula	Medicine	fruit
Ficus religosa	Medicine	fruit
Tectona grandis	Wood	Whole plant

(Source: Field Survey, 2022/2023)

Identification of RET Plant Species

Rare, Endangered and Threatened (RET) plant species are not observed and recorded in the land to be acquired for various project appurtenances.

3.2.2.7 Avifauna

Migratory birds in Nepal

Around 150 species of migratory birds used to Nepal ground in winter season. According to Dr. Hem Sagar Baral, a prominent Ornithologist of Nepal the winged guests have been travelling to Nepal every year especially from Central Asia, Tibet, China, Korea, Mongolia and Siberia.

The peak migration time is from mid-September to late October, and they continue to make Nepal their home until the end of November. There are mostly two kinds of migratory birds that come to country are- wetland birds and terrestrial birds.

Some of common migratory birds are- Green shank (Tringa nebularia), Mallard (Anas platyrhynchos), Ruddy Shelduck (Tadorna ferruginea), Temminck's stint (Calidris temminckii), Bar-headed goose (Anser indicus), Gadwall (Mareca Strepera), Eurasian teal (Anas crecca), Thrush (Turdus rufiventris), Fly Catcher (Muscicapa striata), Steppe Eagle (Aquila nipalenses), Booted Eagle (Hieraaetus pennatus), Grus (Grus grus) and Woodsand Piper (Aquila nipalensis).

However, there are no migratory routes along the proposed TL-3. Some of the species recorded in the TL-3 alignment and surrounding are given in Figures 3.11 and 3.12.

Asian Pied Starling (*Gracupica contra*)

Eurasian Collared-dove (*Streptopelia decaocto*)

Common Stonechat (*Saxicola torquatus*)

Paddy field Pipit (*Anthus rufulus*)

Oriental Magpie-robin (*Copsychus saularis*)

Common Myna (*Acridotheres tristis*)

Grey-headed Lapwing (*Vanellus cinereus*)

Black-rumped Flameback (*Dinopium benghalense*)

Figure 3.11: Some of the birds along TL alignment and Surrounding (BCN)

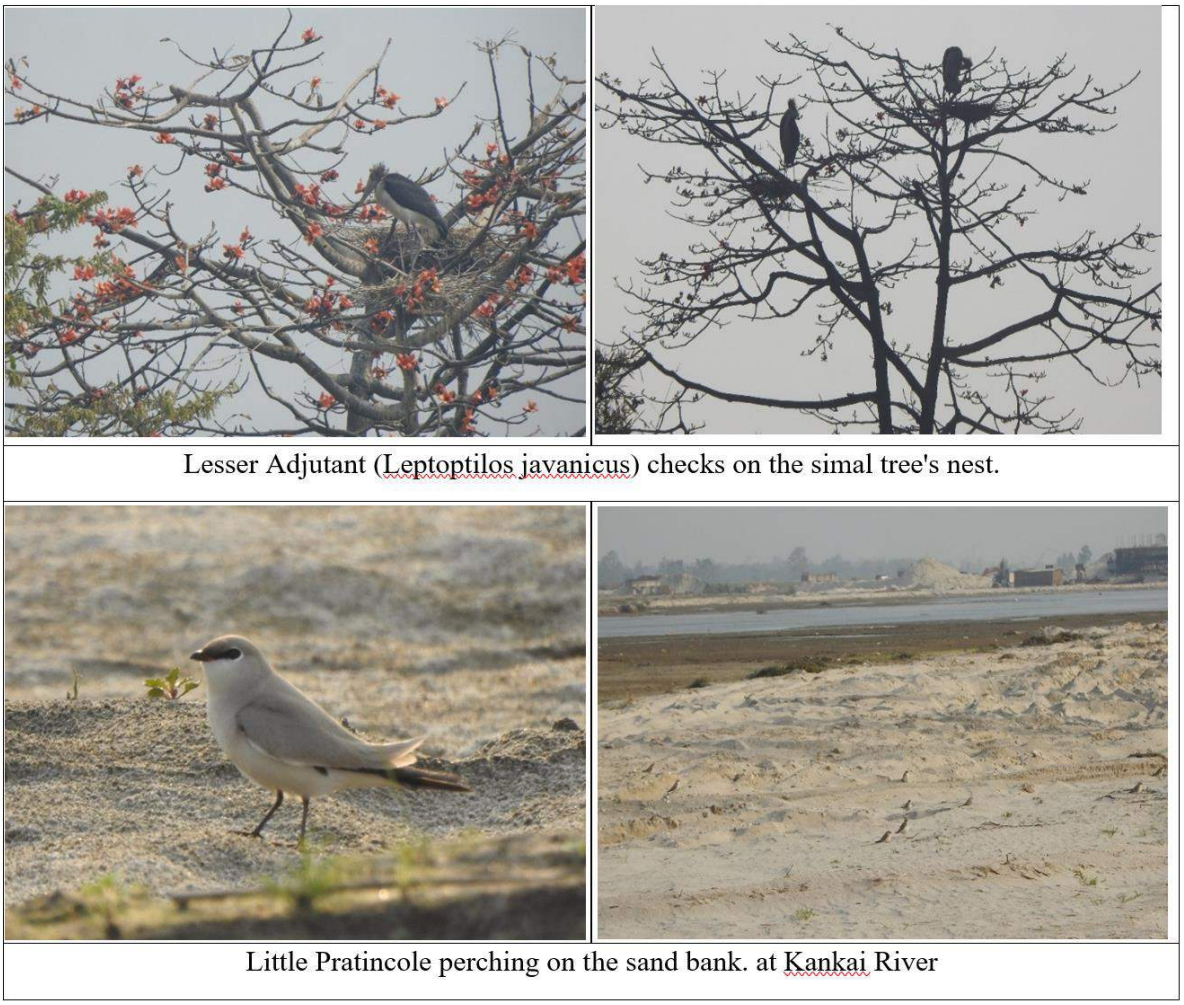


Figure 3.12: Some of the birds in the area

From Anarmani substation to Kankai River is very important habitat for birds. Along the TL-3 Inaruwa to Anarmani TL routes, the following 67 species were notes. Among them Leptoptilos javanicus, Circus aeruginosus, Vanellus malabaricus and Anastomus oscitans are vulnerable while Circus aeruginosus, Anastomus oscitans, Spilornis cheela, Buteo refectus are under CITES II. The details are given in Table 3.16.

Table 3-16: Faunal species recorded from study areas

SN	English name	Scientific name	Nepali name	Globally Threatened	Nationally Threatened	CITES	NPS
1	Eurasian Collared-dove	*Streptopelia decaocto*	Khanthe Dhukur	-	-	-	-
2	Western Spotted Dove	*Spilopelia suratensis*	Karle Dhukur	-	-	-	-
3	Greater Coucal	*Centropus sinensis*	Dhade Gokul	-	-	-	-
4	Common Hawk-cuckoo	*Hierococcyx varius*	Bihukueyo	-	-	-	-
5	Common Tailorbird	*Orthotomus sutorius*	Pasiune Fisto	-	-	-	-
6	Asian Pied		Dangre	-	-	-	-

SN	English name	Scientific name	Nepali name	Globally Threatened	Nationally Threatened	CITES	NPS
	Starling	*contra*					
7	Common Myna	*Acridotheres tristis*	Dangre Rupe	-	-	-	-
8	Common Stonechat	*Saxicola torquatus*	Phapsi	-	-	-	-
9	House Sparrow	*Passer domesticus*	Ghar Bhangera	-	-	-	-
10	Jungle Babbler	*Turdoides striata*	Bagale Bhaykur	-	-	-	-
11	Oriental Magpie-robin	*Copsychus saularis*	Dhobini Chara	-	-	-	-
12	Red-throated Flycatcher	*Ficedula albicilla*	Lalkanthe Arjunak	-	-	-	-
13	White-tailed Stonechat	*Saxicola leucurus*	Kanse	-	-	-	-
14	Brown-headed Barbet	*Psilopogon zeylanicus*	Kumchirke	-	-	-	-
15	Rose-ringed Parakeet	*Psittacula krameri*	Kanthe Suga	-	-	-	-
16	Long-tailed Shrike	*Lanius schach*	Bhadrai	-	-	-	-
17	House Crow	*Corvus splendens*	Ghar Kag	-	-	-	-
18	Red-vented Bulbul	*Pycnonotus cafer*	Jureli	-	-	-	-
19	Chestnut-tailed Starling	*Sturnia malabarica*	Saram	-	-	-	-
20	Paddyfield Pipit	*Anthus rufulus*	Aalai Chuhiyo	-	-	-	-
21	Lesser Adjutant	*Leptoptilos javanicus*	Bhudi Khor Garudh	VU	VU	-	-
22	Cattle Egret	*Bubulcus ibis*	Bakulla	-	-	-	-
23	Little Egret	*Egretta garzetta*	Sano Seto Bakulla	-	-	-	-
24	Black-hooded Oriole	*Oriolus xanthornus*	Chibe	-	-	-	-
25	Large-billed Crow	*Corvus macrorhynchos*	Kalo Kag	-	-	-	-
26	Scaly-breasted Munia	*Lonchura punctulata*	Muniya	-	-	-	-
27	Western Marsh-harrier	*Circus aeruginosus*	Bhuichil	-	VU	II	-
28	Bengal Bushlark	*Mirafra assamica*	Bhardwaj	-	-	-	-
29	Oriental Skylark	*Alauda gulgula*	Bramichat	-	-	-	-
30	Zitting Cisticola	*Cisticola juncidis*	Phirphire	-	-	-	-

SN	English name	Scientific name	Nepali name	Globally Threatened	Nationally Threatened	CITES	NPS
31	Brown Shrike	*Lanius cristatus*	Khairo Bhardai	-	-	-	-
32	Little Cormorant	*Microcarbo niger*	Sano Jalewa	-	-	-	-
33	Yellow-wattled Lapwing	*Vanellus malabaricus*	Huttitaun	-	VU	-	-
34	Red-wattled Lapwing	*Vanellus indicus*	Huttitaun	-	-	-	-
35	White-breasted Kingfisher	*Halcyon smyrnensis*	Matikore	-	-	-	-
36	Blue-throated Barbet	*Psilopogon asiaticus*	Kuthurke	-	-	-	-
37	Black-rumped Flameback	*Dinopium benghalense*	Kalodhade Lahache	-	-	-	-
38	Black Drongo	*Dicrurus macrocercus*	Kalo Chibe	-	-	-	-
39	Rufous Treepie	*Dendrocitta vagabunda*	Kokle	-	-	-	-
40	Plain Prinia	*Prinia inornata*	Fisto	-	-	-	-
41	Red-whiskered Bulbul	*Pycnonotus jocosus*	Jureli	-	-	-	-
42	Tickell's Leaf-warbler	*Phylloscopus affinis*	Fisto	-	-	-	-
43	Red-naped Ibis	*Pseudibis papillosa*	Karra	-	-	-	-
44	Indian Pond-heron	*Ardeola grayii*	Bakulla	-	-	-	-
45	Red-throated Thrush	*Turdus ruficollis*	Bakulla	-	-	-	-
46	Green Sandpiper	*Tringa ochropus*	Rukh Sudiya	-	-	-	-
47	Common Greenshank	*Tringa nebularia*	Timtima	-	-	-	-
48	Lesser Whistling-duck	*Dendrocygna javanica*	Silsile	-	-	-	-
49	Ruddy Shelduck	*Tadorna ferruginea*	Chakhewa	-	-	-	-
50	Rock Dove	*Columba livia*	Malewa	-	-	-	-
51	Oriental Turtle-dove	*Streptopelia orientalis*	Tame Dhukur	-	-	-	-
52	White-breasted Waterhen	*Amaurornis phoenicurus*	Simkukhura	-	-	-	-
53	Asian Openbill	*Anastomus oscitans*	Ghudikhor Garundh	-	VU	-	-

SN	English name	Scientific name	Nepali name	Globally Threatened	Nationally Threatened	CITES	NPS
54	Great White Egret	*Ardea alba*	Seto Bakulla	-	-	-	-
55	Intermediate Egret	*Ardea intermedia*	Sano Seto Bakulla	-	-	-	-
56	Little Ringed Plover	*Charadrius dubius*	Alakchandra	-	-	-	-
57	Kentish Plover	*Charadrius alexandrinus*	Alakchandra	-	-	-	-
58	River Lapwing	*Vanellus duvaucelii*	Hutitaun	-	-	-	-
59	Temminck's Stint	*Calidris temminckii*	Jalarang	-	-	-	-
60	Little Pratincole	*Glareola lactea*	Pani Gauthali	-	-	-	-
61	Pied Kingfisher	*Ceryle rudis*	Matekire	-	-	-	-
62	Sand Lark	*Alaudala raytal*	Bagar Bhardwaj	-	-	-	-
63	White Wagtail	*Motacilla alba*	Fusro	-	-	-	-
64	Crested Serpent-eagle	*Spilornis cheela*	Kakakul	-	-	II	-
65	Himalayan Buzzard	*Buteo refectus*	Shainbaj	-	-	II	-
66	Tree Pipit	*Anthus trivialis*	Bagale Chuiya	-	-	-	-

3.2.2.8 Aquatic Environment

The alignment of TL-3 crosses the streams Sunsari Khola, Budhi Khola, Bakraha Khola, Ratuwa Khola, Kamal Khola, Kankai Khola and Biring Khola. The common fishes in these rivers include Gudusia chapra, Salmonstoma acinaces, Barilius bendelisis, Chela laubuca, Puntius chola, Puntius ticto, Macragnathus aral, Anabas cobojius, Channa punctatus. There will be not much impact on the aquatic life except in some of the APs located in river bank.

Consultations

The awareness levels of the project and its activities were observed to differ across the groups engaged during the consultation process (Ref.: Figure 3.13 and 3.14). The local people in Sunsari and Morang were not much concerned on the wild animals. But they have concern on the Elephant that come along the route towards the Koshi Tapu Wildlife reserve, which is far from the TL alignment.

Figure 3.13: Consultation Meeting at Sunsari District

3.2.2.9 Human-Wildlife Interaction

As per the review and interaction with local respondents, limited information was reported regarding ethnozoological information. Terrestrial fauna is has been considered as good visitor except Elephant. There is no forest in Morang and Jhapa along the TL alignment.

Expectations of Local People

Local people wish for maintaining the loss of the forest and preservation of the birds residing in the Trees.

Figure 3.14: Consultation Meeting at Morang District

Issues Raised by Local People

- Project proponent should ensure appropriate compensation to HHs belonging to the community forest.
- Compensatory plantation needs to be done near the affected HHs.
- Trees should be fell down by checking the nests and birds.

3.2.3 Socio-Economic Environment

The success of implementation of any development project depends on a comprehensive assessment of the affected area, encompassing factors such as socio-economic conditions, physical attributes, and psychosocial aspects of the affected population. This data was gathered through a combination of qualitative and quantitative methods, utilizing the principles of triangulation and convergence. The details of the list of PAFs are presented in **ANNEXURE IX**.

To collect the necessary information, various surveys including census survey of Project-Affected Households (PAHs) was conducted. In addition, physical mapping methods were also applied for deeper understanding of the affected areas. The following techniques were applied as in Table 3.17:

Table 3-17: Data Collection Techniques

Data Collection Technique	Unit of Data Collection	Type of Data Collected
Socio-economic census	Household level	Quantitative data were collected through surveys using questionnaires to ascertain socioeconomic profile of all households likely to be impacted by the Project. This data encompasses details, in addition to the land and asset survey findings, related to female land ownership and the distribution of responsibilities within the household.
Land and asset survey	Properties and belongings located within the boundaries of the Project area, as well as households or individuals utilizing resources within the Project area.	Inventory of all land / assets of all the households and resources in the Project area.

3.2.3.1 Fieldwork and Surveys

The fieldwork and surveys were conducted in following stages

- Reconnaissance survey
- ToR preparation study
- IEE stage consultation.
- Consultation with stakeholders during the public hearing.
- Socio Economic Surveys (SES) and Census survey Training of the surveyors.
- FGDs and KII

Apart from this, secondary data colleceted from literature review including legal documents on ethnic indigenous groups and minority group's people in Nepal including social safeguard policies of WB.

Household Survey Questionnaires

Standard structured questionnaires were administered to collect quantitative data. It was designed for data collection on the general information of the households as well as to gather specifically the household assets of the project affected households. Questionnaires were formulated through a series of consultations with experts. The draft questionnaires were shared among the national and international experts of the ESIA team for comments and feedback. The questionnaire was updated by incorporating the comments/ feedback, as well as suggestions of NEA.

Pre-testing of Questionnaire

10 households amongst the PAFs of the proposed TL were selected for the pre-testing of the questionnaire in each district as in Figure 3.15.

Figure 3.15: Pilot Survey at Sunsari District

Enumerator Selection and Training

A team of supervisors were hired from locals representing all districts of the project areas. It was ensured that the selected team were well versed with language, local customs, rituals and traditions. A one-day training was provided at Birtamod, Jhapa District (Ref.: Figure 3.16 and 3.17).

The field survey training included: rapport building; household interviewing techniques; understanding and review of the survey questions. Mock exercise was also done during the training.

Household survey was conducted in two phases before Dashai and after Dashai festival.

Figure 3.16: Training Program at Jhapa District, East Nepal.

Figure 3.17: Supervisors for the HHs Survey.

Focus Group Discussions (FGDs)

In order to substantiate the data collected from household questionnaire survey, FGDs were held in each Rural Municipality and Municipality (Ref.: Figure 3.18).

Figure 3.18: Meeting at Jhapa, near the Substation.

During the FGDs the focus was gender specific to ascertain the perceptions of male and female participants. This helped in understanding the socio-economic status of males as well as females and especially their views on the proposed TL project.

Field Observations

ESIA team observed that the settlement pattern, available infrastructure, health and sanitation situation of the project area based on the field observation checklists. Informal interviews were conducted along with observation. The field observation was done along the TL route by walkthrough survey. All the project affected local bodies and affected area were visited by different groups of the team.

These techniques helped the team to triangulate the data collected through FGDs and household survey. Photo documentation were also undertaken by the ESIA team to capture fully the whole survey process and observations. The team of experts also interacted with officials of Ministry of Forests and Environment, Koshi Province for understanding the socio-economic and environmental aspects of the project area (Ref.: Figure 3.19)

Figure 3.19: Meeting at Province Ministry of Forests and Environment, Koshi.

3.2.3.2 Settlement Pattern

The settlement patterns in the project areas includes the arable land which is a main source of livelihood and the type of houses structures etc.. The major settlements in the project area includes Bakraha, Chariya, Pachira, Kaiktol Parasitaki, Gidhaniya, Jhapta, Takiya, Koigada, Jaliya Bishal, Jamanpur, Domana, Haldibari, Sijuwa, Gwalmani, Devigada, Kwedi, Kunjbari, Kamatoli, Sarnamati. Most of the settlements in the project area are clustered. There are also semi-clustered and scattered types of settlements in the project area. Most of the houses in the settlements are semi-modern and traditional type.

Table 3.18 shows the Settlements and Major Ethnicity in the Project Area

Table 3-18: Settlements and Major Ethnicity in the Project Area

SN	Ward	Name of Local Level	Cast/Ethnicity	Name of Settlement
1	Sunsari	Bokraha Narsingh Rural Municipality (wards 4,5)	Muslim/Jhagad/Yadav	Bakraha
2	Sunsari	Inaruwa Municipality	Muslim Urau,Yada	Aananda tol

SN	Ward	Name of Local Level	Cast/Ethnicity	Name of Settlement
		(wards 4,9)		
3	Sunsari	Gadhi Rural Municipality (ward 2)	Tharu	Jhoda/Sakwade
4	Sunsari	Duhabi Municipality (ward 2)	Muslim/Tharu / Hill Cast/Terai cast/ Dhanuk	Chariya,Pachira,Kaiktol
5	Sunsari	Budhiganga Rural Municipality (Ward 5)	Muslim/Tharu/ Hill cast/Terai cast	Muslimtol, Gidhaniya, Jalpa,Takiya
6	Sunsari	Gramthan Rural Municipality (Wards 3,4)	Hill cast/Tarai cast	Titariya, Motipur
7	Sunsari	Kanepokhari Rural Municipality (ward 1)	Hill cast/Tarai cast	Titariya, Motipur
8	Morang	Rangeli Municipality (Wards 1,2,3,8,9)	Tharu/ Hill cast/ Terai cast/Santhal/Janajati/ Musahar	Hatkhola,Jaliya Bishal,JamanpurFarsadagi, Domana
9	Morang	Sunawarshi Municipality (wards 3,4,6)	Muslim/Musahar/Terai cast/ Hill cast	Haldiwari ,Jahagirtol, Bhelai,Kaimi
10	Morang	Ratuwamai Municipality (5,6,7)	Hill cast/ Tajpuriya/Rajbamsi	Sijuwa
11	Jhapa	Gauradaha Municipality (Ward 6,8,9)	Hill cast/ Tharu / Tajpuriya/Rajbamsi/ Santhal/ Dhimal/Meche	Gwalmani, Devighoda
12	Jhapa	Gauriganj Rural Municipality (Wards 1,3,5)	Hil cast/Terai cast	Gauriganj ,Itabhatta,Kunjbari
13	Jhapa	Jhapa Rural Municipality	Rajbamsi/Gangai/Satar/Hill cast	Kwadi,Sirjanabasti,Jhati ,Kamatoli,Sarnamati

SN	Ward	Name of Local Level	Cast/Ethnicity	Name of Settlement
		(Wards 2,4,5)		
14	Jhapa	Barhadashi Rural Municipality (wards 4,5)	Muslim / Terai cast/Hill cast/ Santhal/Rajbamsi	Radhanagar, Rajgadh
15	Jhapa	Haldibari Rural Municipality (ward 1)		No settlement

(Source: Household Survey, 2023)

Note: Hill caste means the caste in the hilly region and Terai caste means the caste in Terai region

The transmission line TL 3 passes through 03 districts namely Jhapa, Morang and Sunsari. A total of 205 households in Jhapa, 109 households in the Morang and 132 households in the Sunsari district are to be affected by the proposed project. The details are presented in Table 3.19 and depicted in Figure 3.20.

Table 3-19: Number of Households Affected

S.N.	District	No. of households
1	Jhapa	205
2	Morang	109
3	Sunsari	132
Total		**446**

(Source: Household Survey, 2023)

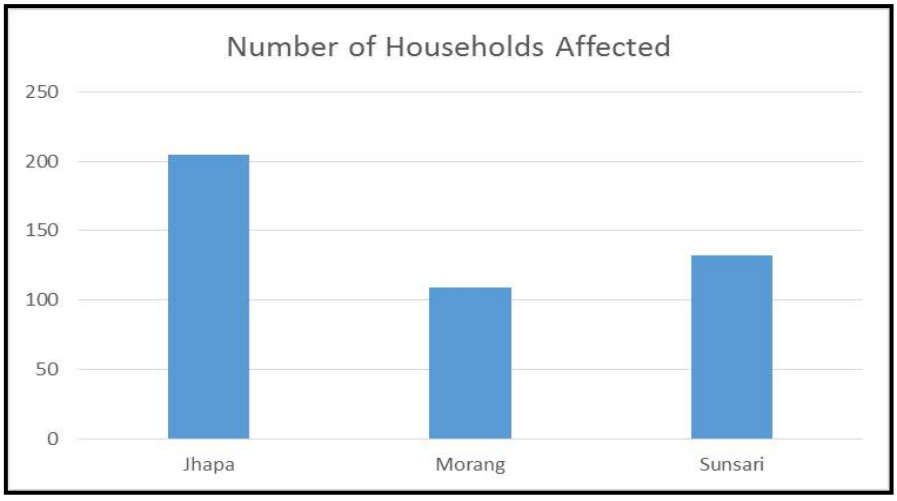


Figure 3.20: District wise Household Affected

(Source: Household Survey, 2023)

The project affected households from 03 districts are the residents of 13 local bodies with 446 households. The details are presented in Table 3.20.

Table 3-20: Number of Household by Local Level

S No.	District	Municipality	No. of HHs (A)	Rural Municipality	No. of HHs (B)	TOTAL (A+B)
1	Jhapa	1	86	4	119	205
2	Morang	2	80	4	29	109
3	Sunsari	2	117	2	15	132
Total		**5**	**283**	**10**	**163**	**446**

(Source: Household Survey, 2023)

The following table shows the Ownership of land Project affected Families and the status of Female. Among 446 HHs Female represent are only 7.40% among Three district Sunsari District has more gap on Awareness of Ownership of land on Female. The details are presented in Table 3.21.

Table 3-21: Ownership of land (Projected affected Families)

Districts	Total PAFs	Male	Percentage	Female	Percentage
Morang	109	97	88.99	12	11.01
Jhapa	205	186	90.73	19	9.27
Sunsari	132	130	98.48	2	1.52
Total	446	413	92.60	33	7.40

(Source: Household Survey, 2023)

Details of Project Affected Persons by Age Group

During the survey it was recorded that a total of 2747 persons from different age group are to be affected by the proposed project. 50.38% of the total population falls under the age group of 0-14 whereas 46.06% under 15-59 and only 3.56% under the age group of 60 and above. The details are presented in Table 3.22 and depicted in Figure 3.21.

Table 3-22: Number of People by Age Group

SN	Age (yrs)	No. of People	Percentage
1	0-14	1384	50.38
2	15-59	1265	46.06
3	above 60	98	3.56
	Total	**2747**	**100.00**

(Source: Household Survey, 2023)

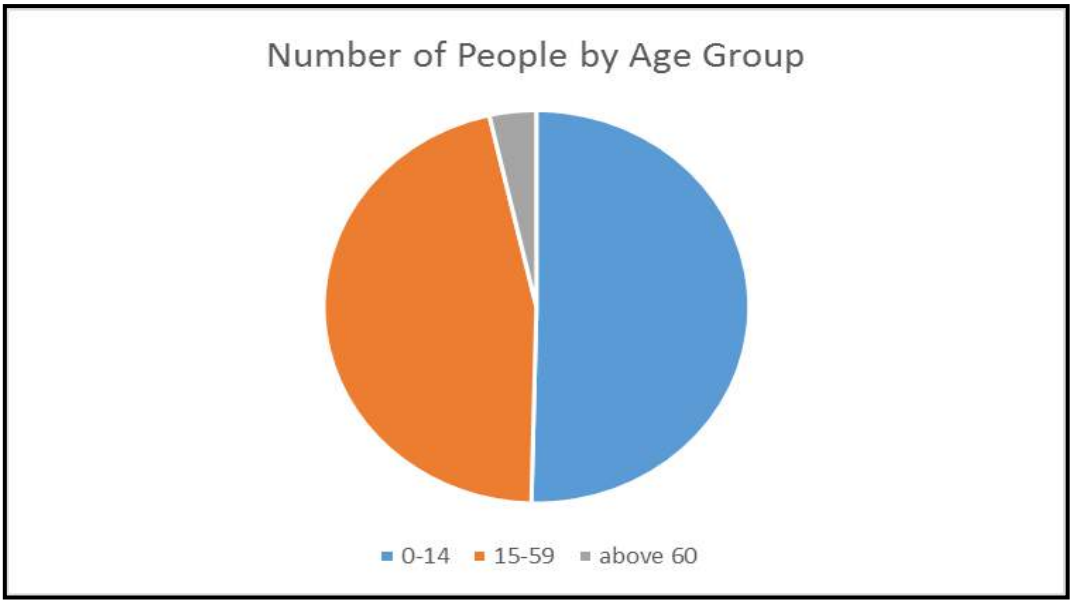


Figure 3.21: Details of Project Affected Persons by Age Group

(Source: Household Survey, 2023)

3.2.3.3 Literacy Level

The details of literate and illiterate population amongst the total affected persons above 06 years of age are shown in Table 3.23. It is recorded that about 92% of the total affected persons are literate, while around 8% are illiterate and is depicted in Figure 3.22.

Table 3-23: Literacy and Education Status

S No.	Education	Total Numbers	Percentage
1	Illiterates (above 6 years)	932	33.93
2	Literates	959	34.91
3	Elementary Level	148	5.39
4	Lower Secondary Level	128	4.66
5	Secondary Level	170	6.19
6	Higher Secondary Level	291	10.59
7	College Level	119	4.33
	Total	**2747**	**100.00**

(Source: Household Survey, 2023)

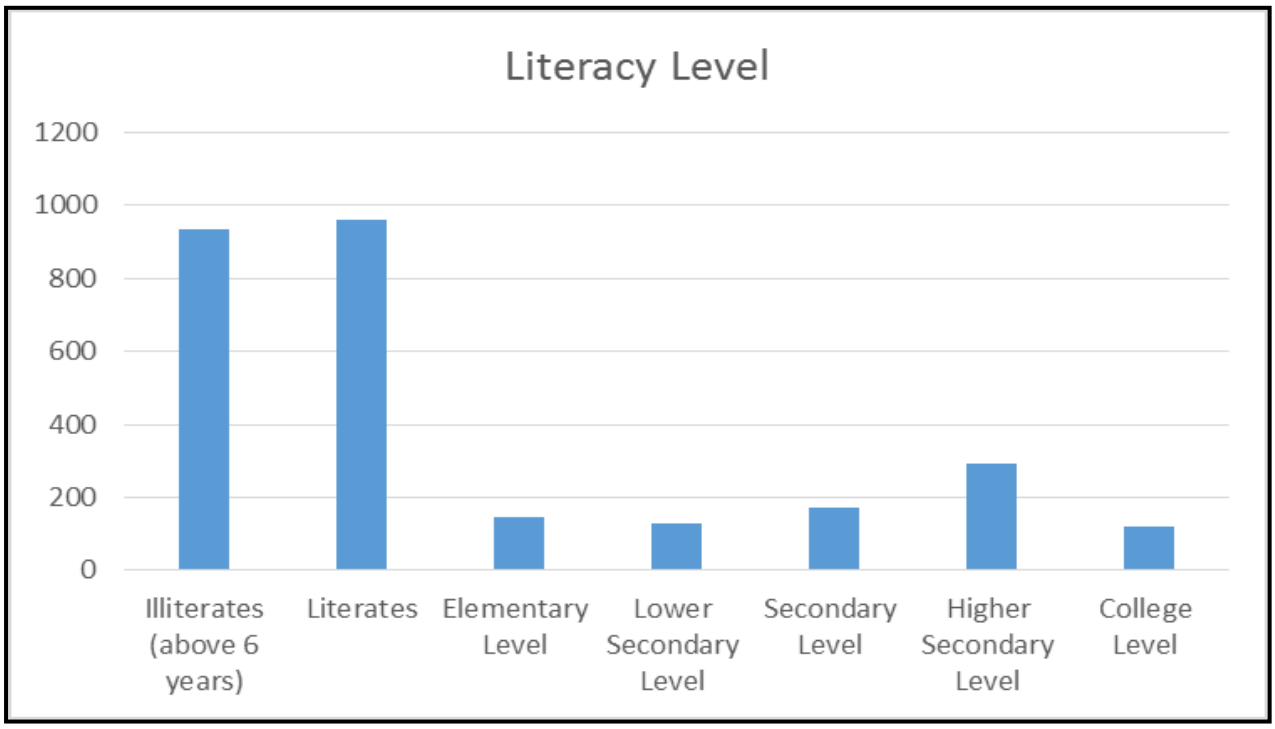


Figure 3.22: Details of Literacy Level among Surveyed Persons

(Source: Household Survey, 2023)

3.2.3.4 Caste Profile

According to data recorded during household survey majority of person belongs to Janjati caste consisting around 46.41% of total followed by Chhetri with 31.84% and Brahmin with 19.95% respectively. The caste profile of the affected persons is given in the Table 3.24 and depicted in Figure 3.23.

Table 3-24: Caste Profile of the Surveyed Persons

S No.	Caste	Number of Households	Percentage
1	Chhetri	102	22.87
2	Brahmin	89	19.96
3	Thakuri	4	0.90
4	Janajati	207	46.41
5	Dalit	37	8.30
6	Muslim	7	1.57
Total		**446**	**100.00**

(Source: Household Survey, 2023)

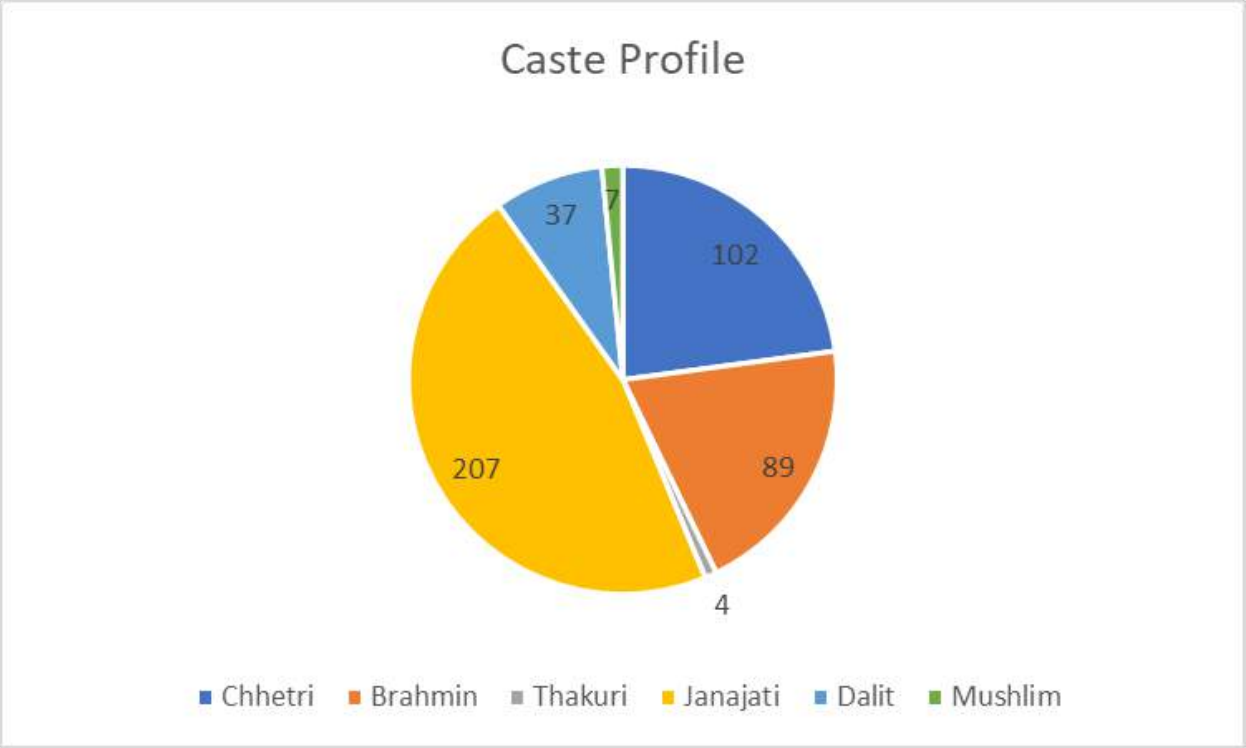


Figure 3.23: Caste Profile of the Surveyed Persons

(Source: Household Survey, 2023)

Religion wise Distribution of the Affected Persons

In the project-affected area, there are 446 households with 428 of them being Hindu, 07 Muslims followed by 06 Naturalist, 03 Buddhists, 02 Christian and 07 being Muslim are given in the Table 3.25.

Table 3-25: Religion Status of Surveyed Persons

S.N.	Religion	Number of Households
1	Hindu	428
2	Buddhist	3
3	Christian	2
4	Naturalist	6
5	Muslim	7
	Total	**446**

(Source: Household Survey, 2023)

3.2.3.5 Occupational Status

Among the total surveyed persons majority of persons practicing agriculture as occupation followed by persons in student category. The details are presented in Table 3.26.

Table 3-26: Occupation Status of the Surveyed Persons

S.N.	Occupation and Employment types	No. of People
1	Agriculture	1174
2	Business	230
3	Service	175
4	Labour	120
5	Foreign employment	120
6	Student	654
7	Housewife	52
8	People in pension	125
9	Others	86
10	Disabled	11
	Total	**2747**

(Source: Household Survey, 2023)

3.2.3.6 Migration Status

The migration status of the project area is shown in Table 3.27. It is observed that only 337 household were migrated on two generations. The majority of People (50.45%) migrated from other place followed by 28.19 % from Himalayan region and 21.36 % from the same region. The migration occurred from high altitude areas to hilly areas and then from hilly areas to Tarai region in search of livelihood, better facilities and opportunities.

Table 3-27: Migrated People (within 2 generations)

S. No.	Migration Place	Count	Percentage
1	Migrated from same region	72	21.36
2	Migrated from Himalayan Region	95	28.19
3	Migrated from other places	170	50.45
	Total	**337**	**100.00%**

(Source: Household Survey, 2023)

3.2.3.7 Health Status

The health status in the project affected area within one year is presented in Table 3.28. Out of 446 families majority of viral flu is seen high with 204 persons which was on seasonal, followed 103 persons are suffered from fever, 25 persons were suffered from pneumonia, 45 peoples were suffered from diarrhea, 28 persons were suffered from typhoid, 25 persons were affected by breathing problem and only one person was suffered from Skin Disease. This also shows that the personal hygiene and availability of safe drinking water is poor in project area.

Table 3-28: Medical Condition of family within 1 year

S. No.	Types of Disease suffered	Number of Families
1	Fever	103
2	Viral Flu	204
3	Pneumonia	25
4	Diarrhea	45
5	Skin Disease	16
6	Typhoid	28
7	Breathing Problem	25
	Total	**446**

(Source: Household Survey, 2023)

3.2.3.8 Sanitation Facilities in Project Area

The provision of latrines are the indicators of good sanitary conditions. It was noticed that most of the houses have latrine facility. However, in Jhapa Dhankuta 100% households had the facility of latrines. However, 95% in Sunsari and 99% households in Morang districts have latrine facilities.

Table 3.29 shows the details of latrine facility in different project area districts.

Table 3-29: Facilities of Latrine in Household

District	Household with latrines	Household without Latrines
Jhapa	205	0
Morang	108	1
Sunsari	125	7

(Source: Household Survey, 2023)

3.2.3.9 Source of Fuel Use for cooking

According to data recorded during household survey majority of households used wood as fuel for cooking. Out of 446, 256 use Fuel wood, 141 houses use LPG gas, 12 houses use Kerosene, 3 houses use Biogas, and 32 Houses use Cow dung only 2 houses are dependent on Solar for Fuel energy. The district wise details are depicted in Table 3.30.

Table 3-30: Source of Fuel Use for cooking

District	Fuelwood	LPG Gas	Kerosene	Biogas	Solar	Cowdung
Jhapa	104	47	5	1	2	5
Morang	75	56	0	0	0	11
Sunsari	77	38	7	2	0	16
Total	256	141	12	3	2	32

(Source: Household Survey, 2023)

3.2.3.10 Source of Drinking Water

The source of drinking water in project affected area is shown in Table 3.31. All 446 households (100%) have access to the drinking water. The majority households use community tap with drinking water, 15 household use well, 59 household use tube well and 67 household people are using private tap for drinking water. Out of 305 Household 161 Household from Jhapa use community tap.

Table 3-31: Source of Drinking Water

District	Private Tap	Community Tap	Well	Tubewell
Jhapa	23	161	5	16
Morang	26	53	7	23
Sunsari	18	91	3	20
Total	67	305	15	59

(Source: Household Survey, 2023)

3.2.3.11 Agriculture Produce

The information on annual agriculture produce by households in the project area districts has been collected during the survey. It was recorded that In all 12,53,938 kg is the total agriculture produce of the districts annually. The major crops cultivated are rice, maize and wheat. The details are given in Table 3.32.

Table 3-32: Agriculture Produce Cultivated by Affected Households in Project Area Districts

District	Maize (kg)	Rice (kg)	Wheat (kg)	Grand Total (kg)
Jhapa	78258	315260	450	393968
Morang	81150	324850	550	406550
Sunsari	88250	364520	650	453420
Grand Total	**247658**	**1004630**	**1650**	**1253938**

(Source: Household Survey, 2023)

3.2.3.12 Compensation Response

Response for Compensation out of 446 HHs, majority 84.3 % (376 HHs) wants cash compensation, 22 HHs demanded land for land compensation, while 48 HHs were unresponsive for the type of compensation during survey. The details are given in Table 3.33.

Table 3-33: Response for Compensation

Districts	Type of compensation			
	Land	Money	No Response	Grand Total
Morang	4	92	13	109
Jhapa	6	182	17	205

Districts	Type of compensation			
	Land	Money	No Response	Grand Total
Sunsari	12	102	18	132
Grand Total	**22**	**376**	**48**	**446**

(Source: Household Survey, 2023)

3.2.3.13 Indigenous and Vulnerable People Status along the TL route

The major ethnic groups living in the project affected Municipality/ Rural municipalities are Tharu, Brahmin Hill, Chhetri, Rajbamsi, Muslim, Santhal/Satar, Tajpuriya, Gangai,Yadav, Jhangad/Dhagar, Kewat, Teli, Dhanuk, Rai,Limbu, Koche Musahar, Sarbaria, Khatwe, Haluwai, Chamar/Harijan/Ram,Sardar,Hajam/Thakur, Kathbaniyan, Terai Others, Mallaha, Marwadi, Baraee, Magar, Tatma/Tatwa, Punjabi/Shikh, Sunuwar, Damai/Dholi, Kami, Kalwar, Kayastha, Tarai, Dom, Sherpa, Newar, Tamang, Yakkha, Khatwe, Sonar, Gharti/Bhujel, Sanyasi/ Dasnami, Majhi, Hajam/ Thakur, Bangali, and others, etc (CBS, 2021). There are total of 128 Indigenous and Vulnerable People along the TL route as given in Table 3-34.

Table 3-34: Indigenous and Vulnerable People

SN	Items/Programs	Number/Quantity	Unit
1	Moderately vulnerable households	1	Households
2	High vulnerable households	2	Households
3	Very high vulnerable	2	Households
4	Women headed households	25	Households
5	Households headed by handicapped person	1	Households
6	Dalit households	37	Households
7	Muslims	7	
8	Adivasi/Janajati (Highly marginalized)	7	Households
9	Adivasi/Janajati (Marginalized)	46	Households
	Total	**128**	

(Source: Household Survey, 2023)

Among the Indigenous people, highly marginalized included Satar 01 and Majhi 06. Similarly, marginalized included Rajbansi 40 and Gangai 06. The district wise their details are given in Table 3.35.

Table 3-35: District wise Distribution of Indigenous People

SN	Districts	Total HHs	Highly Marginalized HHs	Marginalized HHs
1	Morang	109	-	16 (Rajbansi-11, Gangai-5)
2	Jhapa	205	6 (Satar-1, Majhi-5)	26 (Rajbansi-25, Ganagai-1)
3	Sunsari	132	1 (Majhi-1)	4 (Rajbansi-4)
Total	**3**	**446**	**7**	**46**

(Source: Household Survey, 2023)

3.2.3.14 Brief Ethnographic Profile of the Project Area

Satar

Satars are one of the most backward ethnic groups of Nepal. They live in the districts of Jhapa, Morang and Sunsari. Their ancestral are strong hold of the dark-skinned, curly-haired and stoutly built. Australoid Satars or Santhals is the Nepalese Plain and the Santhal Pargana of West Bengal in India. Santhals also call themselves Hor. They have their own unique religion and culture. They are animist. Their ancestral deity is Thakuri and their paternal guardian deity is Maran buru. Bow and arrows are their traditional weapons. Their favorite meat is pork. Most Satars are engaged in farming and labour

Majhis

The Majhis are one of the indigenous peoples of the nation of Nepal - possessing their own language, dress, culture, etc. Majhis are not only polite and shy but also very much friendly and helpful. Nepal is divided in 3 parts horizontally that is Mountain, Hill and Terai. And most of the Majhis have lived in Inner Terai. Except this they live some in plain Terai and Mountain areas also. We can find that most of the Majhis are located just near the rivers shore. In Nepal a group of rivers is called Saptakoshi.

Rajbanshis

Rajbanshis are the indigenous ethnic people of eastern Terai, their origin can be traced back to India's Assam, Bengal and Bihar states of India. The Rajbanshis are found to have settled in most of the villages in Jhapa. They are professionally agro-based people. They have settled in the most fertile land. Most of the houses of Jhapali Rajbanshis have thatched roofs. They are erected with the help of locally available materials such as wood, bamboo and jute stalks. Houses are beautifully smeared with red clay, dung, and white clay.

Gangai

Gangai are mostly concentrated in Jhapa and Morang districts of Nepla. They are also know as Ganehs or Mandal. In the socio-economic cultural practices they are similar to Rajbhansi. They mostly live in the join family.

Dalit

Traditionally Dalits are considered as an untouchable caste group. High castes are considered pure and Dalits are impure according to caste ideology. The dichotomy pure/impure is not the cause of but the form of the hierarchy. As in other parts of the country, Dalits are put at the bottom of the caste hierarchy in the Project area. Kami, Damai and Sarki Badi are the groups of Dalits. These are the craft castes of blacksmiths, tailors, potters, leather workers, and musicians. According to Hindu laws, all Dalits are untouchables and they are not allowed to enter the house of the so-called high caste and Janajati groups. Other caste groups do not accept the water and food cooked by the Dalit people. Government and non-government sectors have been working development works such as non-formal education and income generation activities in the Project area.

Muslims

Although the number of Nepali Muslims is less than their Hindu counterpart, they are regarded as the country's second largest religious minority. The majority of Nepali Muslims are Sunni. They stayed socially and economically at the margin in Nepal. According to sociologists, caste among Muslims is based on cultural or structural characteristics of Hindus. Muslims in Nepal are deeply impacted by the entire social framework of Muslim community in India. Because of this, they also have a variety of caste-like traits.

The SES show that there are total of 128 HHs of Vulnerable People along the TL route as given in Table 3.36.

Table 3-36: Vulnerable and Indigenous People

S.N	Items/Programs	Number/Quantity	Unit
1	Moderately vulnerable households	1	Households
2	High vulnerable households	2	Households
3	Very high vulnerable	2	Households
4	Women headed households	25	Households
5	Households headed by handicapped person	1	Households
6	Dalit households	37	Households
7	Muslims	7	
8	Adivasi/Janajati (Highly marginalized)	7	Households
9	Adivasi/Janajati (Marginalized)	46	Households

(Source: Household Survey, 2023)

Among the Indigenous people, highly marginalized included Satar 01 and Majhi 05. Similarly, marginalized included Rajbansi 40 and Gangai 06. The district wise their details are given in Table 3.37.

Table 3-37: District wise Distribution of Indigenous and Vulnerable People

SN	Districts	Total HHs	Highly Marginalized HHs	District Level Population	Marginalized HHs	District Level Population
1	Morang	109	-		16 (Rajbansi-11, Gangai-5)	Gangai-18334, Rajbansi-23287
2	Jhapa	205	6 (Satar-1, Majhi-5)	Satar-15096; Majhi-3408	26 (Rajbansi-25, Ganagai-1)	Gangai-4784, Rajbansi-22154
3	Sunsari	132	1 (Majhi-1)	Majhi-1235	4 (Rajbansi-4)	Rajbansi-1111
Total	**3**	**446**	**7**		**46**	

(Source: Household Survey, 2023)

3.2.3.15 Gender wise division of work

It was noticed that household activities are generally divided in gender specific pattern. Among the project affected families, most women are involved in collection of fetching of drinking water, cutting grass for fodder, milling the cereals, routine household works like cooking, laundry and washing of utensils and childcare, etc as in Table 3.38.

Table 3-38: Gender wise division of work amongst the families in Project Area

SN	Household works	Percentage of contribution in Sunsari		Percentage of contribution in Morang		Percentage of contribution in Jhapa	
		Female (%)	Male (%)	Female (%)	Male (%)	Female (%)	Male (%)
1	Fetching of Drinking water	90	10	85	15	90	10
2	Fuelwood collection	60	40	65	35	70	30
3	Cutting of grasses	70	30	65	35	65	35
4	Milling the cereals	70	30	85	15	82	18
5	Washing of clothes	95	5	95	5	98	2
6	Cooking	95	5	95	5	97	3
7	Washing of Utensils	80	20	95	5	95	5
8	Child care	60	40	75	25	76	24
9	Old age care	50	50	45	55	47	53
10	Buying of daily need goods	40	60	42	58	44	56

(Source: Household Survey, 2023)

The women have more active participation and hence, their contribution for upkeeping of household is much more than their male counterparts.

Gender wise Division of Agricultural Work in the Project Area

The gender wise distribution of agriculture activities in the project-affected area is given in Table 3.39. It is noticed that the participation in ploughing activities is done by males members mostly (95%) whereas, Fertilizer carrying, Sowing, Cropping, Weeding, Cutting of crops is mainly dominated by female members of the family (40-80%).

Table 3-39: Work Division (Agriculture) of the Project Area

SN	Agricultural activities	Percentage of contribution in Sunsari		Percentage of contribution in Morang		Percentage of contribution in Jhapa	
		Female (%)	Male (%)	Female (%)	Male (%)	Female (%)	Male (%)
1	Ploughing	5	95	5	95	5	95
2	Fertilizer carrying	60	40	65	35	68	32
3	Land preparing	40	60	45	55	48	52
4	Sowing	70	30	75	25	77	23
5	Cropping	80	20	85	15	88	12
6	Weeding	70	30	80	20	85	15
7	Irrigation	40	60	100	0	100	0
8	Cutting	60	40	66	34	68	32
9	Carrying crops	30	70	38	62	42	58
10	Collection crops	30	70	35	65	25	75
11	Harvesting	65	35	50	50	57	43
12	Selling	85	15	87	13	86	14

(Source: Household Survey, 2023)

Division of Social Work in the Project Area

Male representation on family for Land/house purchasing more than female. Male represented batter than female to Education involvements and activities of family. This survey shows that borrowing loan, social work and education of children at home are the main work for female but activities on membership involvements on social activities with leading role goes to male more than female as shown in the following Table 3.40.

Table 3-40: Work division (Social) of the Project Area

SN	Agricultural activities	Percentage of contribution in Sunsari		Percentage of contribution in Morang		Percentage of contribution in Jhapa	
		Female (%)	Male (%)	Female (%)	Male (%)	Female (%)	Male (%)
1	Land/house purchasing	60	40	65	35	65	35
2	Borrowing of Loan	60	40	65	35	65	35
3	Education of Children at home	70	30	70	30	70	30
4	Marriage of Children for decision making	10	90	10	90	10	90
5	Worship	50	50	55	45	50	50
6	Family planning decision	50	50	55	45	50	50
7	Land/house purchasing	50	50	55	45	50	50
8	Social work in the local area in festival and other occasion	60	40	65	35	65	35
9	Memberships in organization	45	55	40	60	40	60

(Source: Household Survey, 2023)

Gender representation on the Social activities with household around 60 to 65%. Male representation on family for Land/house purchasing more than female. Male represented better than female to activities of family like decision in marriage and memberships. This survey shows that Borrowing Loan, land and house purchasing, and family planning decision are the main work for female but activities on social work and membership in different organization involvements on social activities with leading role goes to male more than female.

Gender wise Ownership Status of land amongst the PAFs

The gender wise ownership of land in the project affected area is given in Table 3.41. Amongst 109 PAFs in Morang district, land ownership with males is 97 (88.99%) while females are only 12 (11.01%) with the land ownership. Similarly, amongst 205 PAFs, land ownership with males is 186 (90.73%) with land ownerships while females are 19 (9.27%) with land ownership in Jhapa District. But in Sunsari district, amongst 132 PAFs, land ownership with males is 130 (98.48%) with land ownerships while females are 2 (1.52 %) with land ownership. It was noticed that in all the project area districts the land ownership mainly belongs to male members of the family.

Table 3-41: Ownership of land (Project affected Families)

Districts	Total PAFs	Male	Percentage (%)	Female	Percentage (%)
Morang	109	97	88.99	12	11.01
Jhapa	205	186	90.73	19	9.27
Sunsari	132	130	98.48	2	1.52
Total	446	413	92.60	33	7.40

(Source: Household Survey, 2023)

Consultations

The awareness levels of the project and its activities were observed to differ across the groups engaged during the consultation process (Ref.: Figures 3.24 & 3.25). The women's group consulted in Morang and Jhapa were aware of the project activities, the land requirements, the negotiation process and the payments. However, the women from the villages of Sunsari were observed to have minimal understanding of the project and its activities and were not aware of the negotiation process. Furthermore, while both the women groups had an understanding of the compensation provided and played some role in how the money was to be spent but they seem unsatisfied for the ROW payments done in other TL projects.

Figure 3.24: Consultation at Sunsari District

Issues

During the consultation meetings, there were different issues raised by the local people.

- Issues Raised by male members
- The project should ensure appropriate compensation.
- Employment opportunities to the local people.
- Meeting with the local bodies need to be done before any decision is made.

Figure 3.25: Consultation at Morang District

Issues Raised by Women

- Project proponent should ensure to give appropriate compensation to the affected people.
- Local people were curious to know the chances of the employment opportunities to the local due to the project.
- Overall expectation to improve livelihood and expecting to provide them skill development training.

CHAPTER 4: ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS

4.1 INTRODUCTION

This section highlights environmental and social risks and impacts during the implementation of the TL project. To study the risks and impacts involved with the project, risk screening criteria based on WB ESF was employed as shown in the Table 4.1.

Table 4-1: Risk Screening Criteria

Risk Category	Screening Criteria
High	The resource/receptor would likely experience impacts of large magnitudes that would last for a long time, extend over a large area, exceed national/international standards, endanger public health and safety, threaten species or habitat of national or international significance, and/or exceeds a community's resilience and ability to adapt to change. The Project may have difficulty in complying with the applicable ESF requirement, and significant mitigation would likely be required.
Substantial	The resource/receptor would experience a clearly evident change from baseline conditions and would approach but not exceed applicable standards. The Project would comply with the applicable ESF requirement, but mitigation would be required.
Moderate	The resource/receptor would experience a noticeable effect, but the magnitude of the impact is sufficiently small (with or without mitigation) that the overall effect would remain well within applicable standards. The Project would comply with the applicable ESF requirement, but mitigation may be required.
Low	The resource/receptor will either not be affected or the likely effect would be imperceptible or indistinguishable from natural background variation. The Project would comply with the applicable ESF requirement and mitigation would typically not be required.

This section includes the identification and evaluation of impacts associated with TL-3. Potential interaction of the TL-3 activities and the physical, biological, socio-economic and cultural environment is identified and described. Adverse and/or beneficial effects resulting from the interaction are also identified and assessed. This section also identifies and characterizes residual impacts in terms of magnitude, extent, duration, reversibility and frequency. When impacts cannot be characterized quantitatively, they are characterized qualitatively.

4.2 METHODOLOGY FOR IMPACT ASSESSMENT

4.2.1 Basic Principle

This section includes the identification and evaluation of impacts associated with TL-3. Potential interaction of the TL-3 and the physical, biological, socio-economic and cultural environment is identified and described. Adverse and/or beneficial effects resulting from the interaction are also identified and assessed. This section also identifies and characterizes residual impacts in terms of magnitude, extent, duration,

reversibility, and frequency. When impacts cannot be characterized quantitatively, they are characterized qualitatively.

4.2.2 Managing Impacts

The basic hierarchy for managing impacts are based on the enhancement for positive benefits and then avoidance, mitigation, compensation/offsets for adverse impacts.

4.2.3 Enhancement

Project development also experiences benefits which can be sustained through enhancement measures. Enhancement measures involve being able to provide programs to support biodiversity and conservation, and community development programs in TL-3.

4.2.4 Avoidance

In the hierarchy of impact mitigation, avoidance is in the first order of priority that TL-3 shall follow. This TL-3 considers avoiding the impacts from occurring. Avoidance is tied in with the 'non-implementation scenario' in that, without the project (doing nothing), there will be no disturbance to the existing environmental conditions. If the implementation of the TL-3 cannot be avoided or the activity resulting in potential impact cannot be stopped, mitigation measures have to be implemented.

4.2.5 Mitigation

Mitigation measures involve bringing down the impact to minimum possible level and taking actions to reduce impact over the time of project operation.

4.2.6 Compensation

TL-3 involves acquisition of lands in areas to be developed for establishing permanent structures such as angle towers. The acquisition of these lands will potentially result in economic displacement and relocation of structures. These impacts are mitigated through compensatory measures. For this purpose, TL-3 has prepared RAP to serve as basis for payment of disturbance to these assets.

4.2.7 Environmental Management Planning

This section provides information on the process of developing the Environmental Social Management Plan (ESMP) for TL-3 based on the analysis conducted during the IEE study, which has been carried out in Nepali Language. The ESMP provides a set of management measures for addressing the range of anticipated impacts identified during the different project phases.

The implementation of a practical and results-based ESMP that is capable of identifying and evaluating the actual effects of a project relative to those predicted during the IEE phase is of critical importance. The project proponent will work with design, construction and operational contractors to devise and implement practical adaptive management approaches to ensure appropriate and timely corrective action can be taken as soon as issues are identified. In ESMP the TL-3 has indicated estimated budget to implement mitigation measures.

4.2.8 Adaptive Management

Adaptive management reflects the need for flexibility in responding to changing conditions over the project lifecycle, including: Regulatory or policy reforms; land-use change, and; other developments or unforeseen events. By placing adaptive management as a pillar of environmental management, TL-3 increases the likelihood of a successful outcome for the project in the face of the inherent uncertainty of working with dynamic natural and social systems.

The TL-3 will apply the principal of adaptive management to all aspects of environmental and social impact management based on the process of monitoring impacts, evaluating how effective mitigation measures are, learning and refining implementation accordingly to improve project performance.

In the first phase of the study, to unravel the impacts of these ToR identified issues, field-based studies were conducted at depths on the physical, biological, socio-economic and cultural environments of the project's impact areas. This chapter presents the findings of the studies with highlights on methodological tools used for the study.

The project activities during construction and operation were further analyzed based on the extent, duration, and magnitude of the activities in relation to project impact areas environmental resources and their reversible and irreversible implications using a range of prediction tools which includes cause and effect analysis, GIS tools, simple statistical analysis, prediction models etc. Apart from the above, impacts of the past projects, personnel experience of the professionals in similar geographical locations and similar socio-economic environment have also been used extensively for the impact prediction.

In the second phase, all the identified impacts were analyzed for mitigation options using principles of avoidance, minimization, and compensation. The measures identified as avoidance options were subsequently included in the project design and layout. Those impacts which could not be avoided by design modification or by changing project layouts for locating the project structures and ancillary facilities, a range of options have been identified for implementation which includes both minimization and compensation measures. The selection of the mitigation measures is based on their effectiveness to remediate the potential impacts, their cost effectiveness, and effectiveness in other projects of similar nature, etc.

4.3 BENEFICIAL IMPACTS

4.3.1 Construction Phase

The TL-3 construction activities apart from the above listed adverse impacts have a number of positive/beneficial impacts on the socio-economic and cultural environment of the development areas. Amongst others followings are the important beneficial impacts.

4.3.1.1 Increase in the Economic Activity within the TL-3 RM/Ms

Though the construction activities is potential to increase economic activities throughout the TL-3 corridor, the camp sites for material storage and workforce will

be the specific areas of the enhanced economic activities, particularly for the supply of consumer goods, locally grown vegetable items and the hotel and restaurant/tea stall businesses. This will be an added benefit to the local people of the TL-3 corridor during construction phase.

4.3.1.2 Employment Opportunities to Locals

The TL-3 construction activities will require a substantial number of skilled, semi-skilled and unskilled workforces during tower foundation works, cable stringing works and clearance of RoW. Except for the skilled workforce, other workforce will be employed locally as much as possible. The socio-economic survey has indicated a large number of unemployed workforce in the area and number of such people migrate seasonally outside in search of jobs. These people will get opportunities to work for the project. This will be the direct benefit to the locals along TL-3 corridor.

4.3.1.3 Development of New Skills During Construction

The people employed at project will have on the job training on the new skills and techniques of TL construction which could be an added advantage to the employment in the similar projects in the other areas in future. Apart from the above, the project envisages to provide specific skill training programs to the members of vulnerable communities as a livelihood skills development during the construction period as per their interest, benefit, capacity till they can earn a livelihood themselves.

4.3.1.4 Enhancement of Slope Stability

The TL-3 tower foundation sites require special attention for slope stability. The TL-1 during construction for the structural safety of the tower foundation and also the erosion protection of the RoW corridor will implement a host of protection measures.

4.3.2 Operation Phase

The Key activities of social safeguard concern during the TL-3 operation phase are the regular and periodic maintenance of the tower foundations, cable and insulators and clearance of RoW.

4.3.2.1 Enhancement of Slope Stability

The TL-3 tower foundation sites require special attention for slope stability. The TL-3 during operation will conduct regular site inspection for the stability of the tower foundation as well as the RoW corridor for the safety of the transmission line. Any enhanced erosion or slope failure will be taken care of by the maintenance team of the transmission line. This will be an advantage to the slope protection of some of the specific areas of the TL-3 corridor.

4.3.2.2 Erosion Protection

The risk of slope instability is related to the actions of erosional activities along the TL-3 corridor and adjoining areas whether enhanced by the construction activities or as existing ongoing natural actions. For the structural safety of tower foundations and maintenance of the RoW, besides the erosion safety measures, the project will launch measures in co-ordination and active participation of the Community Forest User Groups (CFUGs) of the affected community forest by the TL-3.

4.3.2.3 Creation of Forest Fire Line Zone

The RoW maintenance in the operation phase will act as a fire line zone for the forest areas. In the well managed forest, such zone trees less zones are maintained for the protection of the forest to control widespread forest fires. The transmission line right of way in the forested areas will function as the forest fire lines of the well managed forest and is envisaged to act as fire breaker line to control the accidental forest fires occurring in the forest areas.

4.3.2.4 Creation of Ecological Niche Zone

The cleared right of the way of the transmission line corridor in the forest areas provide enough light and space for the new plant species which otherwise could not come up in the matured forest areas. Such stripes of the cleared areas within the matured forest are the sites of rich plant diversity. Apart from this, such open areas are also the sites of feeding for a range of wildlife species as the site provide open areas to safeguard themselves from the common predators. In the above aspects, the clearance of trees increases the ecological dimension for various plants and wildlife species.

4.3.2.5 Employment Opportunities to the Local Area People

The maintenance of TL-3 will continue for the life of the project. Though the maintenance activities will be limited to a few weeks twice a year is potential to increase economic activities throughout the corridor though of lesser extent than that of the construction phase. This will be an added benefit to the local people of the TL-3 corridor during the operation phase. Apart from this TL-3 maintenance activities will require a substantial number of semi-skilled and unskilled workforce for maintaining RoW clearance. All such a workforce will be employed from the local area. As emphasized earlier, the area has a few unemployed populations. These people will get opportunities to work on the project. This will be the direct benefit to the local area people along TL-3 corridor.

4.3.2.6 Development of New Skills During Operation

The locals will have hands on training regarding new skills and techniques of TL operation which could be an added advantage to the local people and community.

4.4 ASSESSMENT AND MANAGEMENT OF ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS (ESS 1)

4.4.1 ES Risk Classification

As per the Environmental Protection Rule 2020 (EPR) of Government of Nepal, Schedule 2, Energy, Water Resource and Irrigation Sector section (f), point 1 (a) states that for construction of any transmission line with capacity of 132 kV or higher requires and Initial Environmental Examination (IEE). Arun hub (Sitalpati)-Inaruwa is of 400 kV and doesn't lie within any protected area and doesn't travers any historically and culturally sensitive location thus an IEE is required for the project. The Civil Aviation Authority of Nepal (CAAN) has given the permission on 2080/04/10 to keep the maximum height of the towers will not exceed above 98.53 m. The permission for the tower height has been granted by CAAN **(ANNEXURE-II).** The maximum height of the tower will be as given in Table 4.2.

Table 4-2: Maximum Tower Height

SN	Tower no.	Tower Height (m)	Double Circuit Maximum height (m)
1	56	89.53	80
2	57	98.53	80
3	58	98.53	80
4	61	86.53	80
5	200	86.5	80
6	201	86.5	80

(Source: Feasibility Report, 2023)

4.5 ADVERSE IMPACTS

All adverse impacts have been grouped in as per the new WB ESF and ESSs. All those impacts were grouped between relevant ESSs and evaluated against risk screening criteria as high, substantial, moderate, or low. The following sections summarize the environmental and social risks and impacts likely due to the TL project by each relevant environmental and social standard (ESS 2- 8).

4.5.1 Labour and Working Conditions (ESS 2)

In this project three categories of project workers: direct workers (hired by project), contracted workers (including migrant workers) and primary supply workers (those providing goods and materials) are relevant in terms of labour and working conditions. The major risks in this regard could be inadequate worker accommodation; non-payment or delayed payment of wages and other benefits (e.g. compensation, maternity benefits, leave, insurance, etc.); discrimination/ exploitation/ harrassment at work (e.g. abrupt termination of the employment, poor working conditions, low wages or inadequate benefits etc.); child labour; forced labour; human trafficking; occupational health and safety (OHS) issues, including workplace accident and work related diseases (e.g. Allergies, respiratory problems, Musculo-skeletal disorder); grievances related to GBV. The contracted workers are more susceptible to such risks.

4.5.1.1 Construction Phase

4.5.1.1.1 Occupational Health and Safety Risks

The key activities of the TL-3 construction are foundation excavation, frameworks, concreting, assembling of the tower, erecting of tower, and flitting of insulators, earthing, stringing of cables and testing etc. Occupational health and safety risks for the construction workers in the transmission line projects include exposure to physical hazards from use of heavy equipment and cranes; trip and fall hazards; exposure to dust and noise; falling objects; work in confined spaces; exposure to hazardous materials; and exposure to electrical hazards from the use of tools and machinery.

4.5.1.1.2 Physical Hazards (Working at Heights on Poles and Structures)

The TL-3 construction activities are potential to involve occupation health risks related to rotating and moving excavation, tower erecting and cable stringing equipment's, working with electrical equipment's for welding and hot works related to tower assembling and rotating wrench machine for cable stringing, manual handling of equipment's and construction materials, and working at height while erecting towers and fixing insulators, and cables. These physical hazards represent potential for accident or injury or illness due to repetitive exposure to mechanical action or work activity. Single exposure to physical hazards may result in a wide range of injuries, from minor and medical aid only, to disabling, catastrophic, and/or fatal. Multiple exposures over prolonged periods can result in disabling injuries. The envisaged impacts are direct, site specific, short term, moderate magnitude and of moderate significance.

4.5.1.1.3 Working at Construction Sites

The other hazards to occupational health at the construction sites include exposure to noise and air pollution, exposure to chemicals, exposure to high ambient temperatures and vibration etc. Such exposes of the construction workers for long working hours for months has potential to cause health hazards impairing the physical and physiological health of the construction workforce. The envisaged impacts are direct, site specific, short term, moderate magnitude and of moderate significance.

4.5.1.1.4 Discrimination in Project Employment

Though inclusive policy for employment in the project jobs without discrimination in gender is highlighted by the employers (project and project contractor), in practice are observed to prefer only the male members of communities for project employment. It is likely that similar practice will be followed by the proposed project. If such practice is exercised by the project, the female members of the community will be the victim of discrimination on job opportunities of the project.

In Nepal, there is a general acceptance to have different wage rates for the male and female members, even both of them perform the same quantity and quality of jobs. This is a prevalent discrimination of female. The proposed project has chance of practicing the discriminatory wage rate payments to the female members employed in the project. Specifically, the sub-contractors might pay different rates to the female and male members. The envisaged impact of the gender discrimination is direct, local, short term, moderate magnitude and of moderate significance.

4.5.1.1.5 Employment of Children

The child labors, especially from socially backward and economically poor families, are lured for construction works by the employers. By using child labor and paying them lower rates, the contractors tend to make higher profit margin. Such a practice is not only the violation of basic rights of children as mentioned in the Child Right Act but also contradicts with the policies of international Financing Agency policies and principals. The envisaged impact is direct, local, short term, moderate magnitude and of moderate significance.

4.5.1.1.6 Pressure to Community Services

Establishment and operation of camps and makeshift camps housing outside construction workforce and technical personnel of contractor and developers has potential to increase pressure on the existing community services such as water supply, sanitation, schools, telecommunication, and markets. In the rural areas these services are at times deficient and increased numbers of people seeking the available existing services is likely to create pressure on the existing service systems.

4.5.1.1.7 Water Supply

During the construction phase, 13,917.33 Kiloliters of water from underground and pipeline supply as well as from the nearby rivers/streams will be used. Water supply is the basic requirement of the camps as well as construction process. The envisaged impact is direct, site specific, short term, moderate magnitude and of moderate significance.

4.5.1.1.8 Conflict with Local Communities

Although most of the local people are supportive for the implementation of the Project. There could be possibility of conflict between guest and host communities due to migration of labours/ workers from other areas.

4.5.1.2 Operation Phase

The adverse issues of concern related to the operation activities are the restriction on land use, impairment to community infrastructures and services, occupational and community health risks.

4.5.1.2.1 Working with Live Line

The operation and maintenance workers of TL-3 will have to work with the live line for most of the time. In such instances workers may be exposed to occupational hazards from contact with live power lines. In the event of such contact, the expected implications are fatal. The envisaged impacts are direct, local, long term, moderate magnitude and of moderate significance.

4.5.1.2.2 Exposure to Electro Motive Force (EMF)

The maintenance workers of TL-3 are exposed to the higher EMF area due to the nature of the maintenance works under the RoW and close to the live lines. Expected EMF at the RoW of the TL-3 is 1 to 3 micro-tesla in normal operating conditions. Though the levels for general public and occupational exposure are higher than the values expected under RoW, the potentials of impacts at low level is expected. The envisaged impact is direct, local, long term, low magnitude and of low significance.

4.5.1.2.3 Impacts of Property Value Depreciation of the Private Land under RoW

This impact of de-capitalization initiated during the construction phase will continue till the project decommissioning. The envisaged impact is direct, local, long term, moderate magnitude and of moderate significance.

4.5.1.2.4 Impairment to Community Infrastructures and Services

Electric and magnetic fields are associated with the high voltage transmission lines. Electromagnetic interference is one of the major issues of the high voltage transmission lines passing close to settlement or other infrastructure facility areas.

4.5.1.2.5 Aircraft Navigation Safety

The TL-1 corridor lies far from the operational domestic airports of Nepal. So such impacts are not seen. The envisaged impact is of moderate significance.

4.6 RESOURCE EFFICIENCY AND POLLUTION PREVENTION MANAGEMENT (ESS-3)

4.6.1 Construction Phase

4.6.1.1 Impact on Land use

The most important of the environmental effects related to transmission line construction such as TL-3 is the conversion of land use. The largest amount of land required for transmission systems is for the overhead transmission line. Again, transmission system can be configured in several different ways, requiring different amounts of land area. The configuration chosen depends mainly on the system reliability requirement for the line in terms of the acceptable emergency power drop in the receiving part of a transmission system. For the TL-3 the configuration chosen is steel lattice structure with vertical cable configuration to minimize the impact on the land use.

Transmission lines are the linear infrastructures similar to the highways/ roads which connects the power generating stations with the power consuming centers. Unlike highways/roads, it does not directly interact with the ground surface throughout the corridor length (directly disturb the physical landscape). The interaction with the surface physical landscape is limited to tower pad locations (limited to 35X35 m^2), where the tower pad are founded to the ground to support the cable strung on towers. The transmission line implications, however, is on the biosphere (vegetation particularly trees) and built structures falling under the RoW. For the safety of the cable vis-a-vis community health and safety, tall standing vegetation, and built structures need clearance from the transmission line RoW. The RoW of the transmission lines vary according to the voltage capacity of the line and the arrangements of strung cables. The required RoW for the high voltage TL-3 of 400 kV with vertically arranged conductors is 46m (23 meters on either side from the center). The clearance and maintenance of the RoW of the TL-3, along the corridor length, thus, directly impacts the existing land use under the RoW.

Though RoW clearance and maintenance is required throughout the length of the TL-3, envisaged land use change is expected in the tower occupied areas of agricultural lands/bush lands/grasslands/ barren lands and in the forested lands. In the tower occupied areas of the agricultural/barren/forest lands, the occupied lands will be converted into structures, but the other areas falling under the RoW will not change to other land uses, while in the forest land, the tower pad occupied areas will be converted into structures, and rest of the RoW will also be cleared. Expected land use change by the TL-3 is presented in Table 4.3 below.

The change brought by RoW clearance is the alteration of habitat as well as loss of standing tall vegetation. Permanent change expected on the RoW is on the locations of tower pad, where all the vegetation and soil will be removed and excavated for the foundation of the tower pads. Permanent change on the RoW forest land due to tower construction is comparatively less while there will be alteration in the vegetation structure (habitat), as most of the tall vegetation will be removed for the safety of the overhanging cables. Total of 3.488 hectare of the forests as shown in Table 4.3.

Table 4-3: Total Land Required by the Project

Objectives	Project Structures	Land Types (Ha.)				Total in Ha.
		Forest Area	Agriculture Land	Barren Land	River Bed	
		Community Forest	Private	GoN	GoN	
Permanent	Tower Pad	1.37	25.09	0	3.97	30.43
	Substation	0	7.04	0	0	7.04
Land Use Restriction	RoW	2.12	167.73	209.97	8.70	388.52
Total		3.49	199.86	209.97	12.67	425.98

The total land requirements for the proposed project are 425.98 ha. The land to be acquired from community forest 3.49 ha, agriculture land 199.859 ha., barren GoN land 209.97 ha and river bed is 12.67. The district wise private land required for the proposed project is given in Table 4.4 The total private land needs to be acquired is 199.859 ha. Which includes land in RoW and land required for tower pads.

Table 4-4: District wise land requirement of Private Land

SN	Districts	Land Acquisition	
		Tower Pad	RoW
1	Jhapa	8.7742	74.1614
2	Morang	5.5355	49.6651
3	Sunsari	10.7789	43.9044
Total		**25.0886**	**167.7309**

Further, due to locations of tower pads along the ridge - spurs in the hill areas (Siwalik Physiographic Zones), the intervening saddles (tributary valleys) in the forest covered areas does not need clearance of the standing trees. The envisaged impact is direct, long term, site specific, moderate magnitude, irreversible, and of moderate significance**.**

4.6.1.2 Impacts on Land Instability and Erosion

About 3.5 km TL-3 route mostly is located within the Siwalik Physiographic Zone. By the geologic makeup and the landforms, this zone is prone to erosion and land degradation. Similarly, tower pad locations (limited to 35X35 m^2) make hilly areas more vulnerable to erosion and land degradation. Transmission line construction can enhance erosion at the tower pad foundation sites by digging, crushing by heavy

equipment, and uprooting of trees and vegetation. Similarly, vegetation clearance from the RoW for the cable safety vis-a-vis community health and safety has potentials of exposing sites to erosion or the elements, or by making the sites more prone to erosion. Unplanned disposal of the surplus excavated soil and rocks from the excavation sites of tower foundation also has the possibility of erosion enhancement as well sedimentation of the areas due to damage to surface vegetation.

4.6.1.3 Impact from Tower Foundation Excavation

Poor site preparation and construction practices has a direct implication in the local geology and consequently on erosion and land stability. Preparation of foundation site for construction including access roads/trails to reach the site has direct bearings on the erosion and land instability. Access development, site clearance and excavations involved in the tower foundations works create slopes which are more prone to erosion and land instability.

The TL-3 has a plan to construct 237 towers (122 angle tower, DA will be 115, DB will be 66, DC will be 35 and DD will be 21) foundations of different types along the alignment route. Average tower foundation area for angle tower is 35X35 m^2.

Excavation for the tower foundation on the flat ground is not envisaged to have excavation related failures encompassing the larger surrounding areas. In these locations the associated land instability in the tower foundation site is of local nature. But the tower foundation sites in the slopping ground has potentials of land failure risks involving larger areas in the surroundings, which not properly treated has potential of land failure in the long term as well. Such risks are particularly high in the Siwalik and hilly areas compared to Terai). The rainfall intensity in these physiographic zones is the other factor enhancing the erosion in and around the tower foundation site during the monsoon season. The envisaged impact is direct, site specific, long term, high magnitude, irreversible, and of high magnitude.

4.6.1.4 Impact related to Spoil Management

Site preparation for the tower foundation including access development and excavation for tower foundation generates considerable volume of spoil. The expected volume of excavation from the foundation site of a Tower pad and other structure is expected to 2,09,493 m^3 including foundation of footings and foundation of RCC pad.

The spoil materials thus generated, if not stored in safe place for later reuse and manage the remaining volume after reuse, has potential to enhance upland erosion due to damage of the ground vegetation on the down slope the tower foundation site and sedimentation in the low land areas. Such potentials of erosion and land instability are high at the tower foundations sites located in the hill slopes of the Siwalik and other hilly areas. The envisaged impact is direct, short term, site specific, moderate magnitude, reversible, and of moderate significance**.** Mismanaged spoil, however, could have a long-term implication to the tower foundation sites located particularly in the Siwalik and Mahabharat hill slopes.

4.6.1.5 Impacts on Water Quality

A number of potential impacts on water quality of watercourses may result from the construction of transmission lines and their corridors. Erosion from soils stripped of vegetation during power line corridor clearance and spoils discharged from the tower pad foundations has potentials of significant impacts to the water quality of the nearby streams and rivers. Disposal of construction waste, camp wastes and other chemicals used for construction and support ancillary facilities has the potentials of degrading the water quality both surface and sub-surface at the tower foundation sites, and camp sites.

4.6.1.6 Disposal of Construction Waste

The expected construction waste at the tower foundations sites and during cable stringing operations are the non-hazardous solid and liquid wastes which may include plastic rappers of materials, plastic or jute bags for cement packaging, iron wires and scraps, used wooden frames, left over concrete, broken or punctured containers and water wasted during concrete mixing operations etc.

Haphazard disposal of these wastes in the surrounding environments and in the nearby water body will degrade the land esthetics as well as potential to degrade the water quality of the receiving water bodies. As the expected volume of the construction wastes related to the TL-3 at the tower foundation site is small, the envisaged impact is direct, site specific, short term, low magnitude and of low significance.

4.6.1.7 Disposal of Camp Wastes

23 camps will be there in total for the construction. The total labor requirement in the construction phase is 1,88,223 person-days. The works camp will be established in RoW area. Total estimated waste generation from makeshift camp per day is presented in Table 4.5.

Haphazard disposal of the solid waste and the toiletry waste has potential to cause land as well as water pollution around the camp sites. Unmanaged toiletry waste and decomposable organic waste has potential to contaminate the surface and sub-surface water and are the site of disease vectors resulting into epidemics related to water borne diseases.

Table 4-5: Camp Waste Generated in the Construction Camps

Particulars	Waste water Lt/day	Solid Waste Kg/day	Biological Oxygen Demand (BOD) Kg/day	Chemical Oxygen Demand (COD) Kg/day	Suspended Solid (SS) Kg/day	Total Suspended Solid (TDS) Kg/day
Makeshift Camp	28,233,450.00	282,335.00	308,999.43	690,151.00	313,705.00	572,511.63

The estimation is based on, water consumption at the rate of 150 lt/day/person. The solid waste is estimated with the rate of 1.5 kg/person/ day. The values of BOD – 19.7kg /person/year, COD – 44 kg/person/year, SS – 20 kg/person/year. TDS – 36.5

kg/person/year, N – 3.3 kg/person/year, P – 0.4 kg/person/year (after Rapid Assessment of Sources of Air, Water and Land Pollution, WHO, 1982). The total has been calculated based on the data on human resource required for the project.

Since the workforce will be scattered around the area of RoW hence the daily discharge of the waste amount is small. The envisaged impacts is direct, short term, site specific, moderate magnitude and of moderate significance.

4.6.1.8 Disposal of Spent Oils, Fuels, Lubricants, and other Chemicals

The vehicles and heavy equipment used in the transmission line construction while filling the fuel, and during operation has high potential of spilling of the fuel. The lubricants used in the vehicle, and equipment's is the other major source of spent oils and lubricants that can find its way to the environment. Though the amount of use of the other hazardous material in the transmission line construction is relatively small, improper storage, leakage, spill over from the containers and disposal of the spent materials into the environment has potential of contamination of land and water with serious long-term consequences to the environment as well as community health and safety. Improper handling of the materials exposes the occupational workers to these contaminants. The envisaged impact is direct, short term, site specific, low magnitude, reversible and of low significance.

4.6.1.9 Impact on Air Quality

Construction activities have potential to generate emission of fugitive dust caused by a combination of on-site excavation and movement of earth materials. Similarly, the vehicles moving through the earthen roads to transport the materials from the storage camps to the nearest makeshift camps are also likely to generate high amount of fugitive dusts into the atmosphere due to the blowing effect. Contact of construction machinery with bare soil, and exposure of bare soil and soil piles to wind is the other source of fugitive emission. A secondary source of emissions may include exhaust from engines of earth moving equipment and transportation vehicles used for the material transport. Likewise, cooking in the camps as well as from open burning of solid waste on-site at the construction site and camps are potential to generate combustion emissions.

4.6.1.10 Vehicular Fugitive and Combustion Emissions

All of the construction materials such as steel frameworks, steel bars, cement, etc. required for the tower construction will have to be transported from the storage camps to the makeshift camps and to the construction sites of tower foundation. Such transportation of the materials in the road infrastructure facilitated Terai physiographic Zone will be carried out by transport trucks. Whereas in the Siwalik and hilly region, such transportation will be limited to the nearest road heading to the makeshift camp and manually transported. Vehicles plying in these earthen roads in the dry season are likely to generate high amount of fugitive dusts due to blowing effect. The amount of fugitive dust generated will depend upon the moisture content of the road surface, silt and clay content, and the number and speed of the vehicle. Such fugitive emissions, however, will settle within few hundred meters of the road corridor affecting the recipients located close to the roadside. Apart from this the

vehicles used for transportation will emit pollutants generated from the ignition of the fuel generating CO_2, Nox, Sox, PM10, PM 2.5, volatile and semi volatile components contaminating the ambient air quality.

Since the vehicles to be used for the transportation of the materials to and from the main camps to construction site will be limited to few numbers, its contribution on the ambient air quality is considered insignificant. But fugitive emission at the periods of vehicle movement could be significant in the earthen road corridor area. The envisaged impact is direct, local, short term, low magnitude, reversible and of low significance.

4.6.1.11 Fugitive Emissions from Construction Sites (tower foundation, foot trails)

The construction sites of tower foundations are mostly limited within tower foundation area only. Vegetation clearance of the foundation sites and excavation at tower footings, including the foundation of the RCC pads will generate soils suitable for wind picking. Besides, the spoil materials, particularly the sub-soil when dried could be easily picked up by the wind. Movement of the workers on the foot trails as well within the construction sites is potential to generate fugitive dusts. As the use of equipment's for tower foundation is limited to hand driven equipment's, fuel ignition emissions will be insignificant. The envisaged impact is direct, site specific, short term, low magnitude, reversible and of low significance.

4.6.1.12 Camp Emissions from Cooking Activities

In the rural Nepal, including the TL-3 area, the cooking fuel is the firewood. The energy efficiency of firewood is very poor and generates high amount of TSP, and carbon monoxides in the closed cooking environment which is of health concern to the construction workers. The estimated firewood requirement for one person for a month is about 10 kg. Thus, in general nearly 180 kg/day of fuel wood per day in one camp and about 380kg of fuel wood in one makeshift camp will be required. Such consumption of fuel wood in the camps has potential to generate combustion air pollutants to significantly pollute the indoor air of the camps. But its contribution to the ambient air is considered low. The envisaged impact is direct, short term, site specific, reversible, low magnitude and of low significance.

4.6.1.13 Impacts of Noise Pollution

The noise generating activities during the construction period of the transmission line are related to the vehicles (engine noise, body noise, speed, horn etc.), construction works (construction people, excavation works, concrete mixing, installation of steel frame, cable stringing operations etc.) and camps (people, cooking, radios, etc.)

4.6.1.14 Vehicular Noise

The vehicles to be used for the TL-3 are primarily trucks for the transportation of construction materials from the storage camps to the road head of the makeshift camps. Only limited small four-wheel vehicles for commuting project engineers will be used. Earthen roads with poor surface conditions are likely to generate high body noise apart from the engine noises. As a larger section of the TL-3 is in the hills without roads, transportation of the materials will be primarily though manual labor in

these areas with little noise related impacts. The expected vehicular noise in the road corridor (in the Terai and limited sections of Siwalik and hills) is a short-term noise felt during the passing of the vehicles through the road. The noise level expected by the roadside during vehicle passing is 85 dBA, which is expected to lessen drastically as the distance increases on the roadsides. The envisaged impact is direct, local, short term, low magnitude and of low significance.

4.6.1.15 Construction Noise

Proposed construction methods are labor based with minimum inputs of heavy equipment. Hence, the heavy equipment noise at the construction site is not expected. The noise generated in the construction sites relates to hand driven equipment's, wrench machines, concrete mixtures, wielding etc. Expected short term noise level during construction period at the site could be as high as 85 dBA while operating jack hammers, and generators. As the construction sites are relatively far from the recipient (settlements), the envisaged impacts of noise are direct, site specific, short term, low magnitude, and of low significance.

4.6.1.16 Camp Noise

The construction camps are normally located close to the community. The camp noises include playing of radios, people's talking/ discussions, cooking and occasional use of generators. High noise levels at the camps are expected in the early morning and evening hours, which might be offensive to the neighbors. The envisaged impact is direct, site specific, short term, of moderate magnitude and of moderate significance.

4.6.1.17 Impacts of Electro-Magnetic fields

The high-power electricity transmission systems such as TL-3 influence the surrounding environment through the effects of electric fields and magnetic fields.

Electric fields are produced by voltage and increase in strength as the voltage increases. Electric fields are shielded by materials that conduct electricity, and other materials, such as trees and building materials. The electric fields around the transmission line are the result of high voltage gradient on the surface of conductor. The electric fields are strongest at the surface of conductor and lose intensity away from the conductor. The electric field produced by TL-3 transmission line is a combination of the electrostatic field created by the line voltage and the space charge field due to the charge produced by the line's corona.

The expected electric field strength and magnetic field strength values for TL-3 are below the exposure limits for general public exposure to electric (5000k/m) and magnetic fields (100 μT) published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). It is therefore the envisaged impacts are considered direct, local, long term, low magnitude and of low significance.

4.6.2 OPERATION PHASE

4.6.2.1 Impacts of Noise Pollution

During operation phase noise pollution related to transmission line operation is the corona action on the conductor and during maintenance noise of the maintenance vehicles and the workforce.

4.6.2.2 Noise related to Corona Action

Noise in the form of buzzing or humming will often be heard close to the RoW of the TL-3. The noise will be caused by the ionization of electricity in the moist air near the conductor surface and is because of limited electrical breakdown of the air. This process of air break down is called corona discharge. The process of corona discharge is weather dependent. It is high in the rainy season and foggy season. It is therefore, noise from TL-3 transmission lines is expected to be at its maximum during periods of precipitation (monsoon season June through September). In the periods of high corona discharge, the audible noise of sizzles, crackles, or hissing types is expected close to the RoW. Expected sound pressure level resulting from the corona discharge could be as high as 50 dBA under the RoW and quickly dissipates with distance overshadowed by typical background noises. At the RoW perimeter it is about 45 dBA and has no impact as the background noise level of the area is around 45 to 50 dBA. With the aging of the transmission line, vibrations or humming noise is expected due to loosening of the conductor mounting hardware. Noise generation is also possible due to surface irregularities caused by damage, insects, raindrops, or pollution on the conductor surface. The noise generated by the corona discharge is expected to be masked by the noise of rain in the rainy season but could be audible distinctly in the winter season during foggy weather. Unwanted sounds are called noise pollution. Though the level of expected noises is less than 50 dBA and has no known health risks, could be a source of nuisance to the recipients. Since TL-3 alignment runs mostly through less populated areas away from settlements, the generated noise impacts is considered direct, local, long term, low magnitude and of low significance.

4.6.2.3 Noise related to Maintenance Workforce

The maintenance of transmission line RoW and the tower structures is a periodic work involving about 5 to 10 peoples at a time and for a one or two days at any specific place. As there will be no high pitch noise producing activities during the maintenance works, the envisaged impact though direct, site specific, periodic long term, is of low magnitude and of low significance.

4.6.2.4 Impacts on Air Quality

Due to limited movements of maintenance vehicles and maintenance workforce in the operation phase, the expected air pollution from the maintenance related work is insignificant. The other source of air pollution during operation phase is the Ozone emission as a result of corona discharge.

4.6.2.5 Ozone Emission from Corona Actions

The TL-3, being a high voltage line is expected to show corona discharge. This is what causes the humming sound and has several effects. Emission of ozone and

nitrogen oxides is one of the effects of corona discharge. Ozone is produced near the surface of conductor lines during virtual corona that inldue when a faint luminous color appears together with hissing noise on the surface of conductor. Such incidence of virtual corona is high during the rainy season or foggy conditions. It is generally concluded that amount of ozone and nitrogen oxides produced by the ionization of the air around the conductor of the high voltage line is so small that concentrations reaching at the ground surface are negligible to cause noticeable health effects. It is therefore the envisaged impact is considered direct, local, long term, low magnitude and of low significance.

4.6.2.6 Impacts on Water Quality

The maintenance workforce related discharges are of little concern to water quality due to involvement of a few numbers of the workforce periodically for a limited period along the transmission line. The other water quality concern could be related to the vegetation clearance along RoW to maintain the safety of the cables and community health. As the operations will be limited to trimming of the vegetation below safety heights of the cables, related ground erosion will be minimal on the RoW to cause related water quality and sedimentation problem of the receiving water bodies. Since RoW is the sites preferred by invasive vegetation species, pesticide application to control the invasive species has likely potential of water pollution.

4.6.2.7 Pesticide Use

As of the date, application of pesticide for the control of invasive species on the RoW corridor has not been practiced in Nepal. But such an application in future could not be denied. In the event of such applications, there is potential of agrochemical pollution of the nearby receiving water bodies. Extent of pollution, however, will depend upon the type of pesticide used, and the quantity of the pesticide used apart from the season of pesticide application. The envisaged impact is direct, local, long term, moderate magnitude and of moderate significance.

4.6.2.8 Soil Erosion and Land Instability Impacts

Except for the vegetation clearance for the maintenance of the RoW to avoid risks to cable safety and community health safety, other activities are not envisaged to have impacts on soil erosion and land instability. However periodic supervision and maintenance of the soil erosion protection works around the tower pads and micro-watershed management works will be required to minimize the soil erosion potentials.

4.7 COMMUNITY HEALTH AND SAFETY (ESS 4)

4.7.1 Vector Borne Disease

The TL-3 during construction phase will mobilize construction workforce for the construction of tower foundation, erecting towers, clearing of RoW and stringing cables. The construction workforce will be dispersed in camps and makeshift camps. The numbers of construction workforce will be large in each makeshift camp but will remain in the construction sites for months together till the construction works is completed. Health hazards typically associated with TL-3 are those relating to poor sanitation and living conditions, sexual transmission and vector-borne infections.

Communicable diseases are of concern during the construction phase. There could be a risk of sexually transmitted diseases (STDs), such as HIV/AIDS, apart from this, poor living conditions, discharge of untreated sewage, construction wastes and solid waste from labour camps will be the major cause for spread of vector borne diaseses and pollution of water, land etc. to local community residing close to the camps. As waste dumps are the breeding sites for vectors such as flies, mosquitoes and insects could result to exposure of the community and construction workers to vector borne diseases. The envisaged impact is indirect, site specific, short term, moderate magnitude and of moderate significance.

4.7.2 Girl Trafficking

A large number of human resources (directly employed by the project and indirect seeking economic benefits from the project) will be engaged in different activities during the construction period of the Project. It is most likely that these people will come into contact with the local girls in several ways. In a Project of this scale, there might be close connections between local and outside agents who may be looking after anti-social activities like girls trafficking. The simple and highly discriminated local girls are likely to fall in trap of these agents with the hope of better life then in the local area. The envisaged impacts indirect, local, short term, moderate magnitude and of moderate significance.

4.7.3 Site Hazards

Risks to the community health and safety are potential at the foundation construction sites, during RoW clearance and cable stringing. People in the rural area are bit inquisitive of the construction works. Risks may arise from inadvertent or intentional trespassing at the active foundation construction sites or clearing areas of RoW or on the RoW while cable stringing. In these areas people may be exposed to entrapment hazards. The envisaged impacts are indirect, site specific, short term, low magnitude and of low significance.

4.7.4 Erosion of Local Culture and Traditions

The adverse impacts of the outside workforce during the construction period on local culture and traditions cannot be undermined as these may include people of diverse caste/ ethnic and religious groups which might be different then the local community. Existing social structures have been smoothly functioning on a traditionally built linkages underpinned by local values and norms of the society. Despite differences in opinion and their caste/ethnicity, they are closely connected by their local governing systems as well as cohesiveness in functioning, particularly through participatory approach of different groups (mother groups, women groups, male groups, community forestry groups, and irrigation and drinking water supply groups). The groups including local cooperatives as well as the political representatives of all parties also play roles in decision making for local development. The inflow of outside force coming with different views and opinions might generally break the existing social system that has been functioning effectively since tradition.

Difficult to measure but carrying significant value is the changes that are potentially to occur on the social structure, norms and cultural practices of the communities located close to the construction area. These changes are brought by the influence of the outside construction forces of diverse social background and cultural practices. At times resistance to the influence on the local way of life and cultural and traditional practices by the local community may result into disputes and conflict between the outsiders and locals. Experiences in the major development projects have shown blockade of the construction works by local communities and consequently delays in construction works. The envisaged impacts in overall are potentially adverse, indirect, site specific, short term, low magnitude of low significance.

4.8 LAND ACQUISITION, RESTRICTIONS OF LAND USE AND INVOLUNTARY RESETTLEMENT (ESS5)

One of the most important effects on the socio-economic arena related to the transmission line project is the acquisition of the private land and property for the establishment of transmission line structures. The restriction on the land use particularly the land and property of the HHs is the other dimension related to the depreciation of property value due to the mere existence of the overhanging cables within the RoW area. The TL-3 selected alternative route alignment for optimizes the acquisition of private lands and property, thereby reducing the impacts of social, cultural and economic aspects to the community members. The section below analyses in detail the potential impacts on the socio-economic and cultural environments of the affected community members for the construction and operation phases of the project.

4.8.1 CONSTRUCTION PHASE

4.8.1.1 Impacts on HHs

The transmission line TL 3 passes through 03 districts namely Jhapa, Morang and Sunsari. A total of 205 households in Jhapa, 109 households in the Morang and 132 households in the Sunsari district are to be affected by the proposed project (Ref. Table 4.6). The envisaged impacts of land acquisition and land use restriction is summarized as direct, local, long term, high magnitude, irreversible and of high significance.

Table 4-6: Number of HHs Affected

S.N.	District	No. of households
1	Jhapa	205
2	Morang	109
3	Sunsari	132
Total		**446**

Gender wise Ownership Status of land amongst the PAFs

Among 109 PAFs in Morang district, the males are 97 while females are only 12 with the land ownership as in Table 4.7. Similarly, among 205 PAFs, the males are 186

with land ownerships while females are 19 with land ownership in Jhapa District. But in Sunsari district, among 132 PAFs, the males are 130 with land ownerships while females are 2 with land ownership. This shows the land ownership is mostly limited to males as compared to female. The envisaged impacts of land acquisition and land use restriction is summarized as direct, local, long term, high magnitude, irreversible and of high significance.

Table 4-7: Gender wise Ownership of land (Project affected Families)

Districts	Total PAFs	Male	Percentage (%)	Female	Percentage (%)
Morang	109	97	88.99	12	11.01
Jhapa	205	186	90.73	19	9.27
Sunsari	132	130	98.48	2	1.52
Total	446	413	92.60	33	7.40

4.8.1.2 Impacts of Permanent Loss of Private Property and Land for the Tower Foundations and Land Use Restriction on RoW

The total land requirements for the proposed project are 425.982 ha. The land to be acquired from community forest 3.488 ha, agriculture land 199.859 ha., barren GoN land 209.97 ha and river bed is 12.665. The district wise private land required for the proposed project is given in Table 4.8. The total private land needs to be acquired is 199.859 ha. Which includes land in RoW and land required for tower pads.

Table 4-8: District wise land requirement of Private Land

SN	Districts	Land Acquisition	
		Tower Pad	RoW
1	Jhapa	8.7742	74.1614
2	Morang	5.5355	49.6651
3	Sunsari	10.7789	43.9044
Total		**25.0886**	**167.7309**

4.8.1.3 Loss of Structures

The total land required for the proposed project are 425.982 ha. The land to be acquired from community forest 3.488 ha, agriculture land 199.859 ha., barren GoN land 209.97 ha and river bed is 12.665. Table 4-9 shows the loss of different structures in RoW with the costs disclosed by the project affected people. A total of 26 structures will be affected by the TL-3 project. The overall project risk is thus categorized as 'Substantial'.

Table 4-9: Estimated Cost of Structures Disclosed by Project Affected People

SN	Place	Type	Cost at location NPR at the time of Construction
1	Substation Anarmani	Pig shed concrete	5,00,000
2	Substation Anarmani	Cattle shed (small with local materials but no concrete)	1,50,000
3	Substation Anarmani	Goat Shed (small with local materials but no concrete)	1,50,000
4	Substation Anarmani	Hut with two rooms and metal roof	2,50,000
5	Anarmani	Cattle shed with concrete floor	8,50,000
6	Anarmani	Small house with four rooms (concrete and steel roof)	11,00,000
7	AP88 to T88	Open roof with two rooms on open concrete pillar frame only	3,00,000
8	AP88 to T88	Cattle shed with bamboo wall	50,000
9	AP69 to 70	Two story House with concrete wall	12,00,000
10	AP22 to T21	Three room's single-story house with concrete pillar system newly built	20,00,000
11	T72	Cattle shed with bamboo wall	50,000
12	T103 to AP104	Three room's single-story house with concrete pillar system newly built	20,00,000
13	T72 to T73	Cattle shed with bamboo wall	50,000
14	T66	Two story house with bamboo and mud wall	8,50,000
15	T65 to T66	Small house with bamboo and mud wall	2,50,000
16	T56	Two story house with bamboo and mud wall	8,50,000
17	T35	Small house with bamboo and mud wall	2,50,000
18	T35	Small house with bamboo and mud wall with tile roof	2,50,000
19	AP87	Small house with concrete wall and metal roof	7,50,000
20	AP48	Three room's single-story house with	8,50,000

SN	Place	Type	Cost at location NPR at the time of Construction
		concrete pillar system	
21	AP46	Three room's single-story house with concrete pillar system newly built	20,00,000
22	AP37	Small house with bamboo and mud wall	2,50,000
23	AP28 to 29	Small house with bamboo and mud wall	2,50,000
24	AP24 to T24	Small house with bamboo and mud wall	2,50,000
25	AP20 to AP19	Small house with bamboo and mud wall	2,50,000
26	AP20 to AP21	Small house with bamboo and mud wall	2,50,000
		Total NPR	**1,59,50,000**
		Total USD	**119,925**

USD= NPR 133, Approximate conversion rate as of 03/05/2024

A. Impacts on Agriculture Produce

The RoW land use restriction on the agricultural land is not expected to impart food insufficiency impacts to the land owners. The conversion of agricultural land into structures (tower foundation), however, is expected to have impacts on food insufficiency. The information on annual agriculture produce by households in the project area districts has been collected during the survey. The information on annual agriculture produce by households in the project area districts has been collected during the survey. It was recorded that In all 12,53,938 kg is the total agriculture produce of the districts annually. The major crops cultivated are rice, maize and wheat. The details are given in Table 4.10.

Table 4-10: Agriculture Produce Cultivated by Affected HHs in Project Area Districts

District	Maize (kg)	Rice (kg)	Wheat (kg)	Grand Total (kg)
Jhapa	78258	315260	450	393968
Morang	81150	324850	550	406550
Sunsari	88250	364520	650	453420
Grand Total	**247658**	**1004630**	**1650**	**1253938**

The envisaged impacts of land acquisition and land use restriction is summarized as direct, local, long term, high magnitude, irreversible and of high significance.

4.8.2 Construction Phase

4.8.2.1 Adverse Impacts

A. Impacts of Permanent Loss of Private Property and Land for the Tower Foundations and Land Use Restriction on RoW

Mitigation

Avoidance and minimization efforts were employed during TL-3 alignment route selection. The impacts envisaged above resulting from the land acquisition, and land use restriction on the social and socio-economics of the affected HHs is unavoidable and will remain as the residual impact of the project. To restore the livelihoods of the affected HHs a compensatory program will be launched targeting the affected HHs. The compensatory program (Resettlement and Rehabilitation Program) will carry out the land acquisition and land use restriction as per the law of the country and applicable best practice mechanisms. The Resettlement and Rehabilitation Program will be based on the principle that livelihood of the affected HHs will be restored to conditions at least equal to or better than the existing situation.

B. Resettlement and Rehabilitation Program

A provision of total NPR 1,555,443,634 (USD 11,695,065) needed for the compensation of Houses and Structures, Land Acquisition, Allowances for Vulnerable and Indigenous People, RAP Implementation Monitoring and Evaluation [Table 10-1,considering 1 USD=133 based on the rate of 2024].

4.9 BIODIVERSITY CONSERVATION AND SUSTAINABLE MANAGEMENT OF LIVING NATURAL RESOURCES (ESS-6)

The TL-3 traverse through a diverse landscape comprising of agricultural lands, forest, and barren land used by an equally diverse biological community. In terms of ecological sensitivity, the land units traversed by the transmission line are not considered to be important biodiversity hotspots preserved or conserved for the protection/conservation of flora and fauna. In this context, the implication of the transmission line on the terrestrial and aquatic habitat alteration due to its construction and operation is of lower magnitude and significance. Sections below analyze the perceived impacts for the construction and operation phase in the given geophysical and ecological setup.

4.9.1 Construction Phase

4.9.1.1 Impacts of Terrestrial Habitat Alteration

The change brought by RoW clearance is the alteration of habitat as well as loss of standing tall vegetation. Permanent change expected on the RoW is on the locations of tower pad, where all the vegetation and soil will be removed and excavated for the foundation of the tower pads. Permanent change on the RoW forest land due to tower construction is comparatively less while there will be alteration in the vegetation structure (habitat), as most of the tall vegetation will be removed for the

safety of the overhanging cables. Total of 3.488 hectare of the forests as in Table 4.11.

Table 4-11: Total Land Required by the Project

Objectives	Project Structures	Land Types (Ha.)				Total in Ha.
		Forest Area	Agriculture Land	Barren Land	River Bed	
		Community Forest	Private	GoN	GoN	
Permanent	Tower Pad	1.37	25.09	0	3.97	30.43
	Substation	0	7.04	0	0	7.04
Land Use Restriction	RoW	2.12	167.73	209.97	8.70	388.52
Total		3.49	199.86	209.97	12.67	425.98

The impact of forest fragmentation due to RoW clearance is considered severe if RoW passes through the core forest area while the impact is negligible in the forest fringe areas which are already disturbed by encroachments, and degradation of forest. As the TL-3 alignment pass through the fringe zone in a modified habitat as well as dense forest, the envisaged impact is low.

4.9.1.2 Impacts of the Loss of Standing Vegetation

The TL-3 traverse across 2 community forests as presented in the Table 4.12.

Table 4-12: Forest types along the TL

Sample plot	Forest	Forest composition	Vegetation type	Transmission Line
AP-6	Sunsari Milan	*Dalbergia* mixed forest	Tropical forest	Inaurawa - Anamrmani
Ap-7	Hanumane	*Dalbergia* mixed forest	Tropical forest	Inaurawa - Anamrmani

Note: *CF=Community Forest*

The total tress loss in TL-3 is 105 and poles loss will be 194.The vegetation characteristics of the affected forests with their trees diameter, basal area, height, gross volume, net volume, wood loss, standing biomass along the Transmission line is presented in Table 4.13.

Table 4-13: Loss of Tress/Poles and Wood Volume

Sunsari Milan Community Forest (RoW)							
No. of trees	**Gross Volume (cubic feet)**	**Net Volume (cubic feet)**	**Wood (cubic feet)**	**No of Poles**	**Gross Volume (cubic feet)**	**Net Volume (cubic feet)**	**Wood (cubic feet)**
2	0.00	0.00	0.17	47	13.12	0.37	0.60
Sunsari Milan Community Forest (Tower)							

No. of trees	Gross Volume (cubic feet)	Net Volume (cubic feet)	Wood (cubic feet)	No of Poles	Gross Volume (cubic feet)	Net Volume (cubic feet)	Wood (cubic feet)
25	373.16	10.57	3.07	55	146.53	4.15	1.61
Hanuman Community Forest (RoW)							
No. of trees	**Gross Volume (cubic feet)**	**Net Volume (cubic feet)**	**Wood (cubic feet)**	**No of Poles**	**Gross Volume (cubic feet)**	**Net Volume (cubic feet)**	**Wood (cubic feet)**
23	558.55	15.82	2.87	31	47.19	1.34	0.55
Hanuman Community Forest (RoW)							
No. of trees	**Gross Volume (cubic feet)**	**Net Volume (cubic feet)**	**Wood (cubic feet)**	**No of Poles**	**Gross Volume (cubic feet)**	**Net Volume (cubic feet)**	**Wood (cubic feet)**
55	1888.22	53.47	8.29	61	130.89	3.71	1.18

The expected vegetation loss when evaluated collectively is high. The site specific loss is comparatively small not to impart high levels of significant impacts on the ecological balance of the specific sites. Loss of NTFP species within the RoW is limited to few tree species whose leaves, fruits and barks are occasionally used by the locals for their own consumptions and is not expected to cause impacts on the local livelihood. Further these species are also available in the adjoining areas of the RoW as given below in Table 4.14:

Table 4-14: Economically important plant species along the RoW

Species	Uses	Parts used
Bombax ceiba	Medicine and firewood	Whole plant
Acacia catechu	Medicine	Leaf
Zizyphus mauritiana	Medicine	fruit
Nephrolepis spp.	Medicine	Whole plant
Dalbergia sisoo	Wood	Whole plant
Neolamarckia cadamba	Medicine	flower
Leucas zeylanica	Used as bio insecticides	Leaf
Argemone maxicana	Oil	Whole plant
Bambusa Schreb.	Food	Young shoot
Rubus spp.	Food, as medicine of gastritis other purposes	Fruit and young stem
Eucalyptus	Wood	Whole plant

Species	Uses	Parts used
Artemisia dubai	Used as bio insecticides	Leaf
Ocimum gratissimum	Medicine	Whole plant
Cassia fistula	Medicine	fruit
Ficus religosa	Medicine	fruit
Tectona grandis	Wood	Whole plant

The vegetation clearance on the RoW also will have some positive impacts on the vegetation diversity. Opening of an area under a mature tree covered zone is expected to enhance the floral biodiversity as it provides ecological conditions for many floral species which could not grow on the tree covered areas. But there is also a risk associated with tree clearance on the RoW. The invasion by the invasive species along the RoW is a problem in many transmission line corridors in Nepal with negative adverse impacts on the floral biodiversity. To summaries, the envisaged impacts of the vegetation clearance is considered direct, site specific, long term, moderate magnitude, irreversible and of moderate significance.

4.9.1.3 Impacts of Forest Fragmentation

The construction of transmission line and creation RoW may leads to fragmentation of forest and habitats of wildlife. During the field survey no modified, natural and critical habitats are identified along the transmission line corridor. The transmission line is mainly passing through community forest which is used by locals for the extraction of fuel wood, timber and other NTFPs. To minimize forest fragmentation the TL-3 alignment is proposed along the fringes of forest areas. The envisaged impact related to forest fragmentation has been evaluated as direct, long term, local, low magnitude, irreversible and of low significance.

4.9.1.4 Impacts of the Loss of Vegetation Species of Conservation Significance

There are no vegetation of conservation significance.

4.9.1.5 Habitat loss

The impacts of the TL-3 construction on the species of conservation significance is envisaged to be direct, long term, site specific, low magnitude, irreversible and of low significance.

4.9.1.6 Exploitation by Construction Workforce

Illegal harvesting of important plant species of high economic values is a practice from project area. It is difficult to predict the extent of the illegal harvesting activities, but the risk associated is highly potential in the context of Nepal, where security situation and the surveillance by the concerned government agencies is not stringent. It is therefore the envisaged impact is considered indirect, short term, local, moderate, reversible, and of moderate significance.

4.9.1.7 Impacts of Forest Fires

The risk of the forest fires along or from the transmission line corridor is potential due to two reasons. First, the trimmed vegetation was left to accumulate within right-of-way boundaries and second the undergrowth on the RoW is not managed properly. In both the cases, there will be sufficient fuel on the RoW to promote forest fires. Such forest fires not only damage the forests outside the RoW but also the overhanging cables and pole structures of the transmission line.

The area traversed by the transmission line corridor particularly in the Siwalik and hilly areas is prone to forest fires in the dry season. The litters and dried grass on the forest floor in the dry season (March/June) is the prime cause of the forest fires (man induced or natural). Any activity of construction that promotes accumulation of fuel within the boundaries of the RoW is likely to cause forest fires. The impact of the forest fire is not only to the plant diversity and vegetation structures but also to the wildlife diversity, and habitats. The envisaged impact is direct, short term, local, high magnitude, reversible, and of high significance.

4.9.1.8 Impacts of the Loss of Wildlife Habitat

The construction of TL-3 and clearance of the RoW, especially through forested areas, will result in alteration and disruption to terrestrial habitat of the wildlife including mammals, birds, and herpetofauna. Transmission line RoW vegetation is observed to provide habitat for a number of wildlife species of mammals, birds, reptiles. The corridor alignment lies very close to the motorable roads and foot trails, which is under high disturbance due to noise pollution by vehicle and regular human intervention.

Considering the physical location of the transmission line and associated ongoing disturbance, most of the noise sensitive wildlife has already migrated out of the disturbed zone; they rarely used proposed RoW area in forest area only during night for migration. In view of the existing ecological situation of the TL-3 alignment, construction related impacts are envisaged to be direct, short term, local, low magnitude, reversible and of low significance.

4.9.1.9 Impacts on Wildlife Species of Conservation Significance

The transmission line route passes through the forest having degraded habitat in some places with following species are of Conservation Significance are located as in Table 4.15:.

Table 4-15: Wildlife around RoW

S. N.	Species	Family	Local Name	IUCN Red-List (v2018-2)	Nepal Red List Category	NPWLC Protected Status
	Mammals					
1.	*Mabuya carinata*	Scinidae	Bhanemungro	Least Concerned	N/A	Not Protected
2.	*Mus musculus*	Muridae	Duhure Gharmuso	Least Concerned	Least Concern	Not Protected

S. N.	Species	Family	Local Name	IUCN Red-List (v2018-2)	Nepal Red List Category	NPWLC Protected Status
					ed	
3.	*Herpestes edwardsii*	Herpestidae	Thulo Nyaurimuso	Least Concerned	Least Concerned	Not Protected
4.	*Semnopithecus schitaceus*	Cercopithecidae	Langur	Least Concerned	Least Concerned	Not Protected
5.	*Herpestes edwardsii*	Herpestidae	Thulo Nyaurimuso	Least Concerned	Least Concerned	Not Protected
6.	*Canis aureus*	Canidae	Syal	Least Concerned	Least Concerned	Not Protected
7.	*Amphiesma stolatum*	Colubridae	Har-Hara	Least Concerned	N/A	Not Protected
8.	*Oryctolagus cuniculus*	Leporidae	Kharayo	Least Concerned	Least Concerned	Not Protected
9.	*Macaca mulata*	Cercopithecidae	Badar	Least Concerned	Least Concerned	Not Protected
	Reptiles					
10.	*Ptyas mucosa*	Colubridae	Dhaman	Least Concerned	N/A	Not Protected
11	*Naja naja*	Elapidae	Goman	Least Concerned	N/A	Not Protected

The impacts on the wildlife of conservation significance are potential from the construction of transmission line and clearance of RoW by habitat loss and also by the activities of the construction workforce. Following birds of conservation significance will also be affected by the TL as in Table 4.16.

Table 4-16: Birds around RoW

SN	English name	Scientific name	Nepali name	Globally Threatened	Nationally Threatened	CITES	NPS
1	Lesser Adjutant	*Leptoptilos javanicus*	Bhudi Khor Garudh	VU	VU	-	-
2	Western Marsh-	*Circus*	Bhuichil	-	VU	II	-

SN	English name	Scientific name	Nepali name	Globally Threatened	Nationally Threatened	CITES	NPS
	harrier	*aeruginosus*					
3	Yellow-wattled Lapwing	*Vanellus malabaricus*	Huttitaun	-	VU	-	-
4	Asian Openbill	*Anastomus oscitans*	Ghudikhor Garundh	-	VU	-	-
5	Crested Serpent-eagle	*Spilornis cheela*	Kakakul	-	-	II	-
6	Himalayan Buzzard	*Buteo refectus*	Shainbaj	-	-	II	-

4.9.1.10 Exploitation by Construction Workforce

The risk of illegal hunting of the wildlife of conservation significance by the construction workforce for economic gains is an undeniable issue. Such incidents are possible in areas where wildlife of conservation significance is reported to be present. There is also equal possibility that outsiders could indulge on such activities taking opportunity of the construction works of the transmission line on these areas. Envisaged impact is indirect, short term, local, moderate magnitude, reversible and of moderate significance.

4.9.2 Operation Phase

During the operation phase of the transmission line the major activity undertake for the maintenance of RoW is cutting of grasses and trimming for medium sized trees only with in forest areas in the RoW. This helps in avoiding distraction to overhead power lines and towers. Unchecked growth of tall trees and accumulation of vegetation within RoW may leads to power outages through contact of branches and trees with transmission lines and towers; ignition of forest and brush fires; corrosion of steel equipment; blocking of equipment access; and interference with critical grounding equipment. Use of machinery and total clear felling of the ground vegetation has potential to enhance erosion generating loose sediments which could be washed out to the nearby water bodies, polluting to the water body and degrading the water quality of the water body. Similarly, use of pesticides for weed management in the RoW is likely to have impact on water quality and also on the birds and fishes. The section below briefly discusses the above impacts in reference to TL-3 during the operation phase.

4.9.2.1 Impacts of Terrestrial Habitat Alteration

During the maintenance of the RoW, following are the potential impacts to the terrestrial habitats.

- Direct Habitat loss: Permanent loss of forest land due to the construction of towers and alteration on the land under RoW. The extraction of tall trees from the tower location and RoW area will impact on the wildlife depends on them;
- Habitat damage and disturbance during maintenance of RoW;
- Increased human activity in the RoW area due to opening of access roads;
- Habitat fragmentation by creation of RoW in construction phase will continue throughout the operation phase, as it requires maintenance of RoW by clearing the tall growing trees regularly which will continue maintaining fragmentation of habitats;.
- Loss of species directly though land clearance for RoW maintenance;
- Disturbance associated with noise from RoW maintenance activities which can drive species away from home ranges and may impact on breeding success of certain species e.g. ground-nesting birds)
- Creation of new habitats;
- Introduction of non-native invasive species Lantana camera, etc;
- Pollution or siltation of watercourses from the eroded materials of the RoW and impacts on water quality and fishes.

All of these potential impacts envisaged in the construction phase and will remain in the operation phase. Due to low level of activities related to maintenance works on the RoW and structures, the level of impacts will remain comparatively lower than the construction phase. The envisaged impacts are direct, long term, local, low magnitude, and of low significance.

4.9.2.2 Impacts of Avian Collisions and Electrocutions

The potential impacts of high voltage overhead electricity line and its structures such as angle masts on birds are of particular concern. The main risks posed by transmission line energized overhanging cables and the clearance and fragmentation of habitat by RoW are: *i) Risk of collision, ii) Risk of electrocution and iii) Risks of displacement or loss of habitat quality in breeding and feeding areas*.

Risk of Collision: The birds in flight may collide with conductors or earthing wires of TL-3. Collisions is potential to occur when birds cross transmission lines during display flights, when moving from roosting to feeding areas, when juveniles leave the nest site and when birds migrate through an area. Rain, fog, darkness and other low visibility conditions can contribute to a higher collision risk. Such risks in the TL-3 are considered high in the monsoon season and during the winter period when the entire Terai is covered with fog.

Risk of Electrocution: Birds sitting or perching on power poles and/ or cables may be killed if they cause short circuits and large species, such as raptors, are most at risk. This happens where the electricity structure dimensions are such that phase-to-phase or phase-to-ground contact can be made between the bird and the structure. Birds and bats may be electrocuted by power lines in one of three ways: i)

simultaneously touching an energized wire and a neutral wire; ii) simultaneously touching two live wires; and iii) simultaneously touching an energized wire and any other piece of equipment on a pole or tower that is bonded to the earth through a ground wire. The risk of electrocution is envisaged to be low on TL-3 as the structures are such that phase-to-phase/ phase-to-ground contacts are not possible, even for the largest bird species found in the area due to the dimensions and spacing of conductors.

The bird species most vulnerable to collision are generally “poor’’ fliers, while electrocution victims are usually birds of prey, ravens and thermal soarers. In developed countries such as USA and Europe bird species have been categorized by wing morphology and risk of either collision or electrocution as species with a high risk of collision, species with a high risk of electrocution and mixed group, susceptible to both these causes of death. In Nepal and in the south East Asia there is a lack of published data on the issue of bird collision with overhead cables or power lines and is difficult to assess the collision and electrocution risks at species level.

Recent research suggests that some birds, such as raptors, may spend most of their time, when in flight, looking down or laterally but not forwards. Such behavior may be usual and could result in certain species being at least temporarily blind in the direction of travel. This may partly explain collisions of the raptor species with overhead wires and other obstacles.

In the above context, the envisaged impacts is considered direct, long term, low magnitude, and of low significance.

4.9.2.3 Impacts to other Wildlife and Electrocutions

The population density of the mammalian wildlife is relatively less along the transmission line corridors due the modified and degraded forests. The mammals like bats, primates (monkeys), and rodents (squirrel, particularly flying squirrel) are at the higher risk due to their behavioral nature. The bats are vulnerable to collision due to small area of reflection from the overhanging cables and earth-wires. Monkeys usually do not take refuge on the transmission towers unless they are scared by the people or other wild animals. So possibility of electrocution or collision is very rare, however, could be caught by the stray voltage around the transmission tower structures. There is possibility of climbing by the rodents on the towers to a certain height (less than the surrounding vegetation) and are likely to be caught to stray voltage. Possibility of electrocution is almost negligible because of its small size**.** The envisaged impacts are direct, long term, site specific, low magnitude and of low significance.

4.9.2.4 Impacts to Migratory Wildlife

There is no migratory route along the TL route.

4.9.2.5 Forest Fires

The forest fire risks on the TL-3 alignment relates to the live overhanging cable and the potential accumulation of carbon fuel on the RoW to catch the fire. The

accidental fall of the live or loaded transmission line cable creates an arc sufficient to burn the combustible materials underneath the cable not only in the forest areas but also in the agricultural lands. Forest fires are not only problems of conductor but also problem for line insulators. When there is accidental breaking of the transmission lines, there are two possibilities: One case may be the phase conductor falls upon the other phase conductor or it can touch the ground or some other earthed portion or the next case may be the conductor doesnot touch anything but it is just simply hanging. There is less forest so it is therefore the potential of forest fire risks could not be discarded. The envisaged impact is indirect, long term, local, moderate magnitude and of moderate significance.

4.9.2.6 Impacts of Weeds Encroachment on Biodiversity along RoW

Vegetation maintenance underneath the RoW will be a regular activity of the TL-3 during the operation period**.** Excessive vegetation maintenance may remove unnecessary amounts of vegetation resulting in the continual replacement of successional species with likelihood of the establishment of invasive species replacing the existing species. This will cause direct implication on the biodiversity of the RoW. The envisaged impact is indirect, long term, local, moderate magnitude and of moderate significance.

The total cost of the BMP is 4,575,342/- that includes NPR 30,00,000/- for mitigation/monitoring and NPR 15,75,342 for compensatory plantation. The cost of forest loss is not the part of BMP and the cost is included in total project cost.

4.10 INDIGENOUS PEOPLE (ESS-7)

4.10.1 Impact on Indigenous and Vulnerable People

During the socio-economic survey there were total 128 HHs of vulnerable group noticed along the TL-3 route. The details are given in Table 4.17. The envisaged impacts of land acquisition and land use restriction is summarized as direct, local, long term, high magnitude, irreversible and of high significance.

Table 4-17: Indigenous and Vulnerable People

SN	Items/Programs	Number/Quantity (HHs)
1	Moderately vulnerable households	1
2	High vulnerable households	2
3	Very high vulnerable	2
4	Women headed households	25
5	Households headed by handicapped person	1
6	Dalit households	37
7	Muslims	7
8	Adivasi/Janajati (Highly marginalized)	7
9	Adivasi/Janajati (Marginalized)	46
Total		128

(Source: HH Survey, 2023)

Among the Indigenous people, highly marginalized includes Majhi 01 HH. Similarly, marginalized includes Rishidev 04 HHs, Magar 07 HHs, Rai 74 HHs and Tamang 05 HHs.

The implementation of VIPDP will start after the approval of IEE, RAP, and VIPDP. The VIPDP cost estimates includes program costs, allowances and administrative costs for VIPDP implementation. The VIPDP is mainly focused on the social development of vulnerable and indigenous groups. The total estimated cost for VIPDP is NPR 49,040,000/- (USD 368,722/-).

Gender Action Plan (GAP) has been elaborated to gender-related measures into the TL-3 related activities, ensuring that gender-related risks are avoided or mitigated, and to pay special attention to women, considering that women are not a homogenous group, and the additional challenges that women from indigenous nationalities, Dalit caste and other marginalized groups may face. It further has identified gender-performance indicators and sex-disaggregated targets to be integrated into the project´s gender-responsive results framework. The cost for GAP implementation and the administrative cost is NPR 165,20,000/- (USD 124,211).

4.11 CULTURAL HERITAGE (ESS8)

ESS8 sets out general provisions on risks and impacts to tangible and intangible cultural heritage. During the ESIA, no archeologically and historically tangible heritages such as monasteries, or ancient monuments were found along the TL-3 alignment, and there will otherwise be no impacts to tangible or intangible cultural heritage under the TL-3 Project. A Chance-finds procedures has been included in the Environmental and Social Management Plan (ESMP) which will be followed if, during construction, there are any chance finds. Chance find procedures will also be included in the bidding documents, in the contractor's contract and in the contractor's ESMP (C-ESMP).

CHAPTER 5: ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

5.1 Institutional Arrangement

Institutional arrangements are intended to meet the requirement of World Bank ESS that in turn will make sure that the National laws are not violated during the pre-construction, construction and operational (defect liability period) stages of the project.

5.1.1 Institutions and their Roles in EandS Risk Management of TL and ancillary facilities

The principal responsibility for the development and implementation of TL in Nepal is vested in the NEA under of the Ministry of Energy Water Resources and Irrigation. Arun-Inaruwa-Tingla-Mirchaiya 400 kV Transmission Lines Project under Transmission Directorate, NEA is thus directly responsible for managing the EandS risks of individual projects under the program, i.e., from assessment, mitigation planning, implementation to monitoring. It is also NEA's responsibility to access or involve the services of other agencies and authorities. The organizational structure of NEA is given in the Annex.

Specifically, project environmental management will involve the following main designated parties: the TL-3; appointed Supervising Engineers, Social and Environmental Engineers and Contractors and independent Monitoring Experts; GoN agencies; National and Local advisory NGOs and the local communities as in Table 5.1.

Table 5-1: Project Environmental Management Organizations

Category	Organization/Contractor
Project Owners	• TL-3 Project Office • Environmental Unit (EU) • Resettlement and Rehabilitation Unit (RRU) • Community Liaison Officer (CLO)
TL3 appointed Supervision Engineers and Contractors	• Supervision Engineers (SE)
	• Social and Environmental Engineers (SEE)
	• Construction Contractor (CC)
	• Independent Monitoring Experts (IME)
GoN	• Ministry of Forests and Environment, (MoFE) • Ministry of Energy, Water Resources and Irrigation (MoEWRI) • Department of Forests and Soil Conservation (DoFSC) • Ministry of Home Affairs (MoHA) • Ministry of Federal Affairs and Local Developments (MoFALD) • Department of Electricity Development (DoED) • District Forest Offices of Sunsari, Morang, and Jhapa

Category	Organization/Contractor
	• District Administration Offices of Sunsari, Morang, and Jhapa • District Development Committee Offices of Sunsari, Morang, and Jhapa • Local Administrative bodies Municipality and Rural Municipality.
Advisory Organizations	• National and Local NGOs and the WB
Communities	• Directly and indirectly affected communities

The ESS Implementation for TL3 is presented in Table 5.2.

Table 5-2: ESS Implementation for TL3

MATERIAL MEASURES AND ACTIONS	TIMEFRAME	RESPONSIBLE ENTITY
ESS 1: ASSESSMENT AND MANAGEMENT OF ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS		
ORGANIZATIONAL STRUCTURE • Establish and maintain PCUs with qualified staff and resources to support management of ESHS risks and impacts of the Project including, an environmental specialist, a social specialist and an occupational health and safety specialist, an environmental specialist and a social specialist. • Contractors will be required to recruit an Environmental, Health, and Safety Manager or OHS Officer/Supervisor, who will be responsible for implementing the contractors' environmental, health and safety responsibilities, and liaising with government agencies. The contractors will also be required to have adequate environmental, social, health, and safety staff. c. Design and Construction Supervision Consultants hired by PCUs will be required to have qualified environmental and social staff in the team to supervise and monitor implementation of the ESCP and other plans committed by client.	• Establish and maintain PCUs as set out in the financial agreement, including three specialists (one environmental specialist, a social specialist and an OHS specialist) and other additional staff as needed at PCUs within four months after signing of financial agreement, and thereafter maintain these positions throughout Project implementation. • Prior to commencement of civil works and maintained throughout the contract period • Prior to commencement of civil works and maintained throughout the contract period	NEA Director, Project Director, Contractors Design and Supervising Consultants
ENVIRONMENTAL AND SOCIAL INSTRUMENTS a. Prepare corresponding Environmental and Social Impact Assessment (ESIA) and adopt and implement thereafter.	a. An ESIA has been prepared, and thereafter implement the ESIA throughout Project implementation.	NEA Director, Project Director, Consultants
MANAGEMENT OF CONTRACTORS a. Incorporate the relevant aspects of the ESCP, the relevant ESMPs, the Labor Management Procedures, Occupational Health and Safety Management Plan, Community Health and Safety Plan, Waste Management Plan, GRM and code of conduct, into the ESHS specifications of the procurement documents and contracts with contractors and supervising firms. Thereafter ensure that the contractors and supervising firms comply and cause subcontractors to comply with the ESHS specifications of their respective contracts. b. Contractors will be required to prepare Contractors-ESMP and related plans such as Traffic Management Plan, Occupational Health	a. During preparation of bidding documents but prior to issuance of EOI notice for contractors; and thereafter Supervise contractors throughout Project implementation. b. Prior to site mobilization.	NEA Director, Project Director, Contractors Design and Supervising Consultants

MATERIAL MEASURES AND ACTIONS	TIMEFRAME	RESPONSIBLE ENTITY
and Safety Plan, Workers' Camp Management Plan, SEA/SH Action Plan, Waste Management Plan, Community Health and Safety Plan, Labor Management Plan, Emergency Response Plan etc. to be submitted to and reviewed and approved by the PCU and the WB.		
TECHNICAL ASSISTANCE Ensure that the consultancies, studies (including technical, feasibility studies, if applicable), capacity building, training, and any other technical assistance activities under the Project,	Throughout Project implementation.	NEA Director, Project Director, Contractors
ESS 2: LABOR AND WORKING CONDITIONS		
LABOR MANAGEMENT PROCEDURES a. Adopt and implement the Labor Management Procedures (LMP) for the Project, including, inter alia, provisions on working conditions, management of workers relationships, occupational health and safety (including personal protective equipment, and emergency preparedness and response), code of conduct, forced labor, child labor, grievance arrangements for Project workers, and applicable requirements for contractors, subcontractors, and supervising firms.	a. SEP will be prepared, consulted upon and disclosed. b. Adopt the SEP at project proposal, and thereafter implement the SEP throughout Project implementation.	NEA Director, Project Director, Contractors Design and Supervising Consultants
GRIEVANCE MECHANISM FOR PROJECT WORKERS a. Establish and operate a grievance mechanism for Project workers, as described in the LMP and consistent with ESS2.	a. The Project SEP includes procedures for workers GRM. The GRM will be operationalized prior to engaging. b. Project workers and thereafter maintain and operate it throughout Project implementation.	NEA Director, Project Director, Contractors Design and Supervising Consultants MoFE Project Contractor(s)
OHS MEASURES a. Prepare, adopt, and implement occupational, health and safety (OHS) measures specified in the LMP and OHS Management Plan for all contracts.	a. SEP will be prepared prior to the project appraisal and to be maintained throughout Project implementation. b. The OHSMP will be prepared prior to contractor' mobilization	NEA Director, Project Director, Contractors Design and Supervising Consultants

MATERIAL MEASURES AND ACTIONS	TIMEFRAME	RESPONSIBLE ENTITY
	and thereafter implemented throughout the project implementation.	
ESS 4: RESOURCE EFFICIENCY AND POLLUTION PREVENTION AND MANAGEMENT		
WASTE MANAGEMENT PLAN a. Prepare, adopt and implement a Waste Management Plan (WMP) in C-ESMPs, to manage hazardous and non-hazardous wastes, consistent with ESS4.	Prior to contractors' mobilization	NEA Director, Project Director, Contractors Design and Supervising Consultants
RESOURCE EFFICIENCY AND POLLUTION PREVENTION AND MANAGEMENT a. Incorporate resource efficiency and pollution prevention and management measures	Prior to contractors' mobilization	NEA Director, Project Director, Contractors Design and Supervising Consultants
ESS 5: LAND ACQUISITION, RESTRICTIONS ON LAND USE AND INVOLUNTARY RESETTLEMENT		
RESETTLEMENT POLICY FRAMEWORK a. Adopt and implement a Resettlement Policy Framework (RPF) for the Project, consistent with ESS5.	A RPF has been prepared and consulted upon. Implement the RPF throughout Project implementation.	NEA Director, Project Director,
RESETTLEMENT PLANS a. Prepare, Adopt and implement a resettlement action plan (RAP) for each activity under the Project for which the RPF requires such RAP, as set out in the RPF, and consistent with ESS5.	Adopt RAPs before invitation for bids, and implement the RAPs before commencement of works.	NEA Director, Project Director,
ESS 6: BIODIVERSITY CONSERVATION AND SUSTAINABLE MANAGEMENT OF LIVING NATURAL RESOURCES		
BIODIVERSITY RISKS AND IMPACTS a. Conducted a Biodiversity assessment as part of the ESIA and measures integrated into the ESMP. b. Prepare BMP along with compensatory planting and community awareness raising.	• ESIA including biodiversity assessment prepared and consulted upon. • Throughout Project implementation.	Project Contractor(s) and Sub-contractor(s), Design and Supervision Consultants Project Director
ESS 7: INDIGENOUS PEOPLES/SUB-SAHARAN AFRICAN HISTORICALLY UNDERSERVED TRADITIONAL LOCAL COMMUNITIES		
INDIGENOUS PEOPLES PLANNING FRAMEWORK	An IPDP has been prepared, and this will	Project Director

MATERIAL MEASURES AND ACTIONS	TIMEFRAME	RESPONSIBLE ENTITY
a. Adopt and implement an Indigenous Peoples Development Plan (IPDP) for the Project, consistent with ESS7.	be consulted.	
ESS 8: CULTURAL HERITAGE		
CULTURAL HERITAGE RISKS AND IMPACTS a. Assess risks and impacts on cultural heritage due to the improvements and incorporate and implement management measures including chance finds in the ESIA, in consistent with ESS8.	Throughout Project implementation.	Project Director
ESS 10: STAKEHOLDER ENGAGEMENT AND INFORMATION DISCLOSURE		
STAKEHOLDER ENGAGEMENT PLAN PREPARATION AND IMPLEMENTATION a. Adopt and implement a Stakeholder Engagement Plan (SEP) for the Project, consistent with ESS10, which shall include measures to, inter alia, provide stakeholders with timely, relevant, understandable, and accessible information, and consult with them in a culturally appropriate manner, which is free of manipulation, interference, discrimination and intimidation.	A SEP has been prepared and will be disclosed by the completion of project appraisal; and thereafter implemented throughout the Project implementation	Project EandS Specialists, NEA Project EandS Specialists, Contractor
PROJECT GRIEVANCE MECHANISM a. Establish, publicize, maintain, and operate an accessible grievance mechanism, to receive and facilitate resolution of concerns and grievances in relation to the Project, promptly and effectively, in a transparent manner that is culturally appropriate and readily accessible to all Project-affected parties, at no cost and without retribution, including concerns and grievances filed anonymously, in a manner consistent with ESS10.	Within thirty (30) days after project effectiveness and thereafter implemented throughout Project implementation.	Project EandS Specialists, NEA Project EandS Specialists, Contractor

5.1.2 Resettlement and Rehabilitation Plan

The RRU will be responsible for implementing the RP, VCDP and GRM and liaison with the government and non-governmental organizations on related issues through CLO. The Resettlement will be done as per the RAP report and following entitlement matrix in Table 5-3 presents the main types of losses and corresponding nature and scope of entitlements for this project. These are based mainly on the compensation rates estimated for the Project, field information during site visits of the Consultant and proposals of the Consultant based on international standards, specifically the World Bank policies.

Table 5-3: Entitlement Matrix

Type of Losses	Entitled Persons	Entitlements	Implementation Issues and Proposals
Productive Land (khet/bari/kharbari/orchard)	Legal owner or tenants/ occupants whether or not land is owned	• Based on fixed rates, compensation will be NPR 600,000 to 1500,000/ropani (1 ha=19.66 ropani); but the rate is subject to change as per the CDC decision • 50% cash compensation to the share cropper (registered tenants) of the affected plots as per the prevailing laws (LA Act Clause 20). Other 50% to the landowner Government to provide suitable agricultural and livelihood schemes in order to restore land productivity to levels equal to, if not better than, that which they had before relocation.	Legal owner or tenants/ occupants whether or not land is owned
Residential land and houses and other structures	Legal owner or Tenants/ occupants whether or not land is owned	Affected person will be compensated either through cash compensation or given a permanent house in the relocation site. The type and size of house has been determined based on existing houses and structures owned by the affected persons in the area which also considered fixed rates per sq. foot for each type of materials, as follows: i. NPR 800/square foot: one-story building with straw roof and made of soil and stone including	• Size of land to be provided should consider extended family arrangement. • It should also consider the provision of additional space for animal shed, toilet and gowdown

Type of Losses	Entitled Persons	Entitlements	Implementation Issues and Proposals
		wall as per measurement; ii. NPR 1400/square foot: 2-story building with straw roof and made of soil and stone including wall as per measurement; iii. NPR 25,000: for the toilet made of soil and stone with concrete roof iv. NPR 35,000: for the toilet made of soil and brick with concrete roof	
Crops	Owner of crops	• The compensation rates for Crops has not been determined. i. WB Policy: loss of income from agricultural crops is compensated by cash payment based on the specific stage of cultivation and crop value: area X value, X stage of cultivation (year, up to 5 years). WB Policy on: 60 days' advance notice to harvest/cut/crops prior to land clearance.	The following scheme is more equitable: (i) if standing annual crops are ripening and cannot be harvested, cash compensation at replacement cost equivalent to the highest production of crop over the last 3 years; (ii) for perennial crops and trees, cash compensation at replacement cost equivalent to current market value based on type, age, and productive capacity
Public Infrastructure (social, cultural and other service facilities) and cultural assets	Affected population using these	These should be replaced and restored in the resettlement site as far as possible (e.g. temples, market place, health center/clinic, schools, and social centers.	Replacement cost for public infrastructures is not specified. Consultant's recommendations on the construction public infrastructure as it is existing
Shops and other Business structures/facilities	Owner whether or not land is owned	Cash compensation at replacement cost for the entire structure equivalent to current market prices of: (i) materials, with no deduction for depreciation of the structure or salvageable materials; (ii) materials transport; (iii) labor cost to cover cost for dismantling, transfer, and rebuild.	

Type of Losses	Entitled Persons	Entitlements	Implementation Issues and Proposals
Temporary Use of Land	Legal owner or occupant	• For agricultural and residential land to be used for disposal sites and contractor's working space and labor camps: (i) rent to be agreed between the owner/ occupant and the project but should not be less than the unrealized net income and revenue that could be generated by the property during the period of temporary use of the land; (ii) cash compensation and replacement cost for affected fixed assets (e.g. structures, crops); and (iii) restoration of the temporarily used land within 1 month after closure of the sites or removal of equipment and materials from Contractor's work area subject to the conditions agreed upon between the owner/occupant and the Contractor.	There should be timely information dissemination on construction activities to affected areas in coordination with the local Officials. The following options can be considered by the Project for future cases: • If a small portion of land is affected, cash compensation at replacement cost which is equivalent to the current market value of land to be provided. • Landowner/occupant is adequately informed of his/her rights and entitlements as per Project resettlement policy; and • Agreement reached between the Project and landowner/ occupant are carried out.
Severe impacts on vulnerable People such as the very poor, indigenous groups and women heads of HHs.	Very poor People and Vulnerable	• As far as possible temporary employment will be provided to affected HHs in the project construction work by the project contractor. Preference will be given to affected people living below poverty line, vulnerable or lost their employment or income generation source due to project impacts. • Additional one time assistance allowance of 3-month minimum wage per adult for the HH to cover for additional human resources needed to help them, rebuild their houses, and re-establish their livelihood. This will be over and	The period from relocation and completion of projects proposed for agricultural and livelihood schemes which may take sometime, the vulnerable People will have nothing to live on. Another option that can also be considered is to provide an additional allowance for 1-month supply of subsistence food per person in the HH and provision of appropriate livelihood restoration measures.

Type of Losses	Entitled Persons	Entitlements	Implementation Issues and Proposals
		above the other compensation to be paid for physical assets lost.	
Loss of Income or livelihood strategy due to loss of physical assets and closure of business	All affected HHs losing 10% or more productive lands regardless of tenure status. Absentee landlords will not be eligible for this provision	One-time livelihood assistance allowance of 3 months' minimum wage of the HH (as per established rate of concerned Rural Municipality or Rural Municipality or Ward). They are also entitled to take part in skill development and vocational training as part of income restoration program.	

5.1.3 Compensation matrix

The Table 5-4 below describes a more detailed overview of the compensation and entitlements applicable to each type of loss (that inldue, loss of structures, loss of land, economic losses).

Table 5-4: Summary of RAP Cost

SN	Items/Programmes	Number/ Quantity	Unit	Rate (NPR.) per Unit	Amount (NPR.)	Amount (USD)	ROW 20% NPR	ROW 20% USD	Final NPR	Final USD
	I. Houses and Structures									
1	Houses, sheds etc	26	No.	Rate different in different place as in Table 4.1 [RAP Report]	15,950,000	119,924.81			15,950,000	119,925
								I. Houses and Structures: Sub-total	15,950,000	119,925
	II. Land Acquisition									
SN	**Items/Programmes**	**Number/ Quantity**	**Unit**	**Rate (NPR.) per Unit**	**Amount (NPR.)**	**Amount (USD)**	**ROW 20% NPR**	**ROW 20% USD**	Final NPR	Final USD
1	Land Acquisition (Permanent Purposes) Tower Pad) Jhapa District	8.7742	ha	Rate different in different place as in Table	150,533,595	1,131,831.54			150,533,595	1,131,832
2	Land Acquisition (Temporary Purposes) RoW) Jhapa District	74.1614	ha	Rate different in different place as in Table	1,463,022,104	11,000,166.19	292,604,420.78	2,200,033	292,604,421	2,200,033
3	Land Acquisition (Permanent Purposes) Tower Pad) Morang District	5.5355	ha	Rate different in different place as in Table	117,216,731	881,328.81			117,216,731	881,329
4	Land Acquisition (Temporary Purposes) RoW) Morang District	49.6651	ha	Rate different in different place as in Table	1,018,013,356	7,654,235.76	203,602,671.25	1,530,847	203,602,671	1,530,847
5	Land Acquisition (Permanent Purposes) Tower Pad) Sunsari District	10.7789	ha	Rate different in different place as in Table	308,510,184	2,319,625.45			308,510,184	2,319,625
6	Land Acquisition (Temporary Purposes) RoW) Sunsari District	43.9044	ha	Rate different in different place as in Table	1,552,610,324	11,673,761.83	310,522,064.81	2,334,752	310,522,065	2,334,752
								II. Land Acquisition: Sub-total	**1,382,989,667**	**10,398,419**

SN	Items/Programmes	Number/ Quantity	Unit	Rate (NPR.) per Unit	Amount (NPR.)	Amount (USD)	ROW 20% NPR	ROW 20% USD	Final NPR	Final USD
	III. Allowances									
SN	**Items/Programmes**	**Number/ Quantity**	**Unit**	**Rate (NPR.) per Unit**	**Amount (NPR.)**	**Amount (USD)**	**ROW 20% NPR**	**ROW 20% USD**	Final NPR	Final USD
1	Moderately vulnerable households-Rs 50000	1	House holds	50,000	50,000	375.94	-	-	50,000	376
2	High vulnerable households-Rs 75000	2	House holds	75,000	150,000	1,127.82	-	-	150,000	1,128
3	Very high vulnerable-Rs 100000	2	House holds	100,000	200,000	1,503.76	-	-	200,000	1,504
4	Women headed households-Rs 100000	25	House holds	100,000	2,500,000	18,796.99	-	-	2,500,000	18,797
5	Households headed by handicapped person-Rs 100000	1	House holds	100,000	100,000	751.88	-	-	100,000	752
	Dalit households-Rs 100000	17	House holds	100,000	1,700,000	12,781.95	-	-	1,700,000	12,782
	Adivasi/Janajati (Highly marginalized)-Rs 100000	3	House holds	100,000	300,000	2,255.64	-	-	300,000	2,256
6	Adivasi/Janajati (Marginalized)-Rs 75000	2	No.	75,000	150,000	1,127.82	-	-	150,000	1,128
7	Adivasi/Janajati (Disadvantaged)-50000	149	No.	50,000	7,450,000	56,015.04	-	-	7,450,000	56,015
								III. Allowances: Sub-total	12,600,000	94,737
									Final NPR	**Final USD**
								IV: RAP Implementation Monitoring and Evaluation	2,500,000	18,796.99
								Total (I+II+III+IV)	**1,414,039,667**	**10,631,877**

SN	Items/Programmes	Number/ Quantity	Unit	Rate (NPR.) per Unit	Amount (NPR.)	Amount (USD)	ROW 20% NPR	ROW 20% USD	Final NPR	Final USD
								10% Contingency	141,403,966.73	1,063,187.72
								Grand Total	**1,555,443,634**	**11,695,065**

Note:

- The cost given in the above table for Houses and Structures and Land Acquisition are based on the information given by the project affected families of different Municipalities and Rural Municipalities during the surveys and public consultations as in Table 8.3 of RAP report.
- The cost towards the allowances for vulnerable and indigenous people is taken from “National Foundation for Upliftment of Aadibasi/Janjati Act, 2002”.
- The total cost is tentative and may vary during the time of actual land acquisition and implementation phase.
- The land mentioned in this table is private land which is required for acquisition.

5.1.4 RAP Monitoring and evaluation

The RAP monitoring and evaluation requires NPR 2,500,000 (USD 18,796) during the implementation stage as given in Table 5-5. This cost has been already included in overall RAP cost (Ref. Table 5.4).

Table 5-5: Cost for RAP Monitoring and Evaluation

S. N.	Description of Activities	Estimated Amount (NPR)	Estimated Amount (USD)
1	Administrative and management e.g. notifications for land acquisition and compensation distribution, land title transfers, etc.	600,000.00	4,511.00
2	Conduct Detailed Survey	650,000.00	4,887.00
3	Information disclosure and Consultation Meetings	550,000.00	4,135.00
4	Grievance Resolution	250,000.00	1,880.00
5	Monitoring, reporting and fees to Sociologist, RAP expert and CLOs	450,000.00	3,383.00
	Total Cost	**2,500,000.00**	**18,796.00**

5.1.5 Budget for Indigenous/Vulnerable Groups Community Development

As mentioned in the previous chapter, apart from the allowances, the other costs, i.e. program costs and administrative costs for VIPDP implementation is given in Tables 5.6 and 5.7 respectively. The total estimated cost for VIPDP is NPR 36,440,000.00 (USD 273,985).

Table 5-6: Budget for VIPDP Implementation Programs

S. N.	Activities	Total amount (NPR)	Total amount (USD)
1	Resettlement and rehabilitation	Included in RAP	
2	Replacement and improvement of health infrastructures and service delivery	Included in RAP	
3	Infectious disease program	25,00,000	18,796.99
4	Reproductive health program	15,00,000	11,278.20
5	Child health program	15,00,000	11,278.20
6	Teacher training	5,00,000	3,759.40
7	Scholarships for disadvantaged groups	50,00,000	37,593.98
8	Skill development program	15,00,000	11,278.20
9	Women's awareness program	2,00,000	1,503.76
10	Child concern program	5,00,000	3,759.40
11	Socio-economic development	15,00,000	11,278.20
12	Cultural heritage preservation	15,00,000	11,278.20
13	Environmental awareness programs	10,00,000	7,518.80
14	Literacy program	25,00,000	18,796.99
15	Monitoring VIPDP	15,00,000	11,278.20
	Total	**2,12,00,000**	**159,398.52**

Table 5-7: Administrative Cost for VIPDP

S. N.	Position	Total duration in year	Proposed expenditure for 5 years (in NPR)	Total amount (USD)
1	Manager (full time)	3	25,20,000	18,947.37
2	Health experts	3	18,00,000	13,533.83
3	Education expert	3	18,00,000	13,533.83
4	Income generation and social development expert	3	18,00,000	13,533.83
5	Social mobilizers (5 Nos)	3	9,00,000	6,766.92
6	Office Assistant	3	9,00,000	6,766.92
7	Office running cost	3	25,20,000	18,947.37
8	Internal monitoring of ICDP	3	18,00,000	13,533.83
9	Third Party Monitoring	1	6,00,000	4,511.28
10	Miscellaneous		6,00,000	4,511.28
	Total		**1,52,40,000**	**114,586.46**

The summary of the VIPDP cost is presented in Table 5.8.

Table 5-8:Total Costs for VIPDP

SN	Description	NPR	USD*
1	VIPDP Program Costs	21,200,000.00	159,398.52
2	VIPDP Allowances	12,600,000.00	98,438.00
3	VIPDP Administrative Cost	15,240,000.00	114,586.46
	Total cost	**49,040,000**	**368,722**

*1 USD=133 NPR

5.1.6 Capacity Building for Implementing ESIA and E&S Instrument

The project proponent will have responsible for developing an environmental (and social) training and capacity-development program for Project personnel. The purpose of this program will be to provide personnel with:

- An understanding of what their specific responsibilities are as outlined in the ESIA and E&S Instument;
- A means of developing a culture of compliance with Project requirements and commitments; and
- A means to improve the environmental, social and health awareness of the workforce.
- A Project specific induction is to cover an overview of environmental, social and health requirements of the Project. A register is to be kept, maintained and used to verify that all personnel working onsite have completed the Project induction. The environmental, social and health content of the site induction may include (but not be limited to):
- An overview of the Project and its general location and surrounding environment;
- Relevant details of the ESMF including key potential significant impacts;
- Key general roles and responsibilities of personnel in achieving environmental social and health conformance;
- Worker code-of-conduct;
- Any identified environmentally sensitive areas or key social “hotspot” issues and communities; and
- Rules of engagement with local community and other stakeholders;
- In addition to the general induction, selected environmental topics are to be covered in targeted training sessions for specific groups of personnel to whom these are most relevant. Key topics should include:
- Stakeholder engagement and communication training;
- Procedures for dealing with Cultural Heritage Chance Finds;
- Applicable laws and practices in Nepal (for foreign workers);
- Cross-cultural awareness;
- Driver / road safety;

- Chemical handling and storage, including spill response;
- Emergency preparedness and response;
- Waste management;
- Erosion and sediment control;
- Environmental monitoring; and
- Health awareness and basic first aid.

Apart from the human resources required for the construction works, additional human resources E&S management and monitoring and safeguard implementation will be required and the estimated cost is presented in Table 5.9.

Table 5-9: Capacity Building and E&S management Unit

SN	Item	Unit Cost	Nos.	Year I	Year II	Year III	Total (NPR)	Total (USD)
1	**Personnel Cost**							
1.1	Environmental Safeguard Specialist	65,000	1	780,000	780,000	780,000	2,340,000	17,593.98
1.2	Social Development and Safeguard Specialist	65,000	1	780,000	780,000	780,000	2,340,000	17,593.98
1.3	Gender Equality and Social Inclusion Specialist	55,000	1	660,000	660,000	660,000	1,980,000	14,887.22
1.4	Vulnerable and Indigenous People Specialist	65,000	1	780,000	780,000	780,000	2,340,000	17,593.98
1.5	Biodiversity Expert	65,000	1	780,000	780,000	780,000	2,340,000	17,593.98
1.6	Social Management Assistant	35,000	1	420,000	420,000	420,000	1,260,000	9,473.68
1.7	Greivance Redressal Assistant	35,000	1	420,000	420,000	420,000	1,260,000	9,473.68
1.8	Environment Assistant	35,000	1	420,000	420,000	420,000	1,260,000	9,473.68
1.9	Secretary	30,000	1	360,000	360,000	360,000	1,080,000	8,120.30
1.1	Accountant	50000	1	600,000	600,000	600,000	1,800,000	13,533.83
1.11	Driver	25000	1	300,000	300,000	300,000	900,000	6,766.92
Sub-Total 1							**18,900,000**	**142,105.26**
2	**Office and Operating costs**							
2.1	Building	80,000	LS	80,000	80,000	80,000	240,000	1,804.51
2.2	Furniture	250,000	LS	250,000	250,000	250,000	750,000	5,639.10
2.3	Laptops, Printers etc.	500,000	LS	500,000	500,000	500,000	1,500,000	11,278.20
2.4	Operation	500,000	LS	500,000	500,000	500,000	1,500,000	11,278.20
2.5	Travel Cost	500,000	LS	500,000	500,000	500,000	1,500,000	11,278.20
2.6	Vehicles	1,500,000	LS	1,500,000	1,500,000	1,500,000	4,500,000	33,834.59
Sub-Total 2							**9,990,000**	75,112.78
3	**Training cost**							
3.1	Capacity Building	120,000	LS	120,000	120,000	120,000	360,000	2,706.77
Sub-Total 3							**360,000**	2,706.77
						Grand Total	**29,250,000**	**219,924.81**

5.1.7 Biodiversity Management Plan

Any development project creates impacts on the surrounding environment. If proper mitigation measures as mentioned in the IEE report and BMP report are applied the expected impact could be mitigated and/or compensated. The proposed TL-3, if implemented with appropriate mitigation measures will have an acceptable level of impact on vegetation. The mitigation measures/activities prescribed in this Report to minimize Project impacts is realistic and feasible and is envisaged to manage the adverse Project impacts on flora and fauna to an acceptable level. The total cost of the BMP is 4,575,342/- (USD 34,401) that includes NPR 30,00,000/- (USD 22,556) for mitigation/monitoring and NPR 15,75,342 (USD 11,845) for compensatory plantation. The cost of forest loss is not the part of BMP and the cost is included in total project cost. By analyzing the Project environmental impacts, focusing on terrestrial flora and fauna (wildlife) and its habitat and the benefits of the project to the communities locally and nationally, the Project is recommended for implementation under the condition that the proposed “BMP” will be fully implemented by the Project Proponent.

As a compensatory measure for the loss of vegetation (Total tress loss in TL-3 is 105 and poles is 194), there is need to provide with compensatory plantation. Estimated mitigation cost for the compensatory plantation is NPR 15,75,342 (USD 11,845) for plantation of 4318 seedlings in 2.7 ha. (1600 seedling/ 1 ha.). Similarly, 299 Trees/Poles are going to be felled down from community forest land of 1.66 ha. Thus, equal quantity of land with similar geo-climatic conditions needs to be handover to the Division Forest Office of the concerned Project District by the client/project proponent. This cost is to be included in overall project cost as a part of DPR. This amount needs to be deposited in DFO office account.This amount needs to be deposited in DFO office account. The estimate for plantation is given in Table 5.10**.** (Ref.: **ANNEXURE X)**

Table 5-10: Detail Summary of Compensatory Cost Estimate

S. No.	Particulars	Unit	Rate (NPR)	Quantity	Budget (NPR)	Remarks
1	Number of trees affected due to the project (to be felled due to the project)	No. of tree		299		
	Seedlings to be produced/purchased/planted as compensation at the ratio of 1:10	No. of seedlings		2990		10 seedlings of each tree felled
	Seedlings to be replanted at 2 year (1/3 of previous year)	No. of seedlings		997		With assumption that survival rate of the plantation would be 66.66 %
	Seedlings to be replanted at 3 year (1/3 of previous year)	No. of seedlings		333		
	Total seedlings to be planted as compensation plantation (Seedlings)	No. **of seedlings**		**4319**		
2	Land required for the compensation plantation (ha)	Ha		2.70		1600 seedlings/ha
3	Compensation cost for forest land	NPR				As per the Forest Regulation 2079
4	Seedlings production	NPR	32.42	4,319	140,022	NPR 32.42/Seedling
5	Site preparation and plantation	NPR	145,000	2.70	391,500	NPR.145,000/ha
6	Plantation establishment costs for 5 years - weeding	NPR	86,600	2.70	233,820	NPR 43,300/ha/year (2 years)
7	Plantation establishment costs for 5 years - protection of the plantation - Plantation Watcher (Heralu)	NPR	15,000	2.70	810,000	4 ha/Heralu/year
Total estimated costs for the compensatory plantation					**1,575,342**	

Note:

- Rates for the compensatory plantation are based on the Ministry of Forests and Environment (GoN), 2076/77, Manual for Compensatory Plantation and Government Land Replacement.
- Land cost for compensatory plantation is not the part of BMP. It will be part of overall cost of the project.

5.1.8 Environmental Monitoring

Environmental Monitoring such as the compliance monitoring of the ESIA will be done quarterly. The compliance monitoring report will be prepared and shared to interested parties, including the lenders.

To monitor the impacts of the project on physical, biological and socio-economic and cultural resources of the area, monitoring plan shall be formulated. The proponent will be responsible for the implementation of environmental monitoring of the project. The Consultant shall prepare a detailed plan to monitor the implementation of mitigating measures and the impacts of the project during the construction phase and the operation phase. The plan will include an estimate of capital and operating costs and a description of other inputs (such as training and institutional strengthening) needed to carry out the monitoring activities. The monitoring plan shall include the following aspects;

- Baseline, compliance and impact monitoring in terms of the physical, biological, socioeconomic and cultural environment. Baseline and impact monitoring shall include parameters, indicators, methods, schedules and locations, while compliance monitoring shall include parameters, indicators, methods and schedules. Compliance and impact monitoring shall be categorized in terms of construction and operation phases;
- Agency responsible for monitoring and agencies to be consulted, if required, during monitoring activities,
- Organizational set-up, budget and manpower requirements for carrying out the environmental monitoring; and
- The monitoring cost shall include cost of impact and compliance monitoring activities at least for 2 years of operation period. There should be a provision of self-monitoring as per EPR 2020 of Nepal.

To monitor the impacts of the project on physical, biological and socio-economic and cultural resources of the area, monitoring plan shall be formulated. The proponent will be responsible for the implementation of environmental monitoring of the project. The monitoring plan shall include the following aspects;

- Baseline, compliance and impact monitoring in terms of the physical, biological, socioeconomic and cultural environment. Baseline and impact monitoring shall include parameters, indicators, methods, schedules and locations, while compliance monitoring shall include parameters, indicators, methods and schedules. Compliance and impact monitoring shall be categorized in terms of construction and operation phases;
- Agency responsible for monitoring and agencies to be consulted, if required, during monitoring activities,
- Organizational set-up, budget and manpower requirements for carrying out the environmental monitoring; and

- The monitoring cost shall include cost of impact and compliance monitoring activities at least for 1 years of operation period.

Baseline Monitoring - is done prior to the project implementation, in order to identify existing environmental condition. Baseline monitoring is in general carried for all physical, chemical, biological and socio-economic variables.

Compliance Monitoring - is carried out to know the implementation status of environmental requirements as documented in environmental study report, and they should be complied with during pre- construction, construction and operation Phases of the project as appropriate. The compliance monitoring only focuses on whether environmental requirements have been complied with or not.

Impact Monitoring - is generally carried out to know the effectiveness of the environmental protection measures. Hence, an impact monitoring evaluation study is proposed to carry out at the end of the project construction phase or within two years of project implementation. Impact monitoring evaluation will focus each impact predicted and effectiveness of environmental protection measures. This will also emphasize the stability of slopes, spoil disposal sites, work camp and labor camp, use to toxic wastes on local environment, including the utilization of cash compensation, to the extent possible, condition of the local forest, and said plantation etc.

a) Physical Environment

- Land use
- Stability of the area around the tower pads
- Spoil management
- Waste disposal
- Air and water quality

b) Biological Environment

- Wildlife
- Vegetation clearance
- Pressure on forest resources

c) Socio-economic and cultural environment

- Land loss
- Employment
- Impact on women/children
- Health issues
- Indirect economic benefits

Monitoring Parameters

Based on the level of site-specific information or existing data series and impacts prediction, efforts are made to make the indicators measurable and diagnostic with loss natural variability and broad applicability. In this context, the following indicators will be monitored during the project construction and operational stages of this TL

project. The monitoring plan has been presented in Table 5-11 while the cost of monitoring is not required separately. They are included in each plan.

Table 5-11: Monitoring plan and schedule

S.N.	Parameter	Indicators	Methods	Location	Schedule	Responsible Person
A	**Baseline**					
Physical Environment						
1	Land use	Changes in land use pattern	Site observation	Row and nearby areas	Once during the construction phase and operation phase each	NEA
2	Stability	Stability at tower pads	Site observation	Near tower pads	Before and after rainy season prior to construction	NEA
3	Air and water quality	Dust, toxic materials coliform	Site observation , lab test	Project area	Once before construction	NEA
Biological Environment						
4	Vegetation/ forest cover	Observation of vegetation and maintenance of RoW.	Discussions with users group, observation, local people and District forest Office	Under the RoW and in the vicinity of the corridor	Once each during preconstruction, construction and operational phase	NEA
5	Wildlife	Wildlife habitat and clearance	Observation, discussion with local people	RoW and nearby area	Once each during preconstruction, construction and operational phase	NEA
Socio-economic and cultural environment						
6	Settlement/ infrastructure	Increase in settlements/infrastructure, migration	Discussion with local people, Local level , observation	Project affected Local levels	Once each prior to construction and operation	NEA
7	Socio-economic/cultural baseline	Update socio-economic/cultural baseline	Discussion with local people, observation, review	Project affected area	Once prior to construction	NEA
B Impact Monitoring						
Physical environment						
1	Land use	Stability/land use changes from the baseline	observation	Around the tower pad area	Continuous observation during construction, annually	NEA

S.N.	Parameter	Indicators	Methods	Location	Schedule	Responsible Person
					during operation	
2	Waste disposal	Unpleasant odour and visual impact	observation	Temporary camps/ construction sites	Weekly during the construction	NEA
3	Air quality/water quality	Dust, toxic materials, coliform	Observation lab test	Project area	Half yearly during construction	NEA
Biological environment						
4	Vegetation clearance	No. of trees folled, ground cover	Observation of the area, discussion, counting	Under the RoW	During construction	NEA
5	Compensatory plantation	Survival of saplings	observation	Plantation site	Once in a year during construction and operation phase	NEA
6	Wildlife	No. of wildlife seen	Observation, keeping records on wildlife, birds and reptiles killed	In the vicinity of the corridor	Regular basis during construction and annually during operation	NEA
Socio-economic and cultural environment						
9	Compensation	Socio-economic parameters like economic status, living conditions etc of the affected people	Housing assets, living conditions, income etc	Affected local people	Regularly for at least three years following land acquisition	NEA
10	Land loss	Acquisition of land, lease of land and temporary disturbances in land	Cross checking the compensation list	Tower pad, RoW and leased area	Quarterly during construction and once during operation	NEA
11	Employment	No. of local people employed by project	Records kept by management	Project area	Continuous during construction period and annually during operation	NEA
12	Impact on women/children	Status of women children	Record of women employment	Project area	Continuous during construction phase	NEA
13	Indirect economic benefits	Economic activities in the area	Trade and business revenues	Project affected Local unit	Once a year during construction and once during operation	NEA

S.N.	Parameter	Indicators	Methods	Location	Schedule	Responsible Person
Compliance Monitoring						
1	Incorporation of Environmental considerations mentioned in the tender documents in the contractors proposed work plans	Yes/No	Review of proposed work plan submitted by the contractor	Kathmandu office/site office	During contract negotiations	NEA
2	Integration of mitigation measures in the detail design and contract documents	Yes/No	Review process	Kathmandu office	During project approval	NEA
3	Allocation of adequate budget for the implementation of the environmental mitigation measures and monitoring works		Review, inquiry and consultation	Kathmandu office	During detail design and contract agreement	NEA
4	Clean up and reinstatement of the project area	Spoil disposal, drainage around the tower	Site observation and inspection	Around the tower area substation area	At the end of construction period	NEA

5.2 ESS 10: STAKEHOLDER ENGAGEMENT AND PUBLIC CONSULTATIONS

Stakeholder engagement is an inclusive process, conducted throughout the project lifecycle. ESS 10 of the WB ESF 2018 recognizes different stakeholders, where engagement is done in all different phases of project intervention (from design through to implementation) in a timeframe, which enables meaningful consultations with stakeholders, in a manner that provides stakeholders with opportunities to express their views on project risks, impacts, and mitigation measures to consider and respond to them. As per ESS10, three major types of stakeholders are, affected parties, other interested parties and disadvantages/vulnerable individuals or groups.

The major thrusts of public consultation were for information disclosures, enhancing engagement and participation of relevant stakeholders in identification and mitigation of environmental and social risks and impacts, seeking commitments from the affected communities and stakeholders to engage and support the project activities; grievance redress and others. Various issues were raised in the public consultations by the respective communities and by the relevant stakeholders.

5.3 STAKEHOLDERS CONSULTATION

The stakeholders the project have been identified by the stakeholder mapping. As a part of SE, the public consultations were done in all project affected municipalities (M) and rural municipalities (RMs) with FGDs in the month of September/October, 2022. Four districts with 7 Ms and 5 RMs will be affected by the implementation of TL-3. The dissemination of the study was done via public hearing which were done from 23 to 30 November 2022 in all project affected M and RMs. Other stakeholders included the forest user groups, locals whose land or structure will be affected by the project, Ministry of Tourism, Forests and Environment of Koshi Province, Division Forest Offices (DFOs), Sub-division forest offices. The approved ToR for IEE was submitted to President Chure -Terai Madesh Conservation Development Board and the permission for the study was obtained. Representative from President Chure-Terai Madesh Conservation Development Board conducted the field verification in the Chure section and gave the permission for study on November 22nd with certain conditions to be followed in design stage and for IEE/ESIA study. The comments received from Project Affected Rural Municipalities /Municipalities, after the completion of the 7-day public notice. The the public hearing notices are kept in **ANNEXURE-XI** and public hearing details are kept **ANNEXURE-XII** while a 7-day public notification is kept in **ANNEXURE -XIII.**

This section describes the Stakeholder Engagement Plan during the project cycle till the preparation of ESIA. The Stakeholder Engagement Plan (SEP) is preliminary based on the present surveys and related studies. Throughout the project duration, SEP document will be updated. As a part of SEP, the public consultations were done in all Project affected Municipalities and Rural Municipalities with FGDs in the month of September/October, 2022. There are four districts with seven Municipalities and five

Rural Municipality, which will be affected by the implementation of TL-3. The dissemination of the study was done via Public hearing which were done from 23rd to 30th November in all project affected Municipalities and Rural Municipalities. The recommendation letter are kept in **ANNEXURE-XIV**. Other stakeholder included the forest user groups, locals whose land or structure will be affected by the project, Ministry of Tourism, Forests, Environment, Koshi Province, Division Forest Offices, Sub-division forest offices. The comments received from Project Affected Rural Municipalities /Municipalities after the completion of the 7-day notification are given in Table 5-12.

Table 5-12: Preliminary stakeholder engagement activities in the month of June/July 2023 in TL 3

Local bodies	**Districts**	**Rural Municipality**	**Municipality**	**Issues Discussed**	**Initial Stakeholder Concerns**
	Sunsari	Bokraha Narsingh (Wards 4,5)	Inaruwa (Wards 4,9)	• TL routes and possible localities to be affected by the project • Impact areas and benefits of the TL	• Land of RoW and their evaluation • Job opportunities • Loss of community forests • Impact of high voltage current on human and agriculture
		Gadhi (Wards 2,5)	Duhabi (Ward1,2,5,6,7,10 ,11)		
	Morang	Budhiganga (Ward 5)	Rangeli (Wards 1,2,3,8,9)		
		Gramthan (Wards 3,4)	Sunawarshi (wards 3,4,6)		
		Kanepokhari (ward 1)	Ratuwamai (5,6,7)		
	Jhapa	Gauriganj (Wards 1,3,5)	Gauradaha (Ward 6,8,9)		
		Jhapa (Wards 2,4,5)	-		
		Barhadashi (wards 4,5)	-		
		Haldibari (ward 1)	-		

5.4 ESMP

The summary of ESMP has been presented in Table 5-13.

Table 5-23: Summary of ESMP

		Impacts						Mitigation Measures and Cost		
S.N.	**Environmental Impacts**	**Direct/Indirect**	**Extent**	**Duration**	**Magnitude**	**Reversible /Irreversible**	**Significance**	**Management Plan**	**Cost (NPR)**	**Remarks**
I	**Construction Phase**									
I.A	***Adverse Issues/Impacts***									
I.A.1	***Impacts on Land use***									
I.A.1.1	Land use	D	S	LT	M	Ir	Msi	Bioengineering;	0	Site management measures, include in contract bid document.
								Avoid trimming of the standing trees under RoW, if the height is within safe limit of the strung cable.	0	
I.A.2	***Impacts of land instability and Erosion***									
IA.2.I B1	Tower foundation excavation	D	S	LT	H	Ir	Lsi	Access to the foundation sites will use the existing trails and avoid as far as possible to construct new access and vegetation clearance;	0	Site management measures, include in contract bid document.
								Vegetation clearance should be done in a way that no other forests disturbed;	0	
								Tower foundation excavation in the slopping grounds will be done through labor-based excavation methods;	0	
								Steep cuttings will be avoided in the sub-soils, if steep cuttings is needed, benching shall be developed in every 1.5 m vertical cuttings;	0	
								The landforms around the foundation sites will be landscaped to benefit the surrounding after construction;	0	
								Surface drains of adequate size will be established to drain the surface runoff of the slopes around the foundation sites and safely drained to the nearby natural drain, and	0	
								Steep slopes will be protected through civil or bio-engineering techniques to control site erosion and enhance slope stability.	0	
I.A.2.2	Vegetation clearance of RoW	D	L	LT	HM	Ir	HSi	Trim the standing vegetation of the ROW limited to the safety of the overhanging cables, occupational maintenance workers and community health and safety;	0	Site management measures, include in contract bid document.

		Impacts						Mitigation Measures and Cost		
S.N.	**Environmental Impacts**	**Direct/Indirect**	**Extent**	**Duration**	**Magnitude**	**Reversible /Irreversible**	**Significance**	**Management Plan**	**Cost (NPR)**	**Remarks**
B2								Prohibit clearing of the grassy and bushy vegetation under the RoW;	0	
								Plant grass or NTFP species of local interest and use in the degraded soil exposed areas of the RoW	0	BMP
I.A.2.3	Spoil Management	D	S	ST	MM	Re	Msi	Excavated spoils are placed in a safe area protected from erosion for later reuse around the tower foundation sites within RoW	0	Incorporated in the civil costs; include in contract bid document.
B3								Considering the climatic conditions of the area and potential of runoff erosion of the stored spoil material, construction of tower foundation will avoid the monsoon season,	0	
								The left-over spoil be placed on a safe site, normally away from the water path (runoff water path) in a stable land area, compacted and planted with vegetation.	0	
I.A.3 C	***Impacts on Water Quality***									
I.A.3.1	Disposal spoils	D	L	ST	Lo	Re	Lsi	Haphazard discharge of the spoils will be prohibited;	0	Incorporated in the civil costs; include in contract bid document.
C1								Direct discharge of the spoils on the nearby water body or on the path of runoff will be prohibited;	0	
								Excavated spoils are placed in a safe area protected from erosion for later reuse such as backfilling, and landscaping;	0	
								Construction of tower foundation to be avoided in the monsoon season;	0	
								The left-over spoil to be placed on a safe site, away from the water path (runoff water path) in a stable land area, compacted and planted with vegetation.	0	
I.A.3.2	Disposal of construction waste	D	S	ST	Lo	Re	Isi	Minimize the waste generation, through strict control on the good housekeeping and operating practices, including inventory control.		Site management measures no direct costs.

		Impacts						Mitigation Measures and Cost		
S.N.	Environmental Impacts	Direct/Indirect	Extent	Duration	Magnitude	Reversible /Irreversible	Significance	Management Plan	Cost (NPR)	Remarks
C2								Collect all the solid waste generated at the construction site and segregate the waste according to its characteristics for reuse, recycling, disposal etc. and store in a safe place.		Include in contract bid
								The reusable wastes and recyclable wastes are reused at site or are sold to the local vendors.		
I.A,3.3 C 3	Disposal of camp wastes	D	S	ST	M	Re	Msi	Maintain cleanliness, good housekeeping and sanitary conditions of the camps.	550,000	
								Minimize waste generation activities particularly the solid waste and wastage of water.		
								Establish pit temporary toilets for toiletry waste waters within the camps and at the construction site.		
								Collect the solid waste generated in the camps and segregate the waste as to the waste category and arrange storage facility for the waste.		
								The reusable wastes or recyclable wastes are reused and recycled or sold to the local vendors.		
								Inert and compostable wastes are buried in the earthen pits		
								The wastes which could not be reused or composted are disposed of on site or off site in compliance to the standard procedures of the MoFE or WB.		
I.A.3.4 C 4	Disposal of spent oils, fuels, lubricants, and other chemicals	D	S	ST	Lo	Re	Lsi	Store the hazardous materials in accordance with their hazard category in separate storing facilities.	250,000	
								Prevent uncontrolled releases of hazardous materials to the environment or uncontrolled reactions that might result in fire or explosion in the storage sites and at the use area of construction sites.	0	Site management measures, Include in contract bid
								Establish inventory of the hazardous materials at the store ware with detailed records of daily or weekly use, sites of uses and left over after use.	0	

		Impacts						Mitigation Measures and Cost		
S.N.	**Environmental Impacts**	**Direct/Indirect**	**Extent**	**Duration**	**Magnitude**	**Reversible /Irreversible**	**Significance**	**Management Plan**	**Cost (NPR)**	**Remarks**
								Train the users of the hazardous materials in the proper care against the spilling, and related contamination of the material with the soil, water etc.	0	
								As far as possible minimize the use of hazardous materials in the construction works or substitute the hazardous materials by the non-hazardous or less hazardous ones.	0	
								The fuel storage and dispensing will be placed in a separate area with containment structures to prevent contamination with the other materials.	0	Included in civil costs
								Collect the spent oil, lubricants, and store in a separate containment area.		Include in contract bid
								Left over, used containers and date expired hazardous material are stored in a separate areas according to their characteristics for final disposal management.		
								The final disposal management of the unused, left over, used containers, etc will be carried out off site by contracting officially accredited hazardous waste management company.		
I.A.4 D	***Impacts on Air Quality***									
I.A.4.1 D 1	Vehicular fugitive and combustion emissions	D	L	ST	Lo	Re	Lsi	Transportation vehicles used for the TL-3 will comply with the vehicle emission standards of the MoFE.	0	Include in contract bid
								The vehicles plying in the earthen road will have a speed limit of 10 km/hour to minimize the fugitive dust emissions.	0	Include in contract bid
								Frequently used earthen roads by the transportation vehicle will be water sprinkled twice a day during the use of the road if the settlements are nearby.		Include in contract bid
I.A.4.2 D 2	Fugitive emissions from construction sites (tower foundation, foot trails)	D	S	ST	Lo	Re	Lsi	Spoil materials will be covered with leaf litters and vegetation cleared from the construction sites.	650,000	
								Water sprinkling of the construction sites to moisture the soil.		
								Prohibition on the burning of the cleared vegetation of the construction site		
								Use local trails for the material transport to the construction sites as far as possible to minimize soil disturbance and vegetation clearance.		

		Impacts						Mitigation Measures and Cost		
S.N.	**Environmental Impacts**	**Direct/Indirect**	**Extent**	**Duration**	**Magnitude**	**Reversible /Irreversible**	**Significance**	**Management Plan**	**Cost (NPR)**	**Remarks**
I.A.4.3 D 3	Camp emissions from cooking activities	D	S	ST	Lo	Re	Lsi	Prohibit use of fuel wood as cooking fuel in the camps. Arrangements of alternative fuels such as kerosene or LPG at the construction camps.		Include in contract bid
I.A.5 E								***Impacts of Noise pollution***		
I.A.5.1 E 1	Vehicular noise	D	L	ST	Lo	Re	Lsi	Regular maintenance of the transport vehicles to minimize the body noise and engine noise. Speed limits of the vehicles controlled less than 10 km/hour in the earthen roads. Restriction on the use of horns.	0 0 0	Site management measures; Include in contract bid
I.A.5.2 E 2	Construction noise	D	S	ST	Lo	Re	Lsi	Minimize the use of noise producing construction activities as far as possible. Restriction on the noisy activities at the night hours of the day (6PM to 6AM).	0 0	
I.A.5.3 E 3	Camp noise	D	S	ST	M	Re	Msi	Restriction on loud talking/ discussions and playing of the radios in the camps. Use of generators fitted with noise muffles.	0 0	 Incorporated in civil cost, include in contract bid
I.B 6.1.1.2	**Beneficial Issues and Impacts**									
I.B.1 A	Enhancement of slope stability	Positive impacts						Enrichment of community forest in the immediate vicinity of RoW. Plantation	0	BMP
I.B.2 B	Erosion protection	Positive impacts								
II 6.1.2	**Operation Phase**									
II.A 6.1.2.1	**Adverse Impacts**									
II.A.1	***Impacts of Noise Pollution***									
II.A.1.1	Noise related to corona action	D	L	LT	Lo	Ire	Lsi	Minimize damage to the conductor during stringing operations	0	Include in the contract bid of CC

		Impacts						Mitigation Measures and Cost		
S.N.	**Environmental Impacts**	**Direct/Indirect**	**Extent**	**Duration**	**Magnitude**	**Reversible /Irreversible**	**Significance**	**Management Plan**	**Cost (NPR)**	**Remarks**
								Routine maintenance of the loosened conductor mounting hardware	0	Included in Operation management cost
II.A.1.2	Noise related to maintenance workforce	D	S	LT	Lo	Ire	Isi	Minimize noise generating activities	0	Site management, Instruct operation management
II.A.2 B	***Impacts on Air Quality***									
II.A.2.1 B.1	Ozone emission from corona actions	D	L	LT	Lo	Ire	Isi	Design measures clearance spacing between the phases of transmission line, selection of bundled conductor and diameter of the conductor.	0	Included already in the design
II.A.3 C	***Impacts on Water Quality***									
II.A.3.1 C.1	Pesticide Use	D	L	LT	Mo	Ire	Msi	The pesticides will not be used to control herbicide during the operation phase, hence no impact envisaged.	0	Instruct operation manager
II.A.4 D	Impacts of Electro-magnetic fields	D	L	LT	Lo	Ire	Isi	Design measures such as provision of 46 m wide RoW, ground clearance level, double circuit line, vertical arrangements of the conductors, tower height and good earthing in all the pylon structures.	0	Included already in the design
								A program of awareness building will be implemented on the safety issues to the communities along the RoW of transmission corridor.	0	Included in Social Cost
II.A.5 E	***Soil erosion and Land Instability Impacts***									
II.A.5.1 E.1	Vegetation maintenance of RoW				Lo		Isi	Vegetation removal from RoW will be limited to only lopping topping of the grown up vegetation such that the growth of vegetation next maintenance works does not reach the limits of cable safety heights.	0	Cost included in operation cost; Instruct operation management
								The local community forest user groups will be supported for maintenance of the afforested forest on either side of the RoW.		Cost included in operation cost; Instruct operation management
								The local community forest user groups will be supported for the maintenance of the NTFP plantation on the RoW which are of short heights		
Cost of Physical Impact Mitigation 14,50,000										
Note: D=Direct, ID=Indirect, S= Site specific, L=Local, R=Regional, ST=Short Term, LT=Long Term, H=High, M=Moderate, LO=Low, Re=Reversible, Ir = Irreversible, Si = Significant, Msi = Moderately significant, Isi = Insignificant										

		Impact						Mitigation Measures		Remarks
S.N	**Environmental Impacts**	**Direct Indirect**	**Extent**	**Duration**	**Magnitude**	**Reversible Irreversible**	**Significance**	**Management Plan**	**Cost (NPR)**	
I	**<u>Construction Phase</u>**									
I.A	**Adverse Issues/Impacts**									
I.A.1	***Impacts of Terrestrial Habitat Alteration***									
								Compensation plantation	0	BMP
I.A.1.2	Impacts of forest fragmentation	D	L	LT	Lo	Ir	Isi	Avoid felling unnecessary tree felling		Management Measures, Include in contract bid of felling contractors
								Compensation plantation	**1,575,342**	Included BMP
I.A.1.3	***Impacts of the loss of vegetation species of conservation significance***									
I.A.1.3.1	Biodiversity and Habitat loss	D	S	LT	Lo	Ir	Isi	Compensation plantation	Included above	
I.A.1.3.2	Exploitation by construction workforce	ID	L	ST	M	Re	Msi	The construction workforce will be regularly instructed not to indulge in the illegal harvesting activities of the plants of conservation significance.	0	On site management measures, Include in the contract bid of construction contractor
								Construction workforce found indulged in the illegal harvesting of the plant species of conservation significance will be penalized	0	

		Impact						Mitigation Measures		Remarks
S.N	**Environmental Impacts**	**Direct Indirect**	**Extent**	**Duration**	**Magnitude**	**Reversible Irreversible**	**Significance**	**Management Plan**	**Cost (NPR)**	
								and handed over to the legal authorities for required action under the country law.		
								The district surveillance authorities (Division Forest Office) will be informed of the construction schedules for their regular surveillance of the area.	0	
I.A.1.4	***Impacts of forest fires***									
I.A.1.4.1	forest fires	D	L	ST	H	Re	Si	Day meal cooking/ tea preparation for the construction workforce within the forest area will be prohibited	11,55,000	3,50,000 for two community forest of Sunsari Districts which are affected by the TL and 4,55,000 for other Community forests along or near by the TL (total 11,55,000) this is not inlcuded in BMP
								Cigarette smoking by the construction workforce in the forest area will be prohibited.		
								All the slashed and dried vegetation materials (trees, branches and leaf biomass) under the RoW will be collected and placed outside the Forest area		
I.A.1.5	***Impacts of the loss of wildlife habitat***									
I.A.1.5.1	Wildlife habitat	D	L	ST	Lo	Re	Isi	Restrict vegetation clearance under the RoW as proposed	0	BMP

		Impact						Mitigation Measures		Remarks
S.N	**Environmental Impacts**	**Direct Indirect**	**Extent**	**Duration**	**Magnitude**	**Reversible Irreversible**	**Significance**	**Management Plan**	**Cost (NPR)**	
								Afforestation of lost trees as proposed	0	
								Implement compensatory measures. (micro-watershed management) as proposed	0	
I.A.1.6	***Impacts on wildlife species of conservation significance***									
I.A.1.6.1	Biodiversity and Habitat loss	D	L	ST	Lo	Re	Isi	The mitigation measures employed for the minimization of impacts on wildlife habitats are adequate to address the impacts	0	BMP
I.A.1.6.2	Exploitation by construction workforce	ID	L	ST	M	Re	Msi	The mitigation measures employed for the minimization of impacts on the plant species of conservation significance are adequate to address the impacts	0	BMP
II.A.1.1	Impacts of Avian collisions and electrocutions	D	L	LT	H	Ire	Si	Installation of suitable diverters to increase the visibility of overhead wires (conductors and/or earth wires) to birds.	0	Included in Civil cost, Include in the contract bid
II.A.1.2	Impacts to other wildlife and electrocutions	D	S	LT	Lo	Re	Isi	Fencing of the tower foundation sites with suitable fencing structures.	0	Included in the civil costs; Include in the contract bid
								The bottom half of the tower be covered by barbed wires	0	

		Impact						Mitigation Measures		Remarks
S.N	Environmental Impacts	Direct Indirect	Extent	Duration	Magnitude	Reversible Irreversible	Significance	Management Plan	Cost (NPR)	
								to prevent the wildlife manipulating with the towers		
II.A.1.5	Impacts of Weeds encroachment on biodiversity along RoW	ID	L	LT	M	Re	Msi	Removal of invasive plant species, whenever possible, cultivating native plant species	0	Included in the operation maintenance costs; Instruct operation management
								Implementation of an integrated vegetation management approach based on environmental and site considerations	0	
								Prohibition of use of pesticidles to control weeds	0	
Cost of Biological Impact Mitigation 11,55,000										

Note: D = Direct, ID = Indirect, S= Site specific, L= Local, R= Regional, ST=Short Term, LT= Long Term, H = High, M=Moderate, LO= Low, Re =Reversible, Ir = Irreversible , Si = Significant, Msi = Moderately significant, Isi = Insignificant

		Impacts						Mitigation Measures and Costs		
S.N	**Environmental Impacts**	**Direct Indirect**	**Extent**	**Duration**	**Magnitude**	**Reversible Irreversible**	**Significance**	**Management Plan**	**Cost (NPRs)**	**Remarks**
I	**Construction Phase**									
I.A	**Adverse Issues/Impacts**									
I.A.1	***Impacts of permanent Loss of private property and land for the tower foundations and Land Use Restriction on RoW***									
I.A.1.1	HHs Impacted	D	L	LT	H	Ir	Si	• Implementation of Resettlement and Rehabilitation Program as per the RRP policy with an objective to restore the livelihood conditions of the APs equal to or better than the pre-project conditions. The program besides others will entail. • Market based compensation at replacement cost to affected APs for all kinds of permanent and temporary loss of land and assets, and resettlement and rehabilitation measures to restore the loss of livelihood and income.	0	RAP
I.A.1.2	Impoverishment Risks	D	L	LT	M	Re	MSi			
I.A.1.3	Food Insufficiency	D	L	LT	Lo	Re	ISi			
I.A.2.	***Impacts of temporary loss of agricultural crops along RoW***									
I.A.2.1	loss of standing crops along RoW	D	S	ST	Lo	Ir	Isi	• Avoid making new access facilities to reach the Tower Foundation sites by using the existing trails • Restrict activities only to the areas required for the establishment of Tower foundation sites • Select construction and stringing operation in the months when the standing crop is minimal on the RoW • Compensate the loss of the damaged crops as to the local market price	14,663,052	Inbuilt with the civil costs; include in the contract bid of CC
I.A.2.2	Loss of community income from community forest	D	L	LT	M	Re	Msi	• Compensatory plantation	0	BMP

		Impacts						Mitigation Measures and Costs		
S.N	Environmental Impacts	Direct Indirect	Extent	Duration	Magnitude	Reversible Irreversible	Significance	Management Plan	Cost (NPRs)	Remarks
I.A.3	**Obstruction/impairment to community infrastructures and services**									
I.A.3.1	Motorable access	D	S	ST	Lo	Re	Isi	• Prior notification through the local FM radios and Newspapers to the commutes of the motorable road, foot trails on the day and timing of the obstruction of access • Placement of standby personnel to stop vehicular traffic and commuters on the two ends of the motorable roads and foot trails across which the cable is going to be strung. • Prior notification through local FM radios and newspapers to the service areas of electricity supply and land line telecommunication on the day and timing of the disruption of services.	0	Include in the contract bid of CC
I.A.3.2	Foot trail access	D	S	ST	Lo	Re	Isi			
I.A.3.3	Electricity supply	D	S	ST	Lo	Re	Isi			
I.A.3.4	Telecommunication	D	S	ST	Lo	Re	Isi			
I.A.5.5	Schools	No Impact								
I.A.5.6	Community recreational areas	No Impact								
I.A.6	***Pressure to community infrastructures***									
I.A.6.1	Water supply	D	S	ST	M	Re	Msi	Provide maximum job opportunity to the local area people to minimize the numbers of outside workforce to reduce the exploitation of natural resources available in project alignment	0	Inbuilt with the civil costs; include in the contract bid of CC
								Select the location of the permanent and makeshift camps in areas where the water	0	

		Impacts						Mitigation Measures and Costs		Remarks
S.N	Environmental Impacts	Direct Indirect	Extent	Duration	Magnitude	Reversible Irreversible	Significance	Management Plan	Cost (NPRs)	
								supply facilities are abundant to meet the requirements of the construction workforce		
								If possible, establish own source of water supply not impairing the supply facility of the communities	0	
I.A.7	***Occupational health and safety risks***									
I.A.7.1	Electric shock	D	S	ST	M	Re	Msi	Appropriate efforts and system efforts will be made placed to identify, eliminate, control, and minimize the hazards of electric shock	1,000,000	
I.A.7.2	Working at construction sites	D	S	ST	M	Re	Msi	Plan the work sites and sequencing of works to avoid risks to workers.	1,500,000	
								Establish a first aid and potable water facility at the construction site.		
								Establish an earthen pit lavatory at the construction site.		
								Regular inspection and supervision of construction workforce on the appropriate use of the PPE and fall protection equipment's while at work and enforce the use of PPE and		

		Impacts						Mitigation Measures and Costs		
S.N	**Environmental Impacts**	**Direct Indirect**	**Extent**	**Duration**	**Magnitude**	**Reversible Irreversible**	**Significance**	**Management Plan**	**Cost (NPRs)**	**Remarks**
								fall protection equipment's.		
								Preparedness for rescue of the injured to the nearby stabilization center at the earliest possible.		
I.A.8	***Community Health and Safety Risks***									
I.A.8.1	Site Hazards	ID	S	ST	Lo	Re	Isi	Restricting access to the site, through a combination of institutional and administrative controls including fencing, signage, and communication of risks to the local community	0	Inbuilt in civil costs, include contract bid of CC
								Removing hazardous conditions on construction sites that cannot be controlled affectively with site access restrictions, such as covering openings to small, confined spaces, ensuring means of escape for larger openings such as trenches or excavations, or locked storage of hazardous materials.	0	
I.A.8.2	Exposure to communicable disease (HIV/AIDs, STD, etc.)	ID	S	ST	M	Re	Msi	Provide maximum job opportunity to the local area people to minimize the numbers of outside workforce	8,00,000	
								Screening of workers while employment through health checkups against potential communicable disease.		
								Undertake health awareness programs to the construction workers and communities and awareness on sex education and Sexually Transmitted Diseases.		

		Impacts						Mitigation Measures and Costs		Remarks
S.N	Environmental Impacts	Direct Indirect	Extent	Duration	Magnitude	Reversible Irreversible	Significance	Management Plan	Cost (NPRs)	
								Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements.		
Cost of Socio economic and cultura Impact Mitigation 33,00,000										
Note: D = Direct, ID = Indirect, S= Site specific, L= Local, R= Regional, ST=Short Term, LT= Long Term, H = High, M=Moderate, LO= Low, Re =Reversible, Ir = Irreversible,										
Si = Significant, Msi = Moderately significant, Isi = Insignificant										

The total cost for mitigating the Environmental impact include Physical Environment Impact Mitigation cost NPR 14,50,000 (USD 10,902) Biological Impact Mitigation cost NPR 11,55,000 (USD 8,684) and Socio-economic and Cultura Impact Mitigation cost NPR 33,00,000 (USD 24,812). The total is NPR is 5,905,000 (USD 44,398).

CHAPTER 6: ANALYSIS OF ALTERNATIVES

6.1 INTRODUCTION

This chapter describes the process of selecting the project proposal alternative that will result in the most beneficial and least adverse environmental and social impact, while also achieving the most financially feasible option for TL-3 development. The ESIA analyses the alternative options for energy, do-nothing scenario (without the project); and the other alternatives explored during its investigation stage (with the project considering various options on its design, configuration, location and project footprint, ecological impact, operational procedure, sources of raw materials, and transport, and potentially adverse impacts and ways to mitigate them).

The alternative analysis for TL-3 was considered during its investigation stage. Based on the detailed investigations, various alternatives were considered such as no project alternative, alternative project layouts based on social and environmental consideration. Each of these alternative options has been evaluated in brief in the sections below.

6.2 NO PROJECT ALTERNATIVE/ NON-IMPLEMENTATION SCENARIO OF TL-3

The Nepal Electricity Authority (NEA) is prioritizing the development of the three transmission lines and two new substations that include 400/132 kV New Anarmani Substation located at Haldibari RM ward 1, Jhapa District and 400/132 kV New Tingla Substation located at Tingla next to the existing 132/33 kV Substation in Solududhkunda Municipality ward 11, Solukhumbu District respectively. There are three 400 kV double circuit transmission lines as:

e. TL-1: 400 kV Arun Hub (Sitalpati)-Inaruwa (95km) Transmission Line and substations
f. TL-2: 400 kV Arun Hub-Tingla-Dudhkoshi (110km) Transmission Line and substations
g. TL-3: 400 kV Inaruwa-Anarmani (89.612 km) Transmission Line and substation

Out of these three Transmission lines, a and b will connect the electricity generated from Arun River Corridor and Solu River Corridor. Meanwhile, the third TL will connect the Inaruwa substation to New Anarmani substation leading to supply electricity to the industrial area of Koshi Province. These TLs will also aid in the credibility of the electricity in Koshi Province as well as entire Nepal and trade with India and Bangladesh.

Currently, in Koshi Province, along the Arun River corridor, there is Upper Arun (1061 MW), Irkhuwa HEP, Sankhuwa HEP, etc with capacity of 3500 MW generation of the electricity. There is currently Arun Hub (Sitalpati) substation but no connection to the Main Grid in the Inaruwa substation. The proposed 400 kV Arun Hub (Sitalpati)-Inaruwa (95km) Transmission Line and substation is envisaged to evacuate the energy generated from planned hydropower projects in the Arun

corridor and make the system more reliable. The Inaruwa substation does not have any connection with another substation of 400 kV in far eastern Nepal. In the above context, if the TL-3 is to be developed, a new transmission line of adequate capacity (at least 400 kV) has to be constructed, to conduit power Inaruwa to New Anarmani Substation and then further new TLs can be developed for across the border with India and sale in India as well as Bangladesh.

Nepal's level of development with respect to energy is low as compared to global and South Asia regional standards. An estimated 87% of the country's total primary energy demand is met by traditional (non-commercial) forms of energy, reflecting the overwhelmingly rural distribution of population in Nepal and the virtual absence of relatively clean, commercialized forms of energy outside of urban areas. This heavy reliance on traditional energy sources brings with it the well-known problems of limited opportunities for rural economic development; environmental degradation; inefficiency in provision of energy services; and health impacts, particularly for women and children.

A study jointly conducted by the National Planning Commission (NPC) and Investment Board Nepal (IBN) in 2017 has made a forecast that per capita electricity consumption will reach 700 kilowatt hour per year (kWh/year) by 2030, which can be met through total installed capacity of 8,000 MW. Similarly, in another 25 years the per capita energy consumption is expected to hover at around 1,000 kWh/year and the country needs to develop 10,000 MW energy by 2040, as per the study. The NPC will set a target in its periodic plan based on the recent study.

Actual consumption of electricity remains very low, at about 70 kWh per capita, even for urban Nepalese, compared to 733 kWh for India and 2,600 kWh for China, as a result of severe limitations in the supply of electricity which has not kept up with the sharp rise in demand of recent years. Nepal's total grid-connected generation capacity amounts to a meager 757 MW of which 975 MW is based on hydropower, but the actual available capacity at any moment is generally considerably less due to various reasons. In Nepal 80% of rainfall occurs in the monsoon months of July, August and September, coinciding with glaciers melting and the installed hydropower plants can run in their full capacity. During winter, the water available can support only 35% of the hydropower capacity to generate power, creating a huge supply-demand gap.

Many HP are under construction in the Arun River Corridor, in order to evacuate their powers, 400kV Transmission line network from Sitalpati to Inaruwa. Hence from Inaruwa it is necessary to evacuate the powers in New Anarmani. This is essential because without sufficient hydropower based on the unused water resources is developed, Nepal will continue to be burdened by a heavy dependence on costly and highly polluting alternative means of meeting the economy's demand for electricity, or to do without electricity, at a high cost to its people and its economy.

Considering the above consequences, no transmission line project TL-3 is rejected as it does not restore and enhance the current trends of economic and social development, nor it helps in restoring the existing natural resource base. In no project scenario, there will be lack of electricity and/or opportunity to export electricity in Koshi Province and from the Arun corridor itself.

6.2.1 Alternative Transmission Line Capacity

The TL-3 is proposed for the evacuation of power from the Inaruwa to New Anarmani as well sale to India as well as Bangladesh. A power transmission line for bulk power evacuation with minimum power loss is the project's pre-requisite to reduce the operating costs vis-a-vis optimize the investment costs. The typical tower drawings are presented in **ANNEXURE XV.**

The operating cost is principally due to power loss through electrical resistance. As the line length increases, so does the resistance loss. Electrical resistance converts electric power into thermal energy, which is lost to the atmosphere. The power loss in a transmission system can be reduced by increasing the operating voltage of a line. Therefore, high voltage transmission line has been proposed for the TL-3.

High voltage transmission line existing in Nepal was normally up to 132 kV. Very recently in some sections of central and eastern Nepal 220 kV (Khimti-Dhalkebar, Hetauda – Bharatpur, Bharatpur–Bardaghat) and 400 kV (Duhabi – Hetauda) etc and others are under construction stage. The 400 kV double circuit line is selected on the basis of power carrying capacity of the line required for the evacuation from Sitalpati to Inaruwa Table 6.1.

Table 6-1: Power Carrying Capacity of Transmission Line

Voltage	Power Transmission capacity (MW)	RoW requirement (m)	Normal Span (m)	Distance (km)
132kV D/C	150	18	320	50
220 kV D/C	450	30	350/380	150
400 kV D/C	1000	46	400	250

The double circuit high voltage transmission line below 400 kV capacity will be inadequate to transfer power reliably to the load center and above 400 kV it involves high capital investment. Hence 400 kV double circuit line has been proposed for the project. Similarly, Voltage level depends upon the Power that needs to be evacuated, length of the TL and the loss permitted, voltage regulation guideline.

6.2.2 Transmission Line Alignment Alternatives

In total 3 alternative alignments were examined for alternative assessment of TL-3. The alternative alignments included Alternative 1, Alternative 2 and Alternative 3 (Figure 6-1) and are shown in Table 6-2.

Table 6-2: Alternative analysis

Item	Description	ALT - 1	ALT - 2	ALT - 3
Technical				
1	Total length (km)	96	89.	98
2	No. of Angle Point	81	122	77
3	Estimated Average span (m)	385	389.27	372
4	Estimated maximum single span (m)	641	664	670
5	Estimated No. of total towers:	261	237	263
6	No. of major crossing:	106	116	91
6a	Main River	44	47	32
6b	National /main Road	11	11	11
6c	minor Road/Tarred road	51	58	48
6d	Existing Power Lines	2	2	2
6e	Railway	2	2	2
6f	Canal	3	3	3
7	Airport proximity (m)	7500	8200	6500
Social				
8	No. of Affected Houses	495	446	518
Environmental				
9	Forest Area (hectare)	192.56	3.488	182.23
10	Private Land (hectare)	88.92	199.859	108.23
		Selected	**Best**	

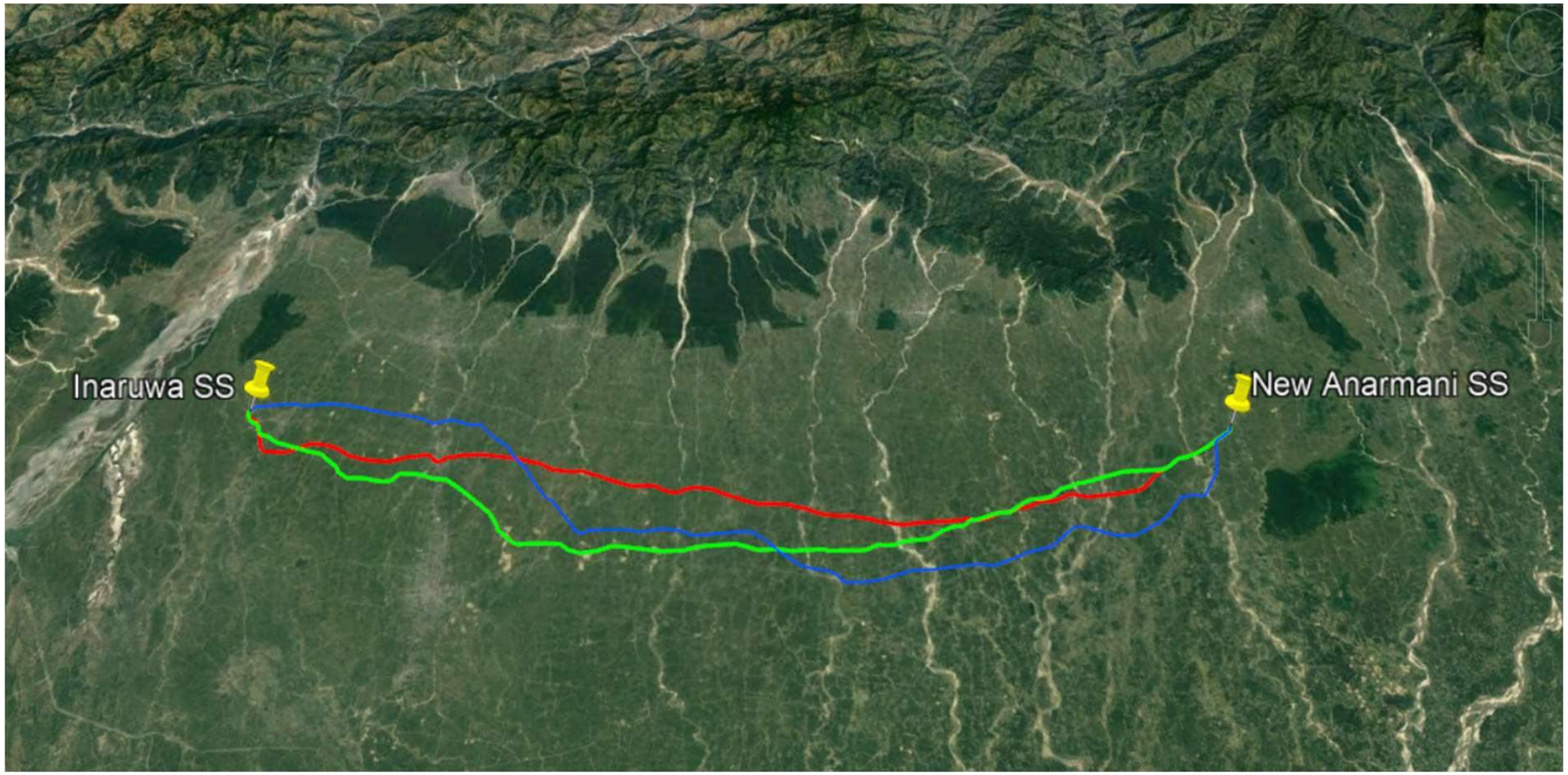


Figure 6.1: Alternatives for TL-3

6.2.3 Alternative with No/ Minimal Forest area requirement

The transmission line alignment selection is governed by a number of parameters such as i) Avoidance of sensitive habitats and wetlands, ii) Avoidance of sensitive areas, iii) Avoidance of farmland, iv) Avoidance of historic buildings and v) Avoidance of residential areas. Of the above features, two features: avoidance of sensitive habitats and wetlands and avoidance of sensitive areas are related with the forest areas in the sense that the transmission line route should not affect the forested areas that might be endowed with rich wildlife habitats of local and global interest.

A complete avoidance of the forest land is impossible as the alignment traverses a long stretch spanning from Terai to hills. In view of the above, alternative route selection was done emphasizing in avoiding the sensitive habitat areas such as national parks and high biodiversity rich areas. As far as possible, the alignment route is aligned at the fringe areas of the forests so as to avoid fragmentation of the core forest areas. The land usemap is shown in Figure 6-2. Then the final route selection is based on the following parameters governing the forested land.

- Length of the alignment within the forest land
- Length of the alignment along the fringe zone of forest with other land uses
- Length of forest fragmentation in the core forest area.

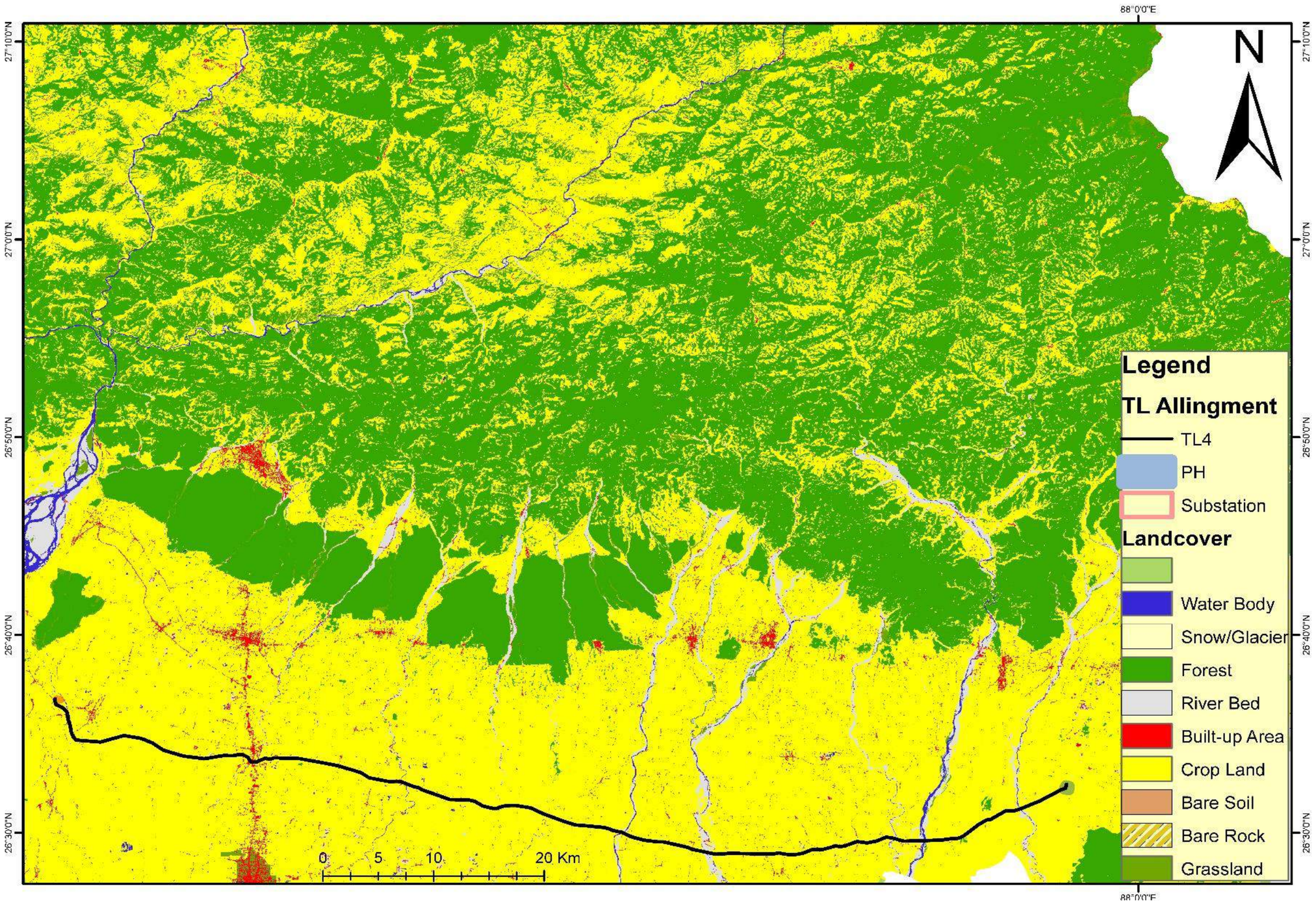


Figure 6.2: Land Use across the Alternative Transmission Line Routes

6.2.4 Design Alternatives

The transmission line design basically includes major design feature as: i) transmission line design

The transmission line design addresses such factors as the type of support structures used, the materials used, the number and spacing of conductors, ground wires, any communication wires used, and line. To minimize the impacts from the transmission line the tower design and arrangements of the conductors were given due consideration. The selected tower structure is self-supporting tower made up of galvanized latticed steel structures and the conductor arrangement selected is vertical so as to minimize the RoW width to the extent possible. Adopted clearance for spacing between conductors; vertical clearance to ground surface, horizontal clearances between the line and other electric lines; horizontal clearances between the line and aboveground and belowground pipelines; horizontal clearances between the line and nearby residences; and vertical and horizontal clearances between the line and vegetation within and adjacent to the RoW meets the GoN standards after accounting for line sag.

RoW design considered in the selection of transmission line has included the following factors in the context of minimizing impacts:

- Slopes. To avoid steep slopes to the extent possible within the selected route.
- Soil types. To avoid unsuitable soils.
- Blasting requirements. To minimize the amount of blasting for tower foundation placement
- Visual impacts. To avoid areas of visual impacts for the placement of transmission line towers
- Significant structures or locations. To avoids places of historical or cultural significance or area of particular interest or importance.
- Existing disturbed areas. Follows the existing roads, access roads, or other already disturbed areas whenever possible to minimize the disturbance to serene or undisturbed areas.
- Tower placement. The placement of transmission line towers avoids residential areas, and wetlands at the river crossings etc.

6.2.5 Associated Risks on Different Alternatives

The project layout planning has avoided the geologically vulnerable area for its various structures and support facilities. The Tower pad foundation and the tower structure are designed with a maximum allowable safety net to avoid the risk of foundation and structure failure. As the project site lies in the potential seismic area, the design has considered the seismic failure risk also into consideration in its design. Fencing provisions of vulnerable work sites, slope protection, etc are the result of the various alternative analyses to minimize the risk to acceptable level during project implementation.

6.2.6 Alternative to Technology, Operation, Procedures, Time Schedules and Raw Materials to be used

Selected construction technology alternative is a mix of labor and machine based so as to provide maximum job opportunities during construction. The technology adopted is safe and proven technology and based on based industrial practices followed elsewhere.

In order to ascertain the construction time required for completion of transmission line broad construction schedule for the tower pad foundation, tower structure erecting, and stringing of cables with yearly working period of 12 months to 14 is envisaged. As far as possible raw materials required for the project will be sourced from the local area except for the timber and fuel wood.

In order to take precautions of the bird hit and possible obstruction to the flight path of the airplane, raptor deflectors on towers and the use of ball markers and flappers with the line wherever required shall be used as a part of the environmental mitigation.

CHAPTER 7: CONCLUSION

7.1 CONCLUSION

The Government of Nepal (GoN) has outlined an ambitious vision for economic development through the efficient use of the country's abundant water resources. This vision is encapsulated in a white paper promulgated by the Ministry of Energy, Water Resources, and Irrigation (MoEWRI) in May 2018. GoN aims to generate 3000 MW by 2021, 5000 MW by 2023, and 15,000 MW (with 5000 MW for export) by 2028, on the supply side and plans to raise annual per capita electricity consumption from 170 kWh to 700 kWh by 2023 and further to 1500 kWh by 2028, on the consumption side, aligning with a commitment to achieving zero emissions by 2045.

All energy sector institutions have embraced the targets outlined in the white paper, with the Water Energy Commission Secretariat (WECS) playing a pivotal role in developing plans and policies to meet electricity demands across various sectors. The Rastriya Prasharan Grid Company Limited (RPGCL) has formulated a transmission master plan, incorporating different power plants at various stages of study and construction. The Nepal Electricity Authority (NEA), as the implementing agency, is conducting feasibility and detailed studies for transmission lines essential for evacuating power generated by 2035. NEA is studying three critical transmission lines for evacuating power generated from the eastern part of Nepal.

TL-1: Arun Hub (Sitalpati) - Inaruwa 400kV Transmission Line

TL-2: Arun Hub (Sitalpati) - Tingla - Dudhkoshi 400kV Transmission Line

TL-3: Inaruwa - Anarmani 400kV Transmission Line

Priority transmission line project TL3 originates from the Inaruwa Substation in Sunsari District and terminates at the Anarmani Substation in Jhapa District. This TL is a crucial for the establishment of the groundwork for electricity trading between Nepal, India, Bangladesh, and other Southeast Asian countries. Also, this line will enhance the reliability of electricity in the eastern part of Nepal as well as entire Nepal. The scope of this project includes the construction of 90km, 400kV Double Circuit Transmission line from Inaruwa substation to New Anarmani substation, expansion of bay at existing Inaruwa substation and construction of new 400/132kV New Anarmani substation at Haldibari, Jhapa. This project affects three districts namely Sunsari, Morang and Jhapa.

The proposed transmission line project does not fall in any National Parks, Wildlife Reserves or Hunting Reserve. Similarly, this TL project is 400 kV double circuit, therefore, for the legal requirement in Nepal, it is necessary for preparation of Initial Environmental Examination (IEE) Report. However, for international financing purpose ESIA is required. Environmental and Social Impact Assessment

(ESIA) document will be prepared in conformance with the World Bank's requirements under the new Environmental and Social Framework (ESF), and its applicable provisions/ requirements of ESS 1 to ESS 8 and ESS 10 Performance Standards. To fullfill the national requirements, separate IEE report has been prepared as per the Environment Protection Act, 2019 and Environment Protection Rules, 2020. This ESIA report includes the content of different plans prepared for the project. The summary for each of the plans prepared are presented below:

Biodiversity Management Plan (BMP)

The objectives of of a Biodiversity Management Plan (BMP) is to mitigate and monitor the impact on the biodiversity. During the study, number of laws were reviewed that included, Constitution of Nepal, Policy and Acts related with Biodiversity and Forest, World Bank Policy ESS5. Local people wish for maintaining the loss of the forest and preservation of the birds residing in the Trees. They also wished for the project to ensure to give appropriate compensation to HHs belonging to the community forest. They also wanted the compensatory plantation needed to be done near the affected HHs. Any development project creates some sort of impact on the surrounding environment. If proper mitigation measures as mentioned in the IEE report and BMP report are applied the expected impact could be mitigated and/or compensated. The proposed TL-3 if implemented with appropriate mitigation measures will have an acceptable level of impact on vegetation. The mitigation measures/activities prescribed in this Report to minimize Project impacts is realistic and feasible and is envisaged to manage the adverse Project impacts on flora and fauna to an acceptable level. The implementation of BMP in coordination with Division Forest Office during construction and operation of project by project proponents will minimize the impacts on ecological aspects.vThe total cost of the BMP is 4,575,342/- (USD 34,401) that includes NPR 30,00,000/- (USD 22,556) for mitigation/monitoring and NPR 15,75,342 (USD 11,845) for compensatory plantation. The cost of forest loss is not the part of BMP and the cost is included in total project cost.

Gender Action Plan (GAP)

This Gender Action Plan (GAP) has been elaborated to gender-related measures into the TL-3 related activities, ensuring that gender-related risks are avoided or mitigated, and to pay special attention to women, considering that women are not a homogenous group, and the additional challenges that women from indigenous nationalities, Dalit caste and other marginalized groups may face. It further has identified gender-performance indicators and sex-disaggregated targets to be integrated into the project´s gender-responsive results framework. This GAP Report is a part of ESIA study for priority transmission line (TL3). The cost for GAP implementation and the administrative cost is NPR 165,20,000/- (USD 124,211).

Vulnerable and Indigenous Development Plan (VIPDP)

This VIPDP is designed for the social safeguard of the directly or indirectly Project- affected indigenous and vulnerable groups. Directly Project affected households will be addressed through the Project's RAP. This VIPDP will address the socio-economic development of indigenous and vulnerable persons and groups along the project alignment. The main objective of this VIPDP is to ensure that indigenous and other vulnerable groups become beneficiaries of the TL project interventions. VIPDP will adopt the participatory and collaborative approach for the program implementation. Affected people will be formed with the collaboration of respective Municipalities/Rural Municipalities. A group will be formed by the men and women of indigenous and vulnerable groups in each affected area. The Project Manager and social mobilizers will facilitate the group formation, project selection, and implementation. The Project will monitor VIPDP activities both internally and externally. Internal monitoring will focus on inputs and outputs and will be aimed at observing the short-term changes in different indicators. The implementation of VIPDP will start after the approval of IEE, RAP, and VIPDP. The VIPDP cost estimates includes program costs, allowances and administrative costs for VIPDP implementation. The VIPDP is mainly focused on the social development of vulnerable and indigenous groups. The total estimated cost for VIPDP is NPR 49,040,000/- (USD 368,722/-).

Resettlement Action Plan (RAP)

The baseline study for socio-economic aspects of HHs hold relevant social parameters along the RoW and tower pads as per preliminary alignment. The transmission line TL 3 passes through 3 districts namely Jhapa, Morang and Sunsari. A total of 205 HHs in Jhapa, 109 HHs in the Morang and 132 HHs in the Sunsari district are to be affected by the proposed project. There are total of 26 structures will be affected by the TL-3 project. The total land required is 425.982 ha, out of which 3.488 ha. falls under community forest, 199.859 ha.is agricultural land, 209.97 ha. is government barren land and 12.66 ha. is river bed. ESIA team observed the settlement pattern, available infrastructure, health and sanitation situation of the project area based on the field observation checklists. Informal interviews were conducted along with observation. These techniques helped the team to triangulate the data collected through FGD and HH survey. Photo documentation was also undertaken by the ESIA team to capture fully the whole survey process and observations. The land valuation has been done in the report as per the rate given by the local bodies at the time of survey. A project-specific Grievance Redressal Mechanism (GRM) will be established to receive, evaluate and facilitate the resolution of people's concerns, complaints and grievances about the social and environmental issues during and before the RAP implementation. The implementation of RAP will be started with the initial land acquisition initiated by the NEA. It is assumed that after the approval of the IEE. The majority of the PAF in the proposed TL3 area dependent on agriculture for livelihood. The TL3 resettlement plan is mainly focused on the restoration of the

affected people's livelihood as land-to-land resettlement is not feasible. The restoration of the lost resources, particularly, forest resource is very important in this TL3 section. Apart from the above, TL3 resettlement plan and compensation packages need modifications keeping in consideration of the national resettlement policy framework. A provision of total NPR 1,555,443,634.00 (USD 11,695,065.00) needed for the compensation of Houses and Structures, Land Acquisition, Allowances for Vulnerable and Indigenous People, RAP Implementation Monitoring and Evaluation [Table 10-1,considering 1 USD=133 based on the rate of 2024]. There is separate cost for VIPDP and GAP implementation and hence, it is not included in RAP.

7.2 ESMP COST OF THE PROJECT

Along with the environmental monitoring work of this project, an environmental and social management action plan comprising organizational structure, staff coordination mechanism, reporting and budget for the implementation of environmental protection measures has been prepared. The project will integrate the aspects mentioned in the environmental management plan as much as possible when finalizing the design of the project and will implement it during construction and operation phase. The project will implement necessary environmental protection measures throughout the pre-construction, construction and operation as well as maintenance period. The implementation Environmental and Social Management Plan, on adopting measures to reduce adverse environmental effects, priority should be given to conducting the program through the local communities that will be affected when the proposal is implemented. The cost of environmental mitigation, monitoring and enhancement for this project will be as followed as mentioned in Table 7-1.

Table 7-1: ESMP Costs Summary

SN	Description	NRS	USD	Remarks
1	RAP cost	1,555,443,634	11,695,065	It includes compensation of Houses and Structures Land Acquisition; Allowances for Vulnerable and Indigenous People RAP Implementation Monitoring and Evaluation
2	VIPDP cost	49,040,000	368,722	It includes the allowances as in RAP
3	GAP cost	16,520,000	124,211	-
4	BMP cost	4,575,342	34,401	Includes the cost of mitigation/monitoring as well as compensatory plantation
5	Cost for Capacity Building and E&S	29,250,000	219,925	-
6	Mitatigation cost	5,905,000	44,399	-
Total		**1,660,733,976**	**12,486,722**	ESIA

The estimated cost of ESMP including RAP, VIPDP, GAP, BMP and cost of mitigation measures, capacity building and E & S management unit is about NPR

1,660,733,976 (USD 12,486,722). The cost given in the above table for Houses and Structures and Land Acquisition are based on the information given by the project affected families of different Municipalities and Rural Municipalities during the surveys and public consultations. It must be mentioned that the ESMP cost is tentative and may vary during the time of actual land acquisition and implementation phase.

वाप्कोस लिमिटेड
WAPCOS LIMITED
(भारत सरकार का उपक्रम - जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय)

In association with

ERMC
Environment & Resource Management Consultant

WAPCOS LIMITED

(A Government of India Undertaking)

76 C, Sector 18, Gurgaon - 122015, Haryana, INDIA

Tel. 0124-2397396, Fax. 0124-2397392

Email: environment@wapcos.co.in

ERMC (P.) Ltd.

Puja Pratisthan Marga-91, New Baneshwor, Kathmandu, Nepal

Tel : +977 01 4483064,

Fax: +977 1 4479361