

# Environmental and Social Impact Assessment

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February 2026

## Bhutan: Solar Farm Expansion Project (Wobthang Transmission Subproject)

### Main Report

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February 2026

## Bhutan: Solar Farm Expansion Project: Wobthang Transmission Subproject

Prepared by the Bhutan Power Company (BPC) Royal Government of Bhutan for the Asian Development Bank (ADB). This ESIA Report is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature. In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or another status of any territory or area.

## CURRENCY EQUIVALENTS

(as of February 2026)

Currency unit	–	Ngultrum (Nu.)
Nu. 1.00	=	\$0.011
\$1.00	=	Nu. 87.95

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### **Abbreviations**

AAC	-	Annual Allowable Cut
ACSR	-	Aluminum Conductor Steel Reinforced
ADB	-	Asian Development Bank
AL	-	Aluminum
AP	-	Angle Point
BAP	-	Biodiversity Action Plan
BC	-	Biological Corridor
BCTA	-	Bhutan Civil Transport Authority
BHU	-	Basic Health Unit
BMEP	-	Biodiversity Monitoring and Evaluation Plan
BMP	-	Biodiversity Management Plan
BOD	-	Biological Oxygen Demand
BOQ	-	Bill of Quantities
BPC	-	Bhutan Power Corporation Limited
BSR	-	Bhutan Schedule Rate
CA	-	Competent Authority
CD	-	Construction Division
CEO	-	Chief Executive Officer
CEMP	-	Contractor Environmental Management Plans
CFMG	-	Community Forest Management Group
CHA	-	Critical Habitat Assessment
CL	-	Center Line
CLA	-	Chief Labor Administrator
CLO	-	Community Liaison Officer
COD	-	Chemical Oxygen Demand
COP 15	-	15th Conference of the Parties
CPO	-	Construction Project Officer
CEPRP	-	Construction Emergency Preparedness and Response Plan
CR	-	Critically Endangered
CS	-	Construction Section
CSO	-	Civil society Organization
DBH	-	Diameter Breast Height
D/C	-	Double Circuit
DCDD	-	Department of Culture and Dzongkhag Development

DECC	-	Department of Environment & Climate Change
DGPC	-	Druk Green Power Corporation
DO	-	Dissolved Oxygen
DoE	-	Department of Energy
DoFPS	-	Department of Forest and Park Services
DoR	-	Department of Road
DOST	-	Department of Safety and Transport
DPR	-	Detailed Project Report
EA	-	Environmental Assessment
EA Act	-	Environmental Assessment Act 2000
EBRD	-	European Bank for Reconstruction and Development
EC	-	Environmental Clearance
ECCD	-	Early Childhood Care and Development
ECP	-	Environmental Codes of Practice
EDRR	-	Early Detection and Rapid Response
EGSS	-	Environmental, Gender, Safety, and Social Unit
EHS	-	Environment, Health, and Safety
EIA	-	Environmental Impact Assessment
EMOP	-	Environmental Monitoring and Operational Plan
EMP	-	Environmental Management Plan
EMR	-	Environmental Monitoring Report
EN	-	Endangered
EPC	-	Engineering, Procurement, and Construction
EPRP	-	Emergency Preparedness and Response Plan
ERA	-	Electricity Regulatory Authority
ESARF	-	Environmental and Social Assessment and Review Framework
E&S	-	Environment and Social
ESD	-	Electrical Substation Division
ESF	-	Environmental and Social Framework
ESIA	-	Environment & Social Impact Assessment
ESS	-	Environmental and Social Safeguards
FI	-	Financial Intermediary
FMID	-	Forest Monitoring and Information Division
FMU	-	Forest Management Unit
FNCA	-	Forest and Nature Conservation Act
FNCRR	-	Forest and Nature Conservation Rules and Regulations
GAO	-	Gewog Administrative Officers
GH	-	Greater Himalaya
GHG	-	Greenhouse Gases
GIIP	-	Good International Industry Practice
GIS	-	Geographic Information System
GNH	-	Gross National Happiness
GPS	-	Geographical Positioning System

GovTech	-	Government Technology Agency
GRC	-	Grievance Redress Committee
GRM	-	Grievance Redress Mechanism
GRO	-	Grievance Redressal Officer
HH	-	Household
HIV	-	Human Immunodeficiency Virus
HSMP	-	Health and Safety Management Plan
IBA	-	Important Biodiversity Area
IBAT	-	Integrated Biodiversity Assessment Tool
IEE	-	Initial Environment Examination
IFC	-	International Finance Corporation
IOSH	-	Institution of Occupational Safety and Health
ILO	-	International Labour Organization
IP	-	Indigenous People
IR	-	Involuntary Resettlement
IUCN	-	International Union for Conservation of Nature
JICA	-	Japan International Cooperation Agency
KBA	-	Key Biodiversity Area
kV	-	Kilovolt
LACRR	-	Land Acquisition and Compensation Rules and Regulations
LC	-	Least Concern
LEA	-	Labour and Employment Act
LG	-	Local Government
LH	-	Lesser Himalayan
LMP	-	Labour Management Plan
LFMA	-	Local Forest Management Area
LOTO	-	Lockout-Tagout
LRO	-	Land Record Officer
LULC	-	Land Use Land Cover
MCA	-	Multi-Criteria Analysis
MWp	-	Megawatt-peak
MoENR	-	Ministry of Energy and Natural Resources
MoHA	-	Ministry of Home Affairs
MoIT	-	Ministry of Information and Technology
MUZ	-	Multiple Use Zone
NBC	-	National Biodiversity Center
NDR	-	Normal Dry Rock/Soil
NEBOSH	-	National Examination Board in Occupational Safety and Health
NECS	-	National Environment Commission Secretariat
NEPA	-	National Environment Protection Act
NEC	-	National Environment Commission
NFE	-	Non-Formal Education
NLCS	-	National Land Commission Secretariat

NNL	-	No Net Loss
NOC	-	No Objection Certificate
NP	-	National Park
NSB	-	National Statistics Bureau
NT	-	Nearly Threatened
NWFP	-	Non-Wood Forest Product
O&M	-	Operation & Maintenance
OHS	-	Occupational, Health and Safety
OPGW	-	Optical Ground Wire
ORC	-	Outreach Clinics
PAP	-	Project Affected People
PAI	-	Project Area of Influence
PAVA	-	Property Assessment and Valuation Agency
PBF	-	Priority Biodiversity Feature
PCR	-	Project Completion Report
PHCB	-	Population and Housing Census of Bhutan
PIAC	-	Project Implementation and Advisory Committee
PIU	-	Project Implementation Unit
PM	-	Particulate Matter
PM	-	Project Manager
PMU	-	Project Management Unit
PNP	-	Phrumsengla National Park
PPE	-	Personal Protective Equipment
PT	-	Project Team
PTL	-	Power TL
RAP	-	Resettlement Action Plan
RBP	-	Royal Bhutan Police
RCC	-	Reinforced Cement Concrete
REA	-	Rapid Environmental Assessment
RECOP	-	Regulation for Environmental Clearance of Projects
RoD	-	Record of Discussion
RoW	-	Right-of-Way
RP	-	Resettlement Plan
RSPM	-	Respirable Suspended Particulate Matter
RSPN	-	Royal Society for the Protection of Nature
SAE &SMR	-	Semi-Annual Environmental and Social Monitoring Report
SEAH	-	Sexual Exploitation, Abuse and Harassment
SH	-	Sub Himalayan
SLD	-	Single Line Diagram
SMS	-	Safety Management System
SOP	-	Standard Operating Procedure
SPL	-	Special Tower
SPS	-	Safeguard Policy Statement

SRFL	-	State Reserved Forest Land
SSoW	-	Safe Systems of Work
St	-	Steel
TB	-	Tuberculosis
TDS	-	Total Dissolved Solids
TH	-	Tethyan Himalaya
TL	-	Transmission line
TNA	-	Training Needs Assessment
ToR	-	Terms of Reference
TSPM	-	Total Suspended Particulate Matter
TSS	-	Total Suspended Solids
TWG	-	Technical Working Group
UNFCCC	-	United Nations Framework Convention on Climate Change
VU	-	Vulnerable
WCNP	-	Wangchuck Centennial National Park
WHO	-	World Health Organization
WWF	-	World Wildlife Fund

### **Dzongkhag Terms**

<b>Dzongkha Term</b>	<b>Translation</b>
Chhu	River/Water
Chuzhing	Irrigated paddy fields
Chiwog	Sub-unit of a Gewog
Dungkhor	Blessed Spinning Prayer Wheel
Dungkhag	Sub-District
Dzong	Fortress (Administrative Centers of each Dzongkhag)
Dzongkhag	District
Gewog	Administrative Block/group of villages
Goenpa	Monastery
Gup	Head of a Gewog
Khimsa	Residential land
Lhakhang	Temple
Shedra	Monastic School
Thromde	Municipality or urban area
Tsachu	Hot Spring
Tshogpa	Community Representative
Thuemi	Representative of the local community
Tshogdu	District council - Dzongkhag Tshogdu
Tshogde	Block council
Mangmi	An elected representative in the Gewog
Tshogpa	Village representative
Thram	Land ownership certificate

Satshab	Land substitution
Tsamdro	Traditional grazing lands or pasture
Sokshing	Leaf litter collection areas
Dzong	Fortified structure housing both political and religious center
Goenpa	Monastery
Lhakhang	Temple
Choeten	Stupa
Gonpa (or Goenpa):	Monastery
Nagtshang	Traditional ancestral houses belonging to noble lineage families
Mani	Prayer wheels
Drupchhu	Holy water
Lu	Subterranean beings
Tshechu	religious festival

## Executive Summary

1. The Royal Government of Bhutan (RGoB), with financing support from the Asian Development Bank (ADB), is proposing the development of the 120 MWp Wobthang Solar Farm and the associated 132 kV transmission line (TL) in Bumthang Dzongkhag. Druk Green Power Corporation (DGPC) is the proponent for the solar generation component, while Bhutan Power Corporation (BPC) will be responsible for the planning, construction, operation, and maintenance of the transmission infrastructure.

2. The project forms part of Bhutan's broader strategy to diversify its renewable energy portfolio, reduce vulnerability of the power sector to climate-induced hydrological variability, and strengthen national energy security. The transmission component is required to evacuate electricity generated from the Wobthang Solar Farm to the Garpang pooling point through a 132 kV double-circuit TL traversing Tang and Chhoekhor Gewogs. This project (hereafter referred to as the 'Project') is a subproject within a sector loan modality. A separate Initial Environmental Examination (IEE) has been prepared for the Wobthang Solar Farm Project, and impact assessment documents for both subprojects are aligned with the Environmental and Social Assessment and Review Framework (EASRF). The TL, once complete, will facilitate reliable evacuation of electricity from the Wobthang Solar Farm, strengthen regional grid connectivity, improve system stability and reliability in eastern and central Bhutan, and support the integration of renewable energy into the national power network, thereby enhancing energy security and contributing to Bhutan's climate resilience and low-carbon development objective.

3. The proposed project includes the construction of a 17.33km 132kV double TL to evacuate power from the Wobthang Solar Farm implemented by DGPC, in Tang Gewog, Bumthang District. The project traverses five chiwogs/Gewo sub-unit in two Gewogs. Of this alignment, 16.22km will traverse Tang gewog and 1.11km will traverse Chokhor gewog until it terminates at the existing substation at Garpang. The TL will require 57 towers that integrate vertical phase conductors comprised of Aluminum Conductor Steel Reinforced (ACSR). The TL will require a 27m Right of Way. To access the towers, 14 new access roads totaling 19.2km will take off from existing roads from the village, highway or from logging roads. Wherever possible, the roads have been aligned within the TL RoW, 1.6ha of overlap between the Roads and TL RoW). Beyond the RoW, the roads alignment will traverse 6.7ha of land.

4. In accordance with the Asian Development Bank's Safeguard Policy Statement (SPS, 2009)<sup>1</sup>, the project has been classified as **Category A** for environment because of anticipated impacts upon natural habitat and the potential presence of IUCN Red List species within the project area. Consequently, a full Environmental and Social Impact Assessment (ESIA) has been undertaken to identify potential environmental and social risks and impacts, assess project alternatives, and define appropriate mitigation and management measures in line with the mitigation hierarchy. Based on quantitative assessment against all ESS6 criteria, no threatened or geographically restricted ecosystems occur within the project area, no species meet population or range-based thresholds, and the site does not function as a migratory, congregatory, connectivity, or evolutionary key area. Accordingly, the project is not located within Critical

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<sup>1</sup> ADB. SPS (2009) <https://www.adb.org/sites/default/files/institutional-document/32056/safeguard-policy-statement-june2009.pdf>

Habitat. Full details of methods, screening, and species-level assessments are provided in the complete Project Critical Habitat Assessment included in the EIA appendices

5. This ESIA has been prepared in compliance with ADB SPS (2009) and relevant national legislation, including the National Environment Protection Act (2007), Environmental Assessment Act (2000), Regulation for Environmental Clearance of Projects (2016, amended 2020), Forest and Nature Conservation Act (2023), and associated rules and guidelines. The assessment methodology included a review of project planning and design documents, site reconnaissance and field surveys, primary baseline data collection for air, water, and noise quality, biodiversity screening and habitat assessments, consultations with Dzongkhag and Gewog administrations, park authorities, and affected communities, and analysis of potential direct, indirect, and cumulative impacts across all project phases.

6. The assessment indicates that the principal environmental impacts are likely to occur during the construction phase. These include vegetation clearance within the transmission right-of-way, disturbance to wildlife and habitats, particularly natural habitat, soil erosion and slope stability risks, generation of construction waste, and occupational and community health and safety risks. Sections of the alignment intersect forested areas and multiple-use zones of Wangchuck Centennial National Park (WCNP), where careful planning and management are required to avoid habitat fragmentation and environmental degradation. Temporary impacts on air quality, noise levels, and surface water quality may also occur due to earthworks, transportation of materials, and construction activities. These impacts are limited to the immediate project area of influence.

7. Social impacts associated with the project are considered limited and manageable. The project does not require physical displacement of households or permanent acquisition of private land. However, temporary land use, access restrictions, and localized disturbances to livelihoods may occur during construction. Risks related to labor influx, worker accommodation, community health and safety, and traffic on narrow roads have been identified and addressed through appropriate mitigation measures. The project is expected to generate positive socio-economic benefits, including short-term employment opportunities, improved reliability of electricity supply, and contribution to national renewable energy targets.

8. The EMP defines mitigation measures, monitoring requirements, institutional responsibilities, capacity-building needs, and budget provisions for all phases. Key details from the ESIA and EMP will be integrated into detailed designs, bills of quantities, and contract documents to ensure adequate safeguards compliance. A stakeholder Engagement Plan has been prepared to guide the stakeholder engagement process. Meaningful consultation will continue to be undertaken with relevant stakeholders throughout project implementation requirements. A project-specific Grievance Redress Mechanism (GRM) will be established and disclosed prior to commencement of construction. Project risks will be addressed and managed through incorporating all requirements set out in the Environmental Management Plan (EMP) into associated Contractor E&S management plans.

9. As ADB shifts to a risk-based approach with its Environment and Social Framework (ESF) (2024, as amended to date)<sup>2</sup> it was agreed between key parties that ADB ESF's Environmental and Social Standard 6 (ESS6) on Biodiversity Conservation and Sustainable Natural Resources Management would be applied to assess and manage the Project. Under ESS6, projects must prioritize avoidance and minimization of impacts. The Biodiversity Management Plan (BMP) and

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<sup>2</sup> [Environmental and Social Framework](#)

the initial framework Biodiversity Action Plan (BAP) have been prepared to address concerns relevant to ESS6, such as no net loss (NNL) due to residual adverse impacts on WCNP, comprising the permanent loss of up to 153 m<sup>2</sup> of habitat in the park.

10. Final transmission alignments, tower locations, access routes, and construction footprints were confirmed during joint site verification with the Department of Forests and Park Services (DOFPS) and WCNP authorities in January 2026 and avoided sensitive areas wherever feasible. All required environmental, forestry, and park clearances will be obtained prior to mobilization, and early consultations with local governments, park authorities, and affected communities have commenced and will continue to be undertaken.

11. During the operation and maintenance phase, potential impacts are expected to be limited and localized. These include periodic vegetation trimming to maintain electrical safety clearances, occupational health and safety risks to maintenance personnel, and a low risk of accidental fires or electrocution if safety procedures are not adequately followed. The potential risk of large, vulnerable birds, such as raptors, colliding with the operational TLs has been assessed and commitments made to install bird diverters every 10 m along the entire length of the TL and monitor the local bird populations for three years. These impacts will be managed through routine inspection and maintenance in accordance with approved environmental and safety procedures.

12. Overall, the assessment indicates that with careful execution of the planning, mitigation measures, and ongoing management efforts outlined in this assessment it is anticipated that impacts can be avoided, minimized, and any residual impacts compensated, and offset, especially those connected to natural habitat and biodiversity. It is expected that the Project will make a positive contribution to Bhutan's renewable energy transition, climate resilience, and sustainable development objectives.

## I. INTRODUCTION

### A. Project Background

13. Hydropower, often referred to as Bhutan's "White Gold," plays a vital role in the country's economy and is the largest source of national revenue. However, hydropower generation is sensitive to river flow patterns, which are affected by climate variability factors such as rainfall, snowmelt, and evaporation from dam sites. While increasing climate variability widens the seasonal gap in streamflow, and challenges the reliability of hydropower generation, incorporating solar power can reduce vulnerability of Bhutan's power system by diversifying the country's energy mix.

14. In June 2025, the Government of Bhutan approved the National Energy Policy, consolidating separate policies on hydropower, renewable energy, and energy efficiency. The policy sets ambitious renewable energy targets: 20,000 MW of hydropower and 5,000 MW of solar power by 2040. Hydropower and solar are identified as the primary pillars of Bhutan's renewable energy strategy. In 2023, the government formulated the Renewable Energy Roadmap to prioritize solar power expansion and identify key development projects. To implement this roadmap, DGPC has been designated as the lead agency for utility-scale solar development and has established a corporate-level strategic solar investment plan

15. DGPC has been tasked with an aggressive implementation plan: installing 500 MW of solar power by 2026 and an additional 500 MW by 2030. This aligns with the broader national target outlined in Bhutan's 13th Five-Year Plan, which calls for 500 MW of solar capacity by 2029.

16. Among several other solar farm projects across the country currently at various stages of development, DGPC is undertaking the development of 120 MWp Wobthang solar farm project in Wobthang, Tang gewog, located under Bumthang Dzongkhag. Bhutan Power Corporation (BPC) as the implementing agency for transmission and distribution of electricity in the country, will facilitate the evacuation of electricity generated by the 120 MWp Wobthang Solar Farm. A separate Initial Environmental Examination (IEE) has been prepared for the Wobthang Solar Farm Project, and impact assessment documents for both subprojects are aligned with the Environmental and Social Assessment and Review Framework (EASRF)

17. The BPC, guided by its vision to be an innovative and efficient power utility driving the socio-economic transformation of Bhutan and its mission to provide affordable, reliable, adequate, and quality electricity services to the people of Bhutan, serves as the implementing agency for the evacuation of power generated from various projects. In line with this mandate, BPC is responsible for the planning, construction, and operation of transmission infrastructure required to evacuate power from the Wobthang Solar Farm.

18. BPC will construct a 132KV TL to evacuate solar electricity from the upcoming 120 MWp Wobthang farm in Bumthang to Garpang, in the same district. After exploring a number of alternatives based on the assessment of social, economic and environmental impacts, the proposed route extends 17.33 kilometers across two Gewogs, namely Tang and Chhoekhor.

19. The primary objective of the proposed TL is:

- To facilitate power evacuation from the Wobthang Solar Farm.
- Reinforce the eastern-western region TL connectivity.
- Strengthen the resilience and reliability of electricity in the eastern regions.

- To support other development activities in the region.

## **B. ESIA Objectives**

20. ADB's Safeguard Policy Statement (SPS) governs the environment and social safeguards of ADB's operations. Based on the ADB Safeguard Policy Statement (SPS), The proposed project is classified as Category A for the environment as it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented, potentially affecting an area larger than the sites or facilities subject to physical works. Because of these significant risks, the project is subject to a detailed ESIA process.

21. Additionally, the ESIA process is also a requirement under the RGOB as the National Environment Protection Act (NEPA 2007) requires all development projects to secure development consent and environmental clearance is a pre-requisite to development consent.

## **C. ESIA Methodology**

22. The methodology used for the preparation of ESIA is presented as follows:

- Review of project-related documents including the Detailed Project Reports, designs, literature pertaining to project baseline (statistical reports, regulations, annual reports, structural plans, state of the environment report, articles and related project documents) These documents were used to prepare the baseline chapters and to understand regulatory requirements and gaps.
- Site visits by BPC technical and environmental staff to the project site to assess existing environmental conditions, understand the area of impact, observe and document biodiversity and ascertain location of landslide areas. Primary data collection at specific sites covering air, noise, and water quality parameters based on which project baselines were developed.
- Consultations with project affected persons Dzongkhag, Gewog, CSO, interested stakeholders, and DoFPS officials to better understand project components, activities, institutional arrangements, revise grievance redressal, and to understand project benefits and impacts and timelines.
- Analysis of the direct, indirect and cumulative environmental and social impacts of the project during project planning, design, construction and operation phases
- Based on the impact assessment, appropriate mitigation measures were determined and proposed to ameliorate potential impacts, in line with the mitigation hierarchy.
- Implementation and monitoring responsibilities as well as capacity building requirements were also identified and proposed.

## II. POLICY LEGAL AND ADMINISTRATIVE FRAMEWORK

### A. ADB Safeguard Policy Statement

23. ADB's Safeguard Policy Statement (SPS) (2009) governs the environment and social safeguards of ADB's operations. The goal of the SPS is to promote the environmental and social sustainability of ADB supported projects by protecting people and their environment from potential adverse impacts and enhancing the benefits provided. The SPS requirements for environmental safeguards support the integration of environmental considerations into the project decision-making process. These requirements are triggered if a proposed project is likely to have environmental impacts and risks to the physical, biological, socioeconomic, and/or physical cultural resources in the project's area of influence.<sup>3</sup> Project screening and categorization using the sector-based rapid environmental assessment (REA) checklists determines the categorization of the project based on the significance of the project's potential environmental impacts and risks.

24. **Categorization.** ADB assigns one of the following environmental categories to the proposed project:

- **Category A.** The project is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. Impacts may affect an area larger than the sites or facilities subject to physical work. A full-scale environmental impact assessment (EIA), including an environmental management plan (EMP), has to be prepared by the borrower/client.
- **Category B.** The project's potential environmental impacts are less adverse and fewer in number than those in category A. Impacts are site-specific, few of which, if any, are irreversible. Impacts can be readily addressed through mitigation measures. An initial environmental examination (IEE), including an EMP, must be prepared by the borrower/client.
- **Category C.** The project is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, but ADB will conduct a desk review of the project's environmental implications.
- **Category FI.** The project involves the investment of ADB funds to or through a financial intermediary
  - (i) begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle.
  - (ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people;
  - (iii) is undertaken in an atmosphere free of intimidation or coercion.
  - (iv) is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and
  - (v) enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

25. Initial screening using the REA checklist indicates that parts of the project are located within WCNP, natural forest, community forest and settlement areas. Therefore, the project is classified as A as per ADB SPS.

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<sup>3</sup> ADB. 2009. *Safeguard Policy Statement*. Manila.

26. For a Category A project, ADB SPS requires the preparation of EIA report, which includes an EMP, consultation and disclosure requirements, establishment of a grievance redress mechanism (GRM), compliance monitoring and reporting, updating of the EIA in the event of unanticipated impacts, applying pollution prevention and control technologies and practices consistent with international good practices, ensuring that workers are provided with a safe and healthy working environment, and other elements as detailed below.

27. **Impact assessment.** The project must also identify and assess the risks to, and potential impacts on the safety of affected communities during the design, construction, operation, and decommissioning of the project, avoid significant damage to physical cultural resources and the institutional responsibilities of all key parties involved in EMP implementation and project environmental management must be clearly designated. The work must not be initiated or contract awarded unless the project is approved by ADB and the EMP is included in the contract documents.

28. **Environmental Management Plan.** For all potential impacts and risks that are identified, mitigation measures are required to be developed. The project must follow the mitigation hierarchy, starting with avoidance, minimization, mitigation, and lastly, compensatory measures to offset significant residual impacts. The first two steps of the mitigation hierarchy can be ensured through incorporation of environmental considerations into the project design.

29. **Meaningful Consultation.** The project must conduct meaningful consultation with affected people which begins during the project preparatory stage and is continued throughout the project cycle. Consultations are required to be conducted without any intimidation or coercion, and relevant and timely information must be disclosed in a language and format easily understood and accessed by people. The process must be gender-inclusive and tailored to the specific needs of disadvantaged and vulnerable groups. All pertinent perspectives from affected people and other stakeholders should be considered and incorporated into decision-making processes, including project design, mitigation strategies, benefit-sharing mechanisms, opportunities, and implementation matters. During the meetings, presentations will be provided about the project's potential environmental and social impacts. Consultation sessions must have attendance sheets prepared and included as part of the documentation.

30. **Information Disclosure.** BPC must submit the EIA to ADB for disclosure on ADB website, the final EIA report, new or updated EIA and corrective action plan prepared during project implementation, if any, and annual environmental monitoring reports. For illiterate people, other suitable communication methods will be used. For the benefit of the community, the summary of the EIA will be translated into the local language (Dzongkha) and made available at: (i) offices of PMU; and (ii) contractors' office. On demand, the person seeking information can obtain a hard copy of the complete EIA document at the cost of photocopy from these offices.

31. **Grievance Redress Mechanism (GRM).** A GRM will be established to allow affected people a reliable process to voice and resolve project-related concerns, and to enable the project to effectively address affected people's concerns. The GRM will cover the environmental, involuntary resettlement and/or Indigenous Peoples safeguard requirements.

32. **Biodiversity Conservation and Natural Resource Management.** Assessment of the significance of project impacts and risks on biodiversity and natural resources is an integral part of the environmental assessment process required under ADB SPS 2009. In line with this, the project location vis-à-vis natural habitat or important areas for biodiversity conservation is assessed as well as the project activities in terms of potential destruction of habitat and

introduction of invasive alien species, unsustainable natural resource use. ADB SPS requires that no project should result to significant conversion or degradation of natural habitats and that no project activity is implemented within critical habitats unless specific conditions are met to protect the critical habitat area

33. A proportional evaluation of Project risks and impacts demonstrated the potentially the most wide-ranging impacts were likely to be upon natural habitat, biodiversity, and state forest due to the RoW alignment. As ADB shifts to a risk-based approach with its updated Environment and Social Framework (ESF) (2024, as amended to date) it was agreed between key parties that ESS6 would be applied to assess and manage the Project. More details of this approach can be found in proceeding biodiversity related sections.

34. **Occupational Health and Safety.** The project must ensure that occupational health and safety of all workers is taken into consideration and that all potential impacts on the safety of affected communities during the design, construction, and operation phases are assessed. Measures to address them must be commensurate with the identified risks and impacts. It is the duty of PT to ensure that contractors adhere to health and safety standards and implement measures to maintain a safe and healthy working environment, considering risks inherent to the nature and scale of work and specific hazards in the subproject work areas, including physical, chemical, biological, and radiological hazards. Contractors must be required to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work, including: (i) identifying and minimizing, so far as reasonably practicable, the causes of potential hazards to workers; (ii) providing preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; (iii) providing appropriate equipment to minimize risks and requiring and enforcing its use; (iv) training workers and providing them with appropriate incentives to use and comply with health and safety procedures and protective equipment; (v) documenting and reporting occupational accidents, diseases, and incidents; and (vi) having emergency prevention, preparedness, and response arrangements in place.

35. **Community Health and Safety.** The PMU must identify and assess the risks and potential impacts on the safety of communities living near the project sites and establish preventive measures and plans to address them during the design, construction, operation, and decommissioning of the project. PT should ensure that design of all structural components incorporate applicable safety measures including signage and PWD responsive features and are constructed according to applicable standards using approved materials to ensure integrity.

36. **Pollution Prevention and Control.** To minimize environmental pollution, applicable pollution prevention and control technologies and practices consistent with international good practice such as World Bank Group's Environment, Health and Safety Guidelines, must be incorporated into the project for all phases of the project. PT must ensure that pollution is avoided in, or, when avoidance is not possible, minimized or controlled in all project components and activities, including transportation, use, storage, and disposal.

37. **Physical Cultural Resources.** All physical cultural resources that may be impacted by the project must be identified and measures incorporated to avoid these or mitigate impacts on these. In the event of a chance find during project implementation, appropriate Chance Find Procedures must be followed by project management and contractors. Based on initial screening, the project is unlikely to cause any direct adverse impact on physical cultural resources as much of the area is uninhabited.

38. **Unanticipated Environmental Impacts.** In case of unanticipated impacts, the same must be reported to ADB and the EIA and EMP must be updated based on the environmental assessment and new or additional mitigation measures to address any unanticipated impacts.

39. **Bidding and Contract Documents.** Once approved, the EMP must be included in bidding and contract documents along with any specific provisions requiring contractors to comply with all other conditions required by ADB or provisions of the loan agreement.

## **B. Applicable Environmental Legislation**

### **The Constitution of Bhutan**

40. The constitution of the Kingdom of Bhutan declares itself as the “Supreme Law” of the state and was promulgated on 18th of July, 2008. Article 4 on Culture states that the state shall endeavor to preserve, protect and promote the cultural heritage of the country, including monuments, places and objects of artistic or historic interest, Dzongs, Lhakhang, Nyes, language, literature, music, visual arts and religion to enrich society and the cultural life of the citizens. Article 5 of the constitution is also applicable to the proposed project which states that every Bhutanese is a trustee of the Kingdom’s natural resources and environment for the benefit of the present and future generations and it is the fundamental duty of every citizen to contribute to the protection of the natural environment, conservation of the rich biodiversity and prevention of all forms of ecological degradation including noise, visual and physical pollution through the adoption of environment friendly practices and policies (The Constitution of The Kingdom of Bhutan, 2008). The Royal Government shall:

- Protect, conserve and improve the pristine environment and safeguard the biodiversity of the country.
- Prevent pollution and environmental degradation.
- Secure ecologically balanced sustainable development while promoting justifiable economic and social development.
- Ensure a safe and healthy environment. The Government shall ensure that, in order to conserve the country’s natural resources and to prevent degradation of the fragile mountain ecosystem, a minimum of 60% of Bhutan’s total land shall be maintained under forest cover for all time.
- Parliament may, in order to ensure sustainable use of natural resources, enact environmental legislation and implement environmental standards and instruments based on the precautionary principle, polluter pay principle, maintenance of inter-generational equity, and reaffirm the sovereign rights of the State over its own biological resources.
- Parliament may, by law, declare any part of the country to be a National Park, Wildlife Reserve, nature reserve, protected forest, biosphere reserve, critical watershed and such other categories meriting protection.

41. Relevance to the project. The Constitution is relevant to the project as the solar power TL will have impacts and risks on the environment that need to be mitigated to ensure environmental protection and conservation.

### **National Legislation pertaining to Energy Generation and transmission The National Energy Policy 2025**

42. The Alternative Renewable Energy Policy provides direction and guidance for the promotion of alternative renewable energy options such as solar, wind, bioenergy, geo-thermal, pico (1-10 kW) / micro (10-100 kW) / mini (100–1000 kW) / small (1000 kW up to 25 MW) hydro and waste to energy, to strengthen national energy security, while contributing to sustainable development, environment conservation and climate change mitigation. The preliminary target for electricity generation from solar, wind and biomass has been set for 5MW, and 3MW for energy generation from biomass and solar thermal systems. The Department of Energy is the Nodal Agency for implementing this policy. Relevant environmental and social safeguards (ESS) sections of the policy cover water use, waste management, land acquisition and compensation, clearances, monitoring, and evaluation, but these are not detailed aside from ensuring compliance with national legislation and securing of all required clearances from relevant agencies.

43. The National Energy Policy 2025 provides Bhutan with a unified, long-term framework to secure adequate, reliable and affordable energy while enabling economic growth and sustaining its carbon-neutral commitment. It aims to achieve 25,000 MW of installed capacity by 2040 through hydropower development (15,000 MW), solar energy (5,000 MW), and diversification into wind, biomass, geothermal, hydrogen, storage systems and emerging technologies. It stated that DoE shall facilitate the allocation of State Reserve Forest (SRF) land and acquisition of private land for the Renewable Energy projects including for the transmission and distribution infrastructure. The Department shall also lead in framing Guidelines and Rules for obtaining Right of Way (RoW) for transmission and distribution lines. All renewable energy projects including generation, transmission and distribution shall comply with the national environmental laws and adhere to international best practices.

### **National Strategy and Action Plan for Low Carbon Development 2012**

44. During the 15th Session of Conference of Parties (COP15) of the United Nations Framework Convention on Climate Change (UNFCCC) in Copenhagen, the Royal Government of Bhutan made a pledge to remain carbon neutral. The National Strategy and Action Plan for Low Carbon Development include interventions and action plans to fulfil commitments to remain carbon neutral through the promotion of green growth. This project will contribute to fulfilling the carbon neutral pledge.

### **Penal Code of Bhutan 2004**

45. Aside from environmental laws and regulations, the 2004 Penal Code of Bhutan also includes a provision on environmental pollution wherein Article 409 states that a defendant shall be guilty of the offense of environmental pollution if such defendant knowingly or recklessly pollutes or contaminates the environment including water.

### **Applicable National Legislation pertaining to Environmental Safeguards Environmental Assessment Act 2000**

46. The Environment Assessment Act outlines procedures for assessing the potential impact of projects on the environment and formulates policies and measures to reduce potential adverse effects on the environment. Based on the above premise, environmental clearance is required prior to the execution of any project that may entail adverse impacts on the environment. To this effect, the Department of Environment & Climate Change (DECC), previously the National Environmental Commission (NEC), is empowered to implement the Environmental Assessment Act 2000 by setting out guidelines for securing environmental clearance for a project.

47. **Relevance to the project.** The Act mandates that BPC conduct environmental impact assessments (EIAs) for its subprojects based on activity type and obtain Environmental Clearance (EC) beforehand, which is a prerequisite for any development consent. Project applicants must include a description of potential environmental effects in their EC application and consult with concerned stakeholders before submission. The applicant is also required to provide any information deemed necessary by the Competent Authority (CA) or the Secretariat. The Department of Environment and Climate Change (DECC) is responsible for reviewing and renewing the EC at least every five years. Furthermore, if a full environmental assessment is required, it must comply with the Terms of Reference (ToR) endorsed by the Secretariat.

48. Clearance is issued once several prerequisites have been met: the project's environmental impacts must be predictable and deemed acceptable; the applicant must be capable of complying with all terms and conditions of the Environmental Clearance (EC); the project, either individually or in conjunction with other activities, must support Bhutan's sustainable development and the preservation of its natural and cultural heritage; the interests of all concerned parties must have been properly considered; and finally, the project must align with Bhutan's existing environmental commitments.

49. The National Environmental Protection Act, 2007 (NEPA) is the umbrella act on environmental conservation in Bhutan. It established the role of the National Environment Commission (NEC) or its successors to protect Bhutan's environment. It mandates that environment conservation receives equal priority with economic development in line with the Government's Middle Path Strategy. It also established the role of the Competent Authorities within Ministries, Thromdes (municipality) or Districts to screen, review and issue or deny environmental clearance, a mandatory requirement for any development activity. The Act promotes the precautionary principle, waste management principles, polluter pays principle, participatory approach, right to information about the state of the environment, right to seek legal redress if a person's health and safety is affected and payment for environmental services. The Act is guided by environmental principles, which states that:

- A developmental activity shall be strategically planned and executed in harmony with the carrying capacity of the country's sensitive ecological settings and geographical terrains.
- Every activity shall be planned and implemented in a way which will cause the least possible change in the environment; present the least environmental risk; minimize the consumption of space, raw materials, and energy during construction, production, distribution and utilization to the greatest extent possible including consideration of the principles of reduce, reuse and recycle; and forestall or limit environmental impact from the start(The National Environment Protection Act of Bhutan, 2007).
- A person polluting the environment or causing ecological harm is responsible for the costs of containment, avoidance, abatement, medical compensation, mitigation, remediation and restoration.
- A person using natural resources shall be liable to pay for ecosystem/environmental services.
- No person shall handle any hazardous substance except in accordance with such procedure and complying with such safeguards as may be prescribed under national and international instruments.
- No person shall discharge or emit or be permitted to discharge or emit any pollutants in excess of such standards as may be prescribed.

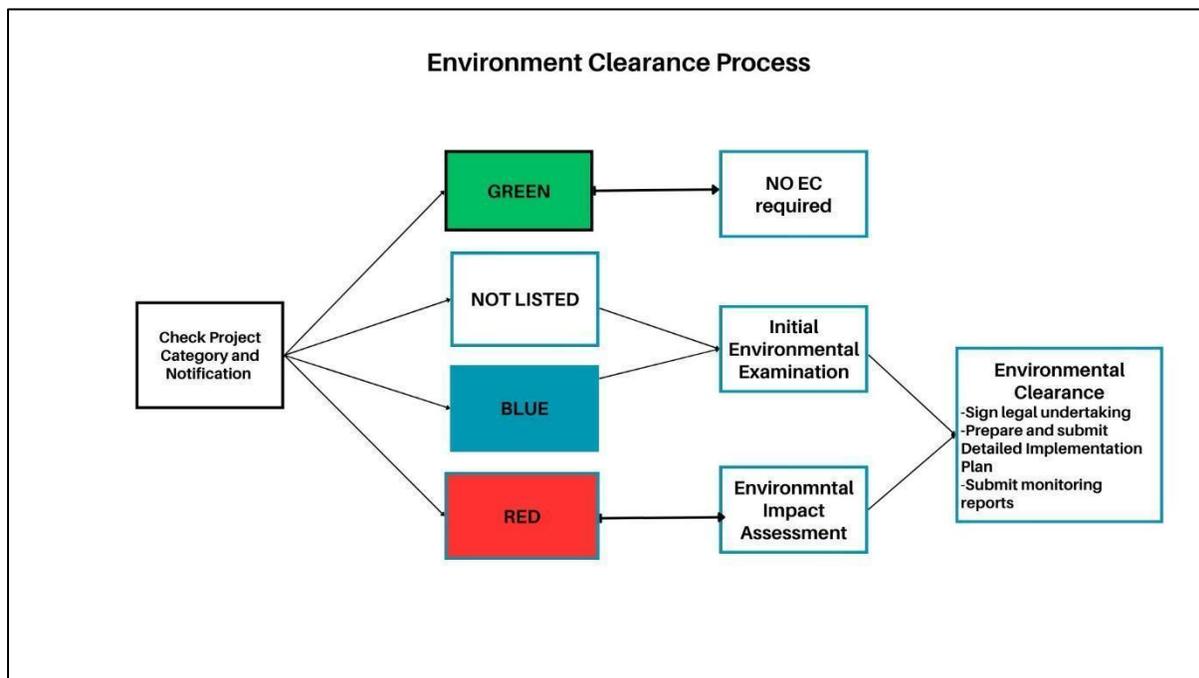
50. Relevance to the project: There will be environmental impacts on air, water and soil during the pre-construction, construction and operation phases of the solar power TL. Hence, the project will need to comply with the DECC environment standards for air, water, and noise.

**Regulation for Environmental Clearance of Projects 2016 and its amendments 2020**

51. The Regulation for Environmental Clearance of Projects, 2016 (RECOP, 2016) repeals RECOP, 2002 and outlines procedures and responsibilities for implementing and supplementing the Environmental Assessment Act, 2000 to issue environmental clearances. The Guide for environmental clearance application procedure, 2022 outlines the process for project categorization and seeking environmental clearance. Basically, approval or issuance of environmental clearance is dependent on (i) project type/activity and (ii) project location, which in turn dictates the level of environmental sensitivity and assessment required, the Competent Authority that will review, and the required clearance process to be followed.

52. **Project Category.** Proponents must check if the proposed activity requires environmental clearance or not by referring to the project category. Environmental clearance will be required for power evacuation lines.

**Figure II--1: General Environment Clearance Process**



Source: Adapted from the DECC 2022, Guide to Environmental Clearance Application Procedure.

**Environmental clearance process for TLs**

53. The application process for obtaining Environmental Clearance (EC) for TLs in Bhutan depends on the voltage level and location of the project, which determines the "Competent Authority" (CA) responsible for reviewing the application.

**Table II-1: Environment Clearance Process for TLs**

Criteria	BLUE	RED
Voltage	Less than and equal to 33kV	>33KV
Location	If the line falls entirely within one Dzongkhag, the application is submitted to the Dzongkhag Environment Committee (DEC).	If the TL falls under two or more Dzongkhags, the application must be submitted to the Department of Environment and Climate Change

54. Before submitting the application for EC, BPC as the proponent is required to inform and consult the community and relevant agencies. Records of consultations must be attached to the application.

55. If the TL affects private property (e.g., tower footing on private land), written consent from the individual, authenticated by the local authority, is required.

56. No Objection Certificates (NOC) or Approvals must be obtained from relevant agencies (e.g., Forestry for clearing Right of Way, Department of Culture if near heritage sites).

**Forest and Nature Conservation Act (FNCA) 2023 and the Forest and Nature Conservation Rules and Regulations (FNCRR) 2023 and its amendment 2025.**

57. This Act repeals the FNCA, 1995, and sections 490, 491, 492, and 493 of the Penal Code of Bhutan 2004 which covers offenses related to protected species, and sections 30 (k)(i) and (k)(ii) of the National Environment Protection Act of Bhutan, 2007. Under this act, forest cover means 'land with tree spanning more than 0.5 ha with tree higher than 5 meters and a canopy cover of more than 10 percent'. A relevant aspect of the act to the project is the requirement for a forestry permit for any activity within State Reserved Forest Land (SRFL). This requires a permit from the Department of Forest and Park Services (DOFPS) (Section 44).

58. The Forest and Nature Conservation Rules and Regulations, 2023 is formulated to facilitate the effective implementation of the Act. This Rules and Regulations supersede all the executive orders and circulars which are inconsistent with the Act and the Rules and Regulation.

**Forestry clearance**

59. Section 14 on the criteria for forestry clearance requires authorization by the DOFPS if forest is to be cleared on a slope greater than 45 degrees, if it is within 100 feet of the bank or edge of any water course/source, or, within 600 feet uphill or 300 feet downhill of a motorable road. Section 45 of the Act grants the Department authority to issue forestry clearance to the Range, Division and Park Office as follows: Range Office for activities up to 1.2ha or 3 km length; Division of Park for activities 3-7 acres or 3-7km length, Head of Department for activities over 2.8ha or over 7 km length. Forestry clearances are valid for the period of the project or activity.

**Protected Areas**

60. Protected areas have core zones, comprising habitats and species that are of high conservation value and wherein development activities are restricted. These include Key Biodiversity Areas, areas of high endemism, critical habitats, and migratory routes. Transition zones are areas adjacent to core zones, with areas important as wildlife habitat but where

traditional and legal use-right season for a fixed time is permitted. Otherwise, this zone is equivalent to a core zone. These include areas used traditionally as grazing or pasture, historical trails, cultural heritage sites, and sacred groves. Buffer zones are areas that provide cushioning for core and transition zones and are found around multiple use zones, along roads and trails, human settlement or core and transition zones. Buffer zones vary from as low as 20m (trails), 50m (centre of farm roads), 150m (from the centres of national highways), 500m (around multiple use zones, campsites, religious sites and hot springs). Multiple use zones are termed zone of cooperation between park and residents and include built up areas, settlements, resource allocation areas and farmlands, developmental activities. 'Biological corridor' is defined as an area set aside to connect one or more Protected Areas. Under the Forest and Nature Conservation Rules and Regulations of Bhutan (2017), Biological Corridors were provided with equivalent legal protection status as any other protected area. For any development in a state reserve forest (whether in a protected area or a biological corridor), a permit from the Department of Forest and Park Services is required.

61. National Parks protect large representative ecosystems, while wildlife sanctuaries are smaller in size and are more specific in terms of conserving particular species and their habitats e.g. Bumdeling Wildlife Sanctuary is famous for the Black-necked cranes and the Phibsoo Wildlife Sanctuary for its Spotted deer. A strict nature reserve is an area with little or no human settlement that is promoted for scientific research. Bhutan has only one strict nature reserve (Jigme Khesar Strict Nature Reserve).

## **Biodiversity**

62. All wild flora and fauna in Bhutan are protected and restricted from being killed, injured, captured, collected, cultivated or traded irrespective of whether these are in State Reserved Forest Land, unless with a permit. This is especially so for species listed in Schedule 1 of the Act, except, for scientific research and population management including conservation breeding or plantation on the recommendation of the Scientific Authority. The cultivation, collection, or trade of wild flora listed in Schedule II and III of this Act is permitted based on the procedure prescribed in the Rules.

## **Waste**

63. Section 284 states that the Forest Department is mandated to manage waste in the State Reserved Forests by the Waste Prevention and Management Regulation, 2012.

64. Cutting of trees and compensatory afforestation. A permit is required to cut trees. They must be marked by the forestry staff and only those trees that are marked can be removed. The FNCA 2023 has been revised and requires any agency taking up developmental activities to be responsible for deforestation or damage to state reserve forest land, to carry out compensatory plantation, but it does not specify whether the area replanted should be equal to the area deforested or double. The Act does not specify requirements for lopping or trimming of trees.

## **Water Act of Bhutan 2011 and the Water Regulation of Bhutan 2014**

65. The Act recognizes that water is one of the most important natural resources in the country and needs to be economically and environmentally managed in all times to come. The Act provides comprehensive legislation to guide various water user sectors in Bhutan. It also aims to ensure that every Bhutanese has assured access to adequate, safe, and affordable water to enhance the quality of their lives. Relevant sections of the Act pertaining to this project are (a) the

right of every individual to safe, affordable, and sufficient water for basic human needs. (Article 5c), (b) ensure that water resources are protected, conserved and/or managed in an economically efficient, socially equitable and environmentally sustainable manner (Article 4a) and (c) the requirement to seek approval to abstract water (Article 31). This regulation ensures the protection, conservation, and management of watersheds for sustainable water supply and minimize other environmental side effects. This regulation is relevant given that project sites may be located near rivers and streams. The Water Act restricts the discharge of effluents directly or indirectly into any water source unless it is within the effluent discharge standard. However, the Environment Standards 2020 are only applicable to industrial effluent discharge and for sewage treatment plants and not applicable for household sewage.

### **The Biodiversity Act 2022**

66. This Act repeals the Biodiversity Act of Bhutan 2003 and subsidiary legislations framed and adopted thereunder, and section 73 of the NEPA 2007. The chapter 7 of the Act on Fair and Equitable Sharing of Benefits discusses on the economic, social, technical, scientific, environmental or any other benefits that are intended or may be likely to be accrued to the country and an indication of the types of short, medium- and long-term benefits to be shared with the RGoB and other relevant stakeholders as well as the proposed mechanisms and arrangements for benefit sharing. This is not very relevant to the project.

### **Waste Prevention and Management Act of Bhutan 2009 and the Waste Prevention and Management Rules 2012 (Amended 2016)**

67. The Waste Prevention and Management Act of Bhutan 2009 and the Waste Prevention and Management Regulation 2012 (amended 2016) provide the necessary institutional framework for coordination on waste management to reduce generation at source, promote segregation, reuse, and recycling, storage, transportation, environmentally-sound treatment, and disposal. It promotes the precautionary principle, the polluter pays principle, the 3R principle and the waste management hierarchy.

68. The Waste prevention and Management Act of Bhutan was enacted to protect, sustain human health through protection of environment by:

- Reducing the generation of waste at source
- Promoting the segregation, reuse and recycling of wastes
- Disposal of waste in an environmentally sound manner and
- Effective functioning and coordination among implementing agencies.
- It states that: All developmental activities that generate waste shall be planned and executed in harmony with the carrying capacity of the country's fragile ecological settings and geographical terrains. A person polluting the environment or causing ecological harm shall be responsible for the costs of avoidance, containment, abatement, medical compensation, mitigation, remediation and restoration.

69. The project is a potential generator of solid waste during the construction phase. The project will comply with this Act and ensure waste segregation, collection, storage and disposal as per requirements. The Rules require construction and excavated waste to be safely stored at the site without inconveniencing the public and transported to designated sites (as identified by the local authority) without any spillage along the way.

## **C. Applicable Social and Involuntary Resettlement Background**

### **Local Government Act of Bhutan 2009**

70. The Local Government Act of Bhutan (2009) promotes decentralization and devolution of power and authority to the Local Governments that represent the interests of local communities. The Dzongkhag Tshogdu and the Gewog (Block) Tshogde (Council) are the highest decision-making bodies at the dzongkhag and gewog level. As per Chapter 14 of the Local Government Act, all activities undertaken by different sectors of the government must be routed through and coordinated by Local Government offices. Section 213 requires that all national agencies conduct periodic consultations with the Local Government before any project or program is implemented in their jurisdiction, as well as involve Local Governments both in the planning and implementation of national projects.

71. The Local Government Act has provisions to undertake activities consistent with other relevant laws and policies of the country that are formulated towards conserving the environment within its jurisdiction and reducing the impact on public health and accelerating socio-economic development. Considering that subprojects are located in districts, the local government will have to be consulted and the requisite approval from the LG sought.

### **The Land Act 2007 and Land Acquisition and Compensation Rules and Regulations 2022**

72. The Land Act 2007 is the latest and revised version of the previous Land Act 1979. The Act intends to manage, regulate and administer the ownership and effective use of land resources and conservation of ecosystems. Some of the clauses from Chapter 7 (Acquisition of Registered Land) and Chapter 12 (Easement) of this Act are relevant to the proposed TL project where it states that:

- ✓ The landowner of a piece of land is bound, subject to reasonable compensation being paid to him, to allow the laying through his land or water pipes or irrigation channel, drainage pipes, telecommunication structures, electricity poles and sub-stations or other similar installations by a government agency or for the use of the adjoining or neighboring land if, without making use of his land, they could not be laid or could be laid only at an excessive cost. The landowner may require that his interests be taken into consideration.
- ✓ The Government may acquire a registered land for public interests.
- ✓ The Government may provide substitute land or cash payment, or both, as compensation.
- ✓ The acquisition of land shall entail fair compensation.
- ✓ For rural areas, the landowner shall have the discretion to opt for substitute land or cash compensation offered by the government. In the case of a Thromde, the landowner shall be provided with cash compensation. If the land is the only plot owned by the landowner in the Thromde, the government shall consider a substitute land in the same Thromde. If the value of substitute land is inadequate, additional cash compensation shall be provided subject to the value of land.
- ✓ Compensation shall be provided for the immovable property on the acquired land.
- ✓ Upon acquisition, if the remaining land parcel is less than 10 decimals, such land both in Thromde and rural areas shall also be acquired.
- ✓ The location of substitute land to be allotted in rural areas shall be in the order of preference of same village, Gewog, and Dzongkhag.

- ✓ The land under acquisition shall be taken over only after registering the substitute land in the name of the affected landowner, or the cash compensation has been made to the landowner.

73. The proposed project will affect private lands, community forests and government land, hence the provisions contained in the Act shall govern all the issues related to land acquisition and compensation

### **Land Acquisition and Compensation Rules and Regulations 2022**

74. In exercise of the power granted by the Land Act of Bhutan 2007, the National Land Commission (NLC) has framed the Land Acquisition and Compensation Rules and Regulations 2022. These rules and regulations aim to ensure fair provision of land substitutes or cash compensation at the appropriate time when government institutions acquire private land for public interest purposes. Some of the provisions of this Rules & Regulations that are relevant to the proposed project are as discussed below.

- ✓ The private registered land shall be acquired only under unavoidable circumstances.
- ✓ The private registered land under acquisition shall be taken over only after registering the land substitute or payment of cash compensation to the landowner.
- ✓ If the remaining land parcel after the acquisition is less than 10 decimals, such land shall be acquired or may be consolidated with the available State land adjoining the registered land of the same landowner.
- ✓ The acquisition of land less than 10 decimals prevalent before the enactment of the Act shall be eligible for a proportionate land substitute.
- ✓ Allotment of a land substitute shall not enclose any patch of State land inside its boundary.
- ✓ If the land substitution process is delayed, the project may choose to lease the proposed land until the substitution is complete. This can be done through formal agreements between parties. However, this option is restricted to National strategic projects.
- ✓ The private registered land acquisition and the land substitute for power transmission and distribution structures shall be in accordance with the Rules and Regulations or Guidelines of the agencies concerned. In the event of any inconsistency or unavailability, these LACRR shall prevail.
- ✓ The private registered land acquisition shall entail fair compensation.
- ✓ The compensation for the acquired land shall be as per the land type recorded in Thram
- ✓ The valuation and fixation of the land value and any other collateral property shall be in accordance with the rate determined by the PAVA and Bhutan Schedule Rate.
- ✓ The compensation rates for crops and trees shall be as prescribed by PAVA.
- ✓ The acquiring agency shall utilize or develop the land within three years from the date of approval. However, non-utilization of the acquired land within the stipulated time or for the intended purpose shall be reverted to State land (NLC, 2022).

75. **Relevance to the project.** The project will impact private land for the construction of TL, so the provisions of this regulation are applicable

### **Guideline for plot boundary realignment/reconfiguration 2021**

76. The Guideline for plot boundary realignment/reconfiguration 2021 outlines the procedures and criteria for plot boundary realignment and reconfiguration to address numerous land-related issues. It establishes a uniform process to ensure fair and consistent service regarding adjustments of common parcel boundaries or those involving state land, primarily in rural areas affected by challenging terrain and inadequate planning. The guideline specifies various scenarios that qualify for realignment, such as plots affected by public utilities, electric structures, high hazard zones, or irregular shapes, and sets forth the objectives, scope, delegation of power, and detailed procedures for processing these applications, including a fee calculation structure.

77. The Guideline for plot boundary realignment/reconfiguration addresses two distinct criteria for qualifying for plot adjustment: Access Provision and plots affected by electric structures. The second criterion under Section 4.2 concerns plots affected by electric structures, specifically high-tension cable pylons, transmission towers, and electric substations. These plots are subject to development restrictions based on the safety regulations issued by the Electricity Regulatory Authority (ERA). Given that these electric structures serve a public use/benefit, and because there is currently no provision for exchange or satshab (land substitution) for such plots, adjustment from vacant state land through plot boundary reconfiguration shall be considered, provided that adjacent vacant state land is available. For this specific type of realignment, applicants are required to submit a supporting letter from BPC that confirms the existence of the electric structure and specifies details concerning the voltage and the minimum setback requirements.

### **National Laws and Regulations on IP**

78. The Constitution of Bhutan 2008, in clause 15 under Article 7, provides that all persons are equal before the law and are entitled to equal and effective protection of the law and shall not be discriminated against on the grounds of race, sex, language, religion, politics, or other status. There is no legislation or regulation related to indigenous peoples. The term 'indigenous peoples' is also not used but the more widely used term is 'socio-cultural groups' to recognize the diversity present among people in Bhutan.

### **Legislation pertaining to Workers**

#### **Labour and Employment Act of Bhutan 2007 and Rules pertaining to worker management and occupational health and safety**

79. The Act applies to matters relating to labor and employment in Bhutan. It prohibits 'forced or compulsory' labor and 'worst forms of child' labor. Discrimination against an employee regarding their wages and working conditions and prohibition against sexual harassment are also prohibited (Chapter II, Sections 6, 9, 11, 12, 16, 17, 18 & 19). The Act also touches on compensation and benefits of employees (Chapter VI) and Chapter IX deals with Occupational Health and Safety.

80. The Rules and Regulations on Occupational Health and Safety and Welfare, 2022 contain legal requirements that must be met by all workplaces within the coverage of the Labor and Employment Act, 2007. It establishes standards to ensure safety, health, and welfare for employees from work-related risks at workplaces. Chapter 3 details the duties of employers, Chapter 4 and 5 describe the workplace health and safety requirements, Chapter 6 covers the workplace environment, Chapter 7 covers machinery and Chapter 13-18 covers fire safety, health, welfare and reporting requirements and compensation. The Schedules provide examples of safety signs and symbols and PPE requirements, permissible exposure levels, safety data sheets, minimum requirements for first aid kits and even specifics on the number of toilets required. A safety officer is required to submit to the manager/employer a monthly report on the duties carried

out as the safety officer, which is to be maintained at the workplace for inspection by the Labor Inspector if desired (Section #44-45). Based on the safety report, the employer is required to undertake remedial measures. The employer is also required to report accidents or fatalities to the Chief Labor Administrator and the nearest Police Station of the accident within 5 days of the occurrence (Section #459). The types of injuries that require reporting are detailed in Section 461 of the Regulation. Dangerous occurrences and occupational diseases as specified in Schedule XI and XII of the regulation must also be reported as per the prescribed formats.

81. The Regulation on Occupational Health and Safety for the Construction Industry 2022 must be followed along with the relevant provisions in the Regulation on Occupational Health, Safety and Welfare, 2022 as applicable to construction sites. It prohibits the employment of persons under the age of 18 for any construction activity. A construction company with 12 or more construction workers must prepare a written statement of health and safety policy in accordance with relevant provisions contained in Regulation on Occupational Health, Safety and Welfare, 2012. If there are more than 50 employees, a health and safety committee must be appointed. The regulations also specify measures such as provision of appropriate personal protective equipment, measures for electrical hazards (ensure all electrical appliances and equipment are sound and adequately earthed, and temporary electrical installations at a construction sites have earth leakage circuit breakers), display of suitable warning signs, traffic management, structural stability of temporary structures, adequate illumination, access, material storage, operation of machines, worker accommodation facilities and waste disposal.

### **Regulation on Occupational Health, Safety, & Welfare 2022**

82. The purpose of this regulation is to establish occupational health and safety standards on construction safety read with relevant provisions enshrined in “Regulation on Occupational Health, Safety and Welfare,” as applicable to construction sites. It is to ensure safety and health for employees, as well as other people at construction sites, from work related risks to their health, safety, and well-being as provided in Chapter IX of the Labor and Employment Act, 2007. One of the keys to the Regulation is: at construction site there shall be appointed, organized and maintained a health and safety committee, and a Safety Officer conforming to the “Regulation on Occupational Health, Safety and Welfare.” It talks about fire protection, emergency action plan, the maximum weight that adult men can lift is 50 kg and adult women 25 kg, safety in the tunneling and excavation, scaffoldings, safety in the transport and earth moving equipment, plant equipment, demolition, explosives, medical facilities, offences and penalties.

83. **Relevance to the project:** Relevant during construction phase of the solar power plant because the workers will be exposed to different occupational hazards

### **The Regulation on Foreign Worker Management 2022**

84. The regulation on Foreign Worker Management 2022 requires that prior to recruitment, all employers must obtain approval from the Chief Labor Administrator (CLA) through the online approval system. The regulation details the eligibility criteria for recruitment, and all workers are required to have a work permit. All foreign workers must have undergone a medical examination before being employed and employers are required to comply with the “Guideline and Handbook on Foreign Workers Management” as well as the Standards for Accommodation as per the Regulation on Occupational Health and Safety for Construction Industry, 2022, the Occupational Health and Welfare regulations and ensure that workers follow the code of conduct and ethics. This regulation will need to be adhered to by the Contractor while BPC will monitor for compliance

## **Safety Code (Amendment) 2021**

85. The Safety Code (Amendment) 2021 updates the minimum electrical safety requirements for the Bhutan Electricity Authority. This Code establishes a framework to strengthen the institutional capacity for electrical safety by Licensees and to better mainstream safety strategies into their operational procedures.

86. The purpose of this Code is to provide for: (i) the establishment and strengthening of licensee-specific Safety Rules; (ii) the implementation of a Safety Management System (SMS); (iii) an integrated and coordinated safety process focusing on formal Work Permits and Test Permits; and (iv) matters incidental thereto.

87. The Code describes the composition and function of the SMS, including the mandatory designation of a Safety Officer, and prioritizes formal processes for training, compliance monitoring, and disciplining for "Serious Breaches".

88. Through this Code, licensees are required to develop safety procedures that include formal isolation and earthing protocols, requiring equipment to be locked and tagged before work commences. The safety process is expected to include special precautions for high-risk work on power cables, transformers, and current transformers. All design, construction, and work must adhere to specified technical standards, including Minimum Approach Distances, overhead conductor clearances, and underground cable burial depths.

## **Other Relevant Acts**

### **Disaster Management Act 2013**

89. The Disaster Management Act, 2013 repeals the 2006 National Disaster Risk Management Framework. This Act establishes a new framework to strengthen the institutional capacity for disaster management of the country and to better mainstream disaster risk reduction strategies at relevant institutions. The purpose of this Act is to provide for: (i) the establishment and strengthening of institutional capacity for disaster management; (ii) mainstreaming of disaster risk reduction; (iii) an integrated and coordinated disaster management focusing on community participation; and (iv) matters incidental thereto. The Act describes the composition, function, and powers of the different authorities, including in relation to the private sector, and prioritizes mainstreaming disaster risk reduction into development plans, policies, programs and projects as well as ensuring agencies receive adequate budgets. Through this Act, Dzongkhag Disaster Management Planning Guidelines were issued to guide the Dzongkhags, through the Dzongkhag Disaster Management Committees, to plan, develop and implement their respective Dzongkhag Contingency Plan. The planning process is expected to include hazard mapping to identify the most hazard-prone areas of the Dzongkhag so that future developments, interventions, and risk mitigation measures can be planned accordingly. All development projects need to be screened and disaster proofed.

### **The Cultural Heritage Bill of Bhutan 2016**

90. The Cultural Heritage Bill of Bhutan provides guidance for the Dzongkhag to identify and register heritage buildings, sites and landscapes and to prepare management plans for the conservation of these and their buffer zones. Development control regulations for these are to be prepared based on these plans, which will come into effect once approved by the Department of Culture and Dzongkhag Development. An entity intending to undertake development activity which may affect a cultural element identified by the Dzongkhag must obtain the consent of the

local community associated with the cultural element prior to seeking a development permit from the Dzongkhag.

### Road Safety and Transport Act 1999 and the Road Safety and Transport Regulation 2021

91. The Road Safety and Transport Act 1999 provide the legal framework for road safety, vehicle regulation, driver licensing, and public transport management in Bhutan. Drivers, vehicle owners are responsible for road safety standards, vehicle registration and must comply with speed limit, vehicle carriage limit, restrictions on alcohol and drugs. Access roads from to the towers will be taken from farm roads and highways. Accordingly, the required clearance will be sought from the Dzongkhag and DoST for the same.

### Applicable Standards and Guidelines Environmental Standards 2020

92. The Environmental Standards 2020 issued by the NEC (now the Department of Environment and Climate Change) set the permissible emission standards for ambient air quality, workplace emission, vehicular emission, and noise limits. These standards differ for Mixed Areas and Sensitive Areas. The Water Act restricts the discharge of effluents directly or indirectly into any water source unless it is within the effluent discharge standard. However, the Environment Standards 2020 are only applicable to industrial effluent discharge and for sewage treatment plants and not applicable for household sewage. The Drinking Water Quality Standards, 2016, developed in accordance with Section 13 (f) and Section 42 (a) and (b) of the Water Act of Bhutan, 2011 describe the quality parameters set for drinking water and the maximum permissible limit for each of the set parameters, to limit the level of contaminants in drinking water.

**Table II-2: Ambient air quality standards**

Parameter	Averaging Period*	Bhutan's Ambient Air Quality Standard, 2020 ( $\mu\text{g}/\text{m}^3$ ) <sup>4</sup>		
		Industrial Area	Mixed Area	Sensitive Area
TSP	24-hour	500	200	100
	Annual	360	140	70
PM <sub>2.5</sub>	24-hour	60	60	60
	1-year	40	40	40
PM <sub>10</sub>	24-hour	200	100	75
	Annual	120	60	50
SO <sub>2</sub>	24-hour	120	80	30
NO <sub>2</sub>	24-hour	120	80	30
	Annual	80	60	15
CO	24-hour	-	-	-
	8-hour	5,000	2,000	1,000
Ozone	1-hour	10,000	4,000	2,000
	Peak Season 8-hour	-	-	-
		100	100	100

<sup>4</sup> Taken from Environmental Standards, National Environment Commission, Royal Government of Bhutan, 2020.

**Table II-3: Workplace emission standards (Environmental standards 2020)**

Parameter	Averaging Period*	Unit	Standard
TSPM	8-hour average	mg/m <sup>3</sup>	<b>10</b>
RSPM (PM <sub>10</sub> )	8-hour average	mg/m <sup>3</sup>	<b>5</b>
PM <sub>2.5</sub>	24-hour average	mg/m <sup>3</sup>	<b>25</b>
	1 year average	mg/m <sup>3</sup>	<b>10</b>
SO	8-hour average	mg/m <sup>3</sup>	<b>1</b>
NO	8-hour average	mg/m <sup>3</sup>	<b>1</b>
CO	8-hour average	mg/m <sup>3</sup>	<b>5</b>
Pb	1-hour average	mg/m <sup>3</sup>	<b>0.0005</b>
Oxone	8-hour average	ppm	0.08

**Table II-4: Noise level standards**

Receptor	Noise Level (dBA) <sup>5</sup> Environment standards 2020	
	Day	Night
Industrial area	75	<b>65</b>
Mixed area	65	55
Sensitive area	<b>55</b>	<b>45</b>

**Table II-5: Effluent Standards for Treated Domestic Sewage Before Discharge to Surface Water**

Parameter	Unit	Guideline
pH	pH	6-9
Biological Oxygen Demand (BOD)	mg/l	30
Chemical Oxygen Demand (COD)	mg/l	125
Total nitrogen	mg/l	10
Total phosphorous	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Total coliform bacteria	MPN/100ml (most probable number)	400

**Table II-6: National Drinking Water Quality Standards**

Group	National Drinking Water Quality Standards, 2016 <sup>6</sup> (for Urban Drinking Water Supply)		
	Parameter	Unit	Maximum Concentration Limits
Physical	Turbidity	NTU	<b>5</b>
	pH	-	<b>6.5 – 8.5</b>
	Color (TCU)	Hazen Unit	<b>15</b>

<sup>5</sup> Taken from Environmental Standards, National Environment Commission, Royal Government of Bhutan, 2020 (no averaging period stipulated, usually taken as 24 hours)

<sup>6</sup> Taken from Bhutan Drinking Water Quality Standard, 2016, National Environment Commission, Royal Government of Bhutan, 8 March 2016.

Group	National Drinking Water Quality Standards, 2016 <sup>6</sup> (for Urban Drinking Water Supply)		
	Parameter	Unit	Maximum Concentration Limits
	Taste and Odor	-	Non- objectionable
Chemical	Iron	mg/l	0.3
	Manganese	mg/l	0.4
	Arsenic	mg/l	0.01
	Fluoride <sup>^</sup>	mg/l	1.5
	Lead	mg/l	0.01
	Nitrate	mg/l	50
	Calcium	mg/l	75
	Mercury	mg/l	0.006
	Residual Chlorine	mg/l	0.2 - 0.5
	Sulphate	mg/l	250
Microbiological	E-coli	CFU/100ml	0

**Table II-7: Motor vehicle emission standards**

Fuel Type	Vehicle registered prior to Jan 1, 2005	Vehicle registered after Jan 1, 2005	Vehicle registered prior to Jan 1, 2021	Vehicle registered after Jan 1, 2021 (Approval type: Euro 6/BS VI)
Petrol (%CO)	4.5%	4.0%	4.0%	0.5%
Diesel (%HSU)	75%	70%	70%	50%

**Table II-8: Vehicle noise level limits (Environmental standards 2020)**

Sl. #	Type of Vehicle	Noise level limits dB(A) <sup>7</sup>
	Two-Wheeler	
1.1	Displacement up to 80cc	75
1.2	Displacement more than 80cc but up to 175cc	77
1.3	Displacement more than 175cc	80
2	Vehicles used for carriage of passengers and capable of having not more than nine seats including the driver's seat	74
3	Vehicles used for carriage of passengers and capable of having more than nine seats, including the driver's seat and a maximum gross vehicle weight (GVW) of more than 3.5 tonnes	
3.1	With engine power less than 150 KW	78
3.2	With engine power more than 150 KW	80
4	Vehicles used for carriage of passengers and capable of having more than nine seats, including the driver's seat: vehicles used for carriage goods	
4.1	With maximum GVW not exceeding 2 tonnes	76
4.2	With maximum GVW greater than 3 tonnes but not exceeding 3.5 tonnes	77
4.3	Vehicles used for carriage of transport of goods with a maximum GVW exceeding 3.5 tonnes	
5.1	With engine power less than 75 KW	77
5.2	With engine power more than 75 KW or above but not less than 150 kv.	78

<sup>7</sup> Sound pressure level (SPL)

Source: Environmental Standards, National Environment Commission, Royal Government of Bhutan, November 2020

### **Environmental Assessment Guideline for Power TL Projects (2012)**

93. The first environmental assessment guideline was published in 1999 by the NECS for six sectors namely, mining, industries, hydropower, roads, forestry and power TLs. It was later revised in 2003 to make it more relevant to our Bhutanese context and in line with the EA Act 2000 and its regulation 2002. However, in 2012 it was proposed for revision and was revised and updated with financial assistance from Asian Development Bank (ADB). The guidelines are mainly intended to:

- Provide guidance and assistance to various stakeholders involved in the EA process;
- Assist the regulatory agency and EIA practitioners to understand the main areas of concern and use that understanding to enhance the quality of the EIA study and report;
- Inform the regulatory agency and EIA practitioners about the best environmental management practices in the TL sector;
- Assist the regulatory agency to better access the EIA report and arrive at a sound decision.

94. Though there is no separate guideline prepared for social impact assessment of energy projects, the Environment Guideline for Power TL 2012 includes sections on the scoping, impact assessment and mitigation of social impacts potentially attributed to TL development.

95. For SIA, there are provisions/clauses within the EA and NEPA addressing social impacts, and similarly, guidelines/regulations from DECC and DoFPS have provisions to address social impacts of Power Transmission and Distribution Lines. Specific regulations that address social aspects are the Land Acquisition and Compensation Rules and Regulations 2022 (LACRR 2022) which is already incorporated in this framework. Additionally, the Guideline for plot boundary realignment/reconfiguration 2021 endorsed by the National Land Commission is added below which contains specific section on land falling within transmission and distribution lines and spells out the provisions/requirements to qualify for private plot boundary realignment/reconfiguration. This guideline is used for BPC projects including TLs and Substations.

### **The Environmental Codes of Practice (ECP), Highways and Roads 2000**

96. The Environmental Codes of Practice (ECP), Highways and Roads 2000 align with Bhutanese Environmental Assessment Sectoral Guidelines for road projects. The ECOP outlines key environmental considerations and requirements for each phase of a project, from initial planning to ongoing operation and covers all aspects of road construction from feasibility studies, design, procurement, Construction and Supervision. It covers eleven broad areas including

97. Slope stability, Spoil Disposal, location of quarries, drainage, location and operation of workcamps, use of explosives, waste management and pollution control and air noise and water management and road use and safety. Table II-9 provides a summary of relevant legislation

**Table II-9: Summary of National Environmental Assessment Act and Related National and Local Legislations**

Regulation	Applicable Consent / Permit Requirement	Governing Agency	Remarks / Relevance to project	Implementation Phase	Responsibility
Bhutan Constitution 2008	Many relevant articles covering ensuring environmental and social measures	All agencies	Maintenance of 60% forest cover for all times to come, and ensuring people's right to work, avoidance of discrimination, exploitation and right to a safe and healthy environment	All phases	PMU, PIU, Contractor
Environmental Assessment Act 2000  Regulation for The Environmental Clearance of Projects (RECOP) 2016	Environment Clearance	DECC	Project is categorized as Red category requiring an EIA The project requires ESIA approval. Under this Act, the EIA of the project will be reviewed by DECC. The provisions of the EMP will be followed during project implementation to ensure compliance with this Act.	Design Phase / Pre-construction Phase	PMU
Environmental Assessment Guideline for Power TL Projects (2012) Environmental Standards 2020	Compliance with national environmental standards	DECC	The project will be required to comply with applicable standards. Applicable environmental standards for the project are ambient air, noise level limits, and drinking water quality. PMU will ensure compliance of Contractor(s) to applicable environmental standards during construction.	Construction Phase	Contractor
Cultural Heritage Bill of Bhutan 2016 and EA Act 2000	Consent and chance finds	Local Government and Dzongkhag, DCDD	The project must seek the consent of the local community in case any religious and cultural site is affected by the project. Chance Find Procedures are to be followed in case the need arises	Design Phase / Pre-construction Phase / Construction Phase / Operation Phase	PMU, PIU, Contractor
Waste Prevention and Management Act of Bhutan 2009 Waste Prevention and Management Regulation 2012 (amended 2016)	Waste disposal permit	DECC	The project will generate construction and general wastes during construction and operation phases. The project will comply with this Act and ensure waste segregation, collection, storage and disposal as per law and regulation.	Design Phase / Pre-construction Phase / Construction Phase / Operation Phase	PMU, PIU, Contractor
Water Act of Bhutan 2011 Water Regulation of Bhutan 2014 National Drinking Water Quality Standards, 2016	Water conservation	Local Community	The project will generate wastewater that could potentially impact the environment. No specific permit required, but any development project needs to comply with the provisions of this Act and regulation in terms of drinking water quality standards and minimizing impacts on water sources,		

Regulation	Applicable Consent / Permit Requirement	Governing Agency	Remarks / Relevance to project	Implementation Phase	Responsibility
Forest and Nature Conservation Act 2023 and Regulation 2022	Forest Clearances Compensation for community forest		The TL will originate at the multipurpose zone of the Wangchuk Centennial Park. Also, the TL will require removal of vegetation for which forest clearance is mandatory. The Project will also consult and collaborate with DoFPS for appropriate mitigation measures		
Labour and Employment Act (LEA) 2007 Regulation on Working Conditions 2022 Regulation on Occupational Health, Safety and Welfare 2022 Regulation on Occupational Health and Safety for the Construction Industry 2022	Foreign worker permit  lays out obligations and rights of Employers	Department of Labor	The project will involve contractors and workers and must ensure that Contractor(s) comply with the relevant provisions of this Act and Regulations from worker recruitment, risk assessment, and provision of OHS measures and promotion of a safe work environment, while minimizing risks to communities.	Design Phase / Pre-construction Phase / Construction Phase / Operation Phase	PMU, PIU, Contractor,
Safety Code 2021	Compliance with safety code	DOL and BPC	Contractor(s) will comply with the safety code.	Construction Phase / Operation Phase	PMU, PIU, Contractor,
Road Safety and Transport Act 1999 and Road Safety and Transport Regulations 2021	Clearance from the DoST is required for takeoff from highways	BCTA	Access roads from to the towers will be taken from farm roads and highways. Accordingly, the required clearance will be sought from the Dzongkhag and DoST for the same. Also, material transporters and the contractor will be required to follow regulations regarding speed limits, licenses, maximum carriage for vehicles and restrictions on driving while intoxicated or use psychotropic substances	Design Phase / Pre-construction Phase / Construction Phase / Operation Phase	PMU, PIU, Contractor,
Disaster Management Act of Bhutan 2013		District and Local Government, Department of Local Government and Disaster Management	The project must collaborate with both district and central government in case of a disaster or emergency	Design Phase / Pre-construction Phase / Construction Phase / Operation Phase	PMU, PIU, Contractor,
Land Act 2007 and Land Acquisition and	Consent and compensation	Local Government, NLCS	The TL and transmission towers will fall on private land for which compensation must be	Design Phase / Pre-construction Phase	PMU

<b>Regulation</b>	<b>Applicable Consent / Permit Requirement</b>	<b>Governing Agency</b>	<b>Remarks / Relevance to project</b>	<b>Implementation Phase</b>	<b>Responsibility</b>
Compensation Rules and Regulations 2022			paid to the landowners and their consent secured.		
Local Government Act of Bhutan 2009	Consent and collaboration	Local Government and District	Considering that subprojects are located in districts, the local government will be consulted and the requisite approval from the LG sought.	Design Phase / Pre-construction, Construction and Operation Phase	PMU

#### D. Prior National Approvals and Consents

98. Social Clearances from the community for project implementation have been received (refer table V-4 Permits relevant to the Project). These include

- Clearance from Community Forest Management Groups (CFMGs)
- Clearance from the project affected persons whose land is impacted.
- Community clearance for the project

99. Pending clearances include:

- Environmental Clearance from the Department of Environment and Climate Change – The ESIA has been submitted to the DECC for review and approval in January 2026 and under process.
- Forestry clearance from Department of Forest and Park Services. The application was submitted in December 2025 and is currently under process.
- Clearance from DOST where access roads need to take off from an existing highway or Dzongkhag Road. This is expected to be submitted in March 2026.
- Clearance from the Department of Culture and Dzongkhag Development in case there are religious and cultural sites in the vicinity (30 -50m) of the project.

#### E. Applicable International Agreements

100. Bhutan is not a signatory to all Multilateral Environmental Agreements or the core labor standards of the International Labor Organization. The applicability of relevant international conventions/agreements is described in Table II-10.

**Table II-10: Applicability of International agreements ratified by Bhutan**

#	International convention	Date of ratification or accession	Applicability to the project
1	Convention on Biological Diversity (1992)	August 1995	Applicable as the TL will have a direct impact on habitats and biodiversity.
2	Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington 1973) – also known as CITES	August 2002	Not applicable as there will be no extraction, sale, import or export of fauna and flora
3	The Nagoya Protocol	September 2013	This Protocol is not applicable because the project does not involve commercial research, export of biological material or use of genetic resources.
4	International Plant Protection Convention (IPPC)	June 1994	Species that may be invasive should be assessed, monitored and managed, if necessary, according to IPPC provisions
5	Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris 1972)	October 2001	Proximity to heritage sites and maintenance of a minimum distance (50-100m) from heritage and cultural sites will

#	International convention	Date of ratification or accession	Applicability to the project
			be followed. As required under national processes, the clearance from the Department of Culture and Dzongkhag Development will be secured for sites of national significance and community clearance for sites of community significance
6	Convention on Safeguarding of the Intangible Cultural Heritage	October 2005	The project gewogs have Intangible practices such as religious festivals and traditional practices. The project is not expected to directly affect intangible practices, the project incorporates measures to ensure that impacts are minimized by contractors and workers
7	Vienna Convention for the Protection of the Ozone Layer	August 2004	By promoting renewable energy, the project contributes to reduction in GHG emissions and protection of the ozone layer and mitigation of climate change
8	UN Framework Convention on Climate Change	August 1995	The project directly supports Bhutan's Climate mitigation and resilience commitments of the convention, through enabling expansion of renewable energy.
9	Kyoto Protocol to the United Nations Framework Convention on Climate Change	August 2002	Bhutan has committed to remain carbon neutral, and to keep greenhouse gas (GHG) emissions less than the sequestration capacity of its forests for all times. The project will include measures to compensate for the loss of forest cover.
10	Montreal Protocol on Substances that Deplete the Ozone Layer	April 2004	The ESIA process takes into consideration compliance with this agreement, ensuring that the project follow DECC requirements, including prohibition on the use of ozone-depleting substances
11	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	August 2002	The export of hazardous waste is subject to the prior written consent of the country of import and is applicable to the project
12	United Nations Convention to Combat Desertification	August 2003	The implementation of renewable energy is supported. Compensatory afforestation to mitigate forest clearance will be applied.
13	The Cartagena Protocol on Biosafety to the UN Convention on Biological Diversity	September 2002	Not relevant to the project as no LMOs or genetically modified plants will be used for the project.

## F. Gaps in Legal and Guiding Instruments

101. There are some minor areas where the national legal system could be further strengthened as summarized below.

### **National environmental assessment procedure.**

102. National procedures are sufficiently robust to ensure that developmental activities, such as the construction of the TL and its associated facilities avoid impacting sensitive or critical habitats, ecosystems, rare or endangered species, religious and cultural sites, or involving large-scale resource extraction. This avoidance is secured from the initial screening stage through the forest clearance process and the mandatory requirement for seeking consent from affected parties, owners, or the community. Nevertheless, there are minor areas where the national legal system could be further strengthened.

### **Standards**

103. ADB requires the project to comply with not just national but international standards such as the concept of indigenous peoples is missing in the Constitution. However, the Constitution guarantees diversity as it provisions that people can be different based on ethnic group, language etc. To define existing diversity among the people of Bhutan, the generally accepted term in the country is 'socio-cultural groups'.

**Table II-11: Comparison of ADB SPS Requirements and National Environmental Regulations**

No.	ADB SPS Principles	National requirements	Extent of Equivalence or Gaps	Gap-filling Measures
1	During the project identification phase, ADB uses a categorization system to indicate the significance of potential environmental and social risks and impacts. Such categorization is determined by the projects most sensitive component and includes direct, indirect, cumulative, and induced impacts within the project's area of influence	<p>Projects are screened into Green, Blue and Red categories that determine whether the level of environmental assessment</p> <p>The Environmental Assessment Guidelines 2012 provide guidance for EIA practitioners and regulatory agencies, covering stages like scoping, baseline data collection, impact assessment, mitigation, and environmental management plans. The Regulation for Environmental Clearance of Projects (RECOP) 2016 sets the timeline for EC decisions, with 40 working days for Blue (IEE level) and 170 working days for Red (EIA level) projects.</p>	There are no specific requirements to minimize impacts aside from ESIA. BPC has their criteria for feasibility studies.	During the project/subproject selection, BPC will examine alternatives to avoid and minimize the IR and IP impacts. Any unavoidable impact shall be mitigated and compensated as per ADB SPS and national legislation
2	Conduct environmental assessment	<p>Green project – No environmental assessment</p> <p>Blue project- initial environmental examination (EIA) is required</p> <p>Red project- environmental impact assessment (EIA) is required</p>	No gaps	None required
3	Examination of project alternatives	Under RECOP, Annex 3, Sections 6 and 8, the project must provide a detailed analysis of the negative and positive impacts of the proposed project and its alternatives including the “alternative of not undertaking the project”.	No gaps	None required
4	EMP preparation is part of the EIA Process	<p>The Environmental Assessment Act (EAA) provides for the formulation of environmental management plans (EMPs). The EMPs must identify environmental risks and address means of avoiding or minimizing adverse impacts (including direct, indirect and cumulative effects) and enhancing positive impacts. Applicants must also set out a monitoring program (both baseline and compliance monitoring) and are responsible for all project monitoring. Project monitoring is undertaken by the Competent Authority (CA) or ECC</p> <p>The RECOP provides that: (i) “the CA shall be responsible for monitoring compliance” for</p>	No gaps	None required

No.	ADB SPS Principles	National requirements	Extent of Equivalence or Gaps	Gap-filling Measures
		<p>projects requiring development consent and environmental clearance (EC), and (ii) the Secretariat [DECC] shall monitor projects “that do not require development consent”.</p>		
5	<p>Conduct meaningful consultation with affected people</p>	<p>Public consultation is mandatory for any EIA. Under the EAA, applicants have a duty to inform and consult with “concerned people” and organizations before submitting the environmental assessment documents to the CA where the project is classified as a “significant project”. DECC or the CA is authorized to “ensure that concerned people are given adequate opportunity to express their views on the project and that their views are adequately taken into account.”</p>	<p>No gaps</p>	<p>None required</p>
6	<p>EMP implementation and monitoring (with corrective actions, when needed)</p>	<p>The EAA mentions that Applicants must [also] set out a monitoring program (both baseline and compliance monitoring) and are responsible for all project monitoring (project monitoring is undertaken by CA or DECC).</p> <p>RECOP requires that EMPs include the proposed mitigation measures, the need to budget mitigation measures, supervision, monitoring and evaluation requirements for the construction, operation and maintenance phases of the project cycle.</p> <p>RECOP provides that: (i) “the CA shall be responsible for monitoring compliance” for projects requiring development consent and EC, and (ii) the Secretariat [of DECC] shall monitor projects “that do not require development consent”.</p> <p>The Environmental Assessment Act states that “compliance monitoring of projects” is undertaken by the Secretariat [of DECC]...on becoming aware of non-compliance with the terms or other activities related to a project that may be dangerous to the environment.”</p>	<p>EMPs are not normally included in Contractor’s contracts to ensure implementation of EMPs.</p>	<p>The project will include EMP into Contracts and ensure compliance monitoring and submission of environmental monitoring reports.</p>

No.	ADB SPS Principles	National requirements	Extent of Equivalence or Gaps	Gap-filling Measures
7	<p>Establish Grievance Redress Mechanism (GRM)</p>	<p>Different agencies have different GRMs.</p>	<p>Partial gap due to lack of specific guidelines for projects.</p>	<p>The project will establish a GRM procedure while including the option for access to country's legal system independently and regardless of the outcome of the project GRM process.</p>
8	<p>Appropriate public disclosure of EIA and EMP</p> <p>A draft full EIA, including the draft EMP, must be disclosed on the ADB website at least 120 days prior to ADB Board consideration. The final EIA as well as any updates or corrective action plans prepared during implementation, must be disclosed upon receipt.</p> <p>Disclosure process must be appropriate, accessible and understandable and must be a continuous process. Environmental monitoring reports are also to be disclosed within two weeks of ADB clearance.</p>	<p>Not mandatory to disclose, but documents are available in relevant government agencies.</p>	<p>Partial gap due to lack of specific directives or guidelines requiring mandatory disclosure of environmental assessment documents.</p>	<p>The project will follow ADB disclosure requirements</p>
9	<p>Unanticipated Impacts-</p> <p>If unanticipated environmental or social impacts become apparent, the borrower or client is required to update the environmental assessment and environmental management plan (EMP) or prepare new one. To address these new impacts effectively, the updated assessments and plans must assess the potential impacts that have emerged, evaluate alternatives to address these new risks and outline mitigation measures and the resources necessary to implement them</p>	<p>Unanticipated impacts must be reported to the DECC and appropriate measures must be incorporated</p>	<p>Partial gap due to the need to update the Emp and reporting requirements</p>	<p>If unanticipated environmental impacts become apparent after the EIA has been cleared by ADB, BPC must inform ADB, undertake meaningful consultations, and update the environmental assessment and EMP or prepare a new environmental assessment and EMP to assess the potential impacts, evaluate the alternatives, and outline mitigation measures and resources to address those impacts. These documents need to be cleared and disclosed before the related works start or are cleared to continue work.</p>
10	<p>Apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such</p>	<p>The DECC sets the permissible emission standards for a) ambient water quality, Industrial Effluent Discharge Standard, Sewage Treatment Plant (STP) Discharge</p>	<p>No gaps in terms of availability of standards in the country. However, the</p>	<p>To ensure equivalence, the Project should:</p> <p>(i) comply with the stricter internationally recognized</p>

No.	ADB SPS Principles	National requirements	Extent of Equivalence or Gaps	Gap-filling Measures
	<p>as the World Bank Group's Environmental, Health and Safety Guidelines. Adopt cleaner production processes and good energy efficiency practices.</p> <p>The policy prioritizes the modification, substitution, or elimination of hazardous conditions or substances.</p> <p>Where avoidance is not possible, borrowers must provide appropriate personal protective equipment, enforce its use, and train workers while providing incentives for them to comply with health and safety procedures</p> <p>Borrowers are required to have emergency prevention, preparedness, and response arrangements in place and to document and report occupational accidents, diseases, and incidents</p>	<p>Standards, Ambient Air Quality, Workplace Emission Standards, Vehicular Emission and Noise Limit Standards, Noise Level Limits but monitoring is not mandatory for construction</p> <p>The Vehicle fitness test must be done annually by the vehicle owner. The agency responsible for this is Bhutan Construction and Transport Authority</p>	<p>implementation of regulations pertaining to these standards is an issue. Further, the values of the national standards are less strict than the internationally recognized standard values.</p> <p>Partial gap in terms of the legislation having no explicit requirement for adopting cleaner processes and good energy efficiency practices, although it might be considered implicit in the legislation</p>	<p>standards or provide justification if the option under the Project is to use the national standards; and</p> <p>(ii) require the adoption of cleaner technologies and energy efficiency measures, reporting and documentation</p>
11	Safe working conditions	<p>The Labour and Employment Act, 2007 and the regulations govern and worker recruitment, employment and Occupational health and safety (OHS), including physical or mental health problems related to work. While not an ILO member, the Act and regulation reflect key ILO principles. There are detailed requirements for contractors to follow to ensure the safety, health and welfare for employees and other persons at workplaces.</p>	<p>There are no special provisions for community workers who may be employed by the project.</p>	<p>subcontractors and third parties, irrespective of being formally or informally employed by them, will also comply with the CEMP, the Labour Management Plan and the Health and Safety Management Plan</p>
12	<p>The ADB Safeguard Policy Statement (2009) 8 requires borrowers to site and design the project to avoid significant damage to physical cultural resources. Such resources likely to be affected by the project will be identified, and qualified and experienced experts will assess the project's potential impacts on these</p>	<p>The Cultural Heritage Act of Bhutan (2016), requires that entities undertaking any development activity within an area that includes cultural elements must first obtain consent from the local community associated with that cultural element, before approaching the Dzongkhag for a development permit.</p>	<p>No gaps, BPC criteria for selecting the TL alignment includes avoidance of PCR</p>	<p>The project will institute a step-by-step approach for chance finds</p>

No.	ADB SPS Principles	National requirements	Extent of Equivalence or Gaps	Gap-filling Measures
	resources using field-based surveys as an integral part of the ESIA process.	Any valuable cultural property discovered must be immediately reported to the Department of Culture, Ministry of Home and Cultural through the concerned Dzongkhag.		

### III. DESCRIPTION OF THE PROJECT

#### A. Project Location

104. Located in Bumthang District, the project involves the construction of a 17.33km TL to evacuate the power from the Wobthang Solar Farm implemented by DGPC. After exploring a number of alternatives based on the assessment of social, economic and environmental impacts, the proposed route extends across two Gewogs i.e., Tang and Choekhor. The map below illustrates the location of the TL (TL).

105. The power generated from the Wobthang Solar Farm Project will be evacuated through a 132 kV double-circuit TL on double-circuit towers. The primary objective of the proposed TL is mainly:

- Reinforce the eastern and western region TL connectivity.
- Strengthen the resilience and reliability of the electricity in the eastern regions.
- To support other development activities in the region.
- To facilitate power evacuation from the Wobtang Solar farm
- Reinforce the eastern and western region TL connectivity.
- Strengthen the resilience and reliability of the electricity in the eastern regions.
- To support other development activities in the region.

106. The area's terrain features deep valleys, steep slopes, and bushes, interspersed with patches of temperate coniferous forests. The proposed route passes through state reserved forest, community forest, small streams, roads, and varied landscapes. The TL originates from Wobthang, Tang Gewog in Bumthang Dzongkhag and terminates at Garpang in the same district. The alignment traverses Bumthang Dzongkhag, covering a total length of approximately 17.33 km with 57 transmission towers. The route covers the Gewogs of Tang, and Choekhor.

#### TL Alignment

107. Selecting the most feasible route for the 132 kV TL alignment utilized an expansive array of information gathered during the development of the feasibility study and consideration of BPC's technical requirements and practices. Six primary factors to support decision making are discussed below.

- Economy- The survey aimed to minimize project costs and environmental impact by following the "Bee-Line" (shortest path) determined via Google Maps wherever possible. To achieve economic efficiency, the route was aligned to avoid private lands, settlements, monuments, and steep terrain, thereby reducing potential compensation costs and construction difficulties
- Construction Feasibility - Due to Bhutan's challenging geographical landscape, the alignment was strategically planned to leverage existing infrastructure, such as highways, farm roads, and old footpaths. Key construction considerations included:

Figure III-1: Map indicating project location



Source: Election Commission of Bhutan (ECB) Gyalyong Tshogdu Demkhong – Bumthang Dzongkhag (<https://www.ecb.bt>)

- Minimizing tree cutting, especially in long, deep valleys.
- Avoiding steep or inaccessible terrains.
- Ensuring the availability of logistical support, including water, sand, aggregates, ropeway options, and communication networks.
- Operation and Maintenance (O&M)- To ensure effective maintenance during routine operations and unforeseen emergencies, the route avoids steep and inaccessible corridors. Instead, the alignment follows highways or remains accessible via farm roads and footpaths to facilitate easy access for maintenance teams.
- Environmental Impact -The route was aligned to minimize disturbances to biological corridors, natural forests, community forests, and habitats of endangered plant and wildlife species. Protected and reserved forest areas were avoided where possible, or traversed with minimal tree cutting. This approach is intended to streamline the Environmental Impact Assessment (EIA) study and expedite the process of obtaining environmental clearance.
- Social Impact - The survey sought to minimize the impact on local communities by avoiding specific sensitive areas in consultation with Local Authorities. These areas include:
  - Private land and settlement areas.
  - Drinking and irrigation water sources.
  - Educational and religious institutions, as well as sacred religious sites.
- Stability of the Corridor - The survey team assessed geological stability to mitigate risks to tower foundations. They avoided geologically disturbed areas, unstable grounds, and flood-prone zones. This assessment involved both visual inspection and the gathering of historical information from local residents regarding the terrain.

## **B. Project Components**

### **TL Composition and Design**

108. The proposed 132 kV double-circuit TL extends for approximately 17.33 km, traversing the Tang and Chhoekhor Gewogs. The basic design of the TL features a total of two circuits. Using a standard tower design, BPC opts for a configuration suited for general purposes. The selected standard tower, conforming to 132kV specifications, integrates vertical phase conductors comprised of Aluminum Conductor Steel Reinforced (ACSR), a common choice within Bhutan. Atop the tower, a single ground wire is positioned, serving dual roles for grounding and communication, utilizing Optical Ground Wire (OPGW) technology.

109. To streamline construction and maintenance, the project adopts Composite Insulators, renowned for their lightweight nature, over traditional disk insulators. Additionally, arcing horns are strategically installed to safeguard against insulator damage during lightning strikes. To mitigate wind-induced vibration damage, stock bridge vibration dampers are affixed to both phase and ground wires.

110. The right-of-way (ROW) width for the 132kV TL is 27m. Notably, the necessity for clearing of vegetation within the ROW during construction is not compulsory but may be required

depending on the ground realities during construction. Vegetation clearance, if required, is conducted selectively, addressing only those instances where it directly impedes construction activities.

**Table III-1: Salient features of the TL**

SN.	Features	Description	Remarks
1.	Tower		
	a.	Nos. of tower	57
	b.	DE tower	2
	c.	Type of tower	Tension Tower
	d.	Tower Height	NT: 37.8m to 39.1m / SPL:51.075m
	e.	Foundation depth	3.05m
	f.	Foundation type	Normal Dry Soil (NDR)/Dry Fissured Rocks (NDR)
2.	Conductor		
	a.	Type of conductor	ACSR Panther
	b.	stranding wire	AL:30/3mm & St.:7/3mm
	c.	Ambient temperature	32 degrees
	d.	Max. operating temperature	75 degrees
3.	Clearance		
	A	Ground clearance	6.4m
	i	Vertical	4.58m
	ii	Horizontal	2.75m
	B	Line crossing clearance	
	i	11Kv	2.44m
	ii	33kV	2.44m
	iii	66kV	2.44m
	iv	132kV	3.05m
	v	220kV	4.58m
4	Telecommunication Line	2.75m	
5	RoW	13.5m on either side from CL of tower	

111. The TL is divided into 19 sections with variable lengths defined by specific Angle Points (towers).

- Tang Gewog: The majority of the route runs through this Gewog, covering 16.22 km. This includes Sections 1 through 16 (AP-1 to AP-49) which are exclusively within Tang. Section 17 (AP-49 to AP-52) is spread over both Tang and Chokhor Gewog
- Chokhor Gewog: The final segment covers 1.11 km and includes the end of Section 17, Section 18 (AP-52 to AP-54) and Section 19 (AP-54 to AP-57), which terminates at the Garpang Substation.

112. Salient features and land use along the TL is detailed in Appendix 1-1 and 1-2.

### Transmission Towers

113. The total estimated towers to be installed along the proposed 17.33 km TL route is 57 towers after maintaining the nominal ruling span of 250 m for 132 kV PTL. However, the minimum

and maximum span between any two towers for the project may vary depending on the topography of the terrain and towers shall be spotted within the tower design parameters (tower spotting data) of the 132 kV towers.

114. The first transmission tower is located at 289437 Easting 3058182 Northing at 2963m while the last one is at 281285.00 easting and 3045806.00 northing at 2610m. The transmission towers along the project route are strategically distributed across diverse geographical locations and span lengths, reflecting the topographical and technical requirements of the corridor. Each tower type was selected to optimize structural stability, ensure safe clearance, and accommodate terrain variations such as rivers, valleys, and elevated sections. The highest tower (AP-15) is at 3275m while the lowest tower (AP-56) is at 2580m. Depending on their sections, towers are located in Community Forest (AP-2: Garablung community forest, AP-39 -AP-45 in Phomrong community forest. Details on the TLs and tower locations are provided in Appendix 1-2.

### **Substation**

115. The 33/11kV Substation at Garpang, Bumthang was completed in 2008 to strengthen the distribution system of Bumthang Dzongkhag. The Substation has 2 33kV incoming feeder lines from the Yurmoo and Kewathang Substations under Trongsa Dzongkhag. Similarly, there are 6 outgoing feeders of 33kV and 11kV lines provide power to the four gewogs/blocks under Bumthang Dzongkhag. The substation is operated and maintained by the Electricity Service Division, BPC, Bumthang.

### **Future upgradation**

116. In line with the new renewable energy roadmap developed by DoE, MoENR, the Garpang Substation will be upgraded to a Pooling Station for the upcoming solar projects namely 29 MW Tharpaling and 33MW Pedseling including the 120 MW Wobthang solar farms. Moreover, it will also pool in the power generated from upcoming hydropower projects such as Chamkharchu IV and connect the existing 400kV Mangdechu TL system. The upgradation works are included within BPC's next five-year investment plan 2026-2030 although designs nor alignments were developed or confirmed at the time of writing. A Single Line Diagram (SLD) is provided for visual representation in Figure III-3.

### **Associated and Existing Facilities**

117. The Associated facilities for the project include Druk Green Power Corporation's 120 MW Wobthang Solar Project which will evacuate power through the Garpang Substation, located in Bumthang Dzongkhag. An IEE aligned with national and ADB requirements has been developed and disclosed for Wobthang Solar Project<sup>9</sup>.

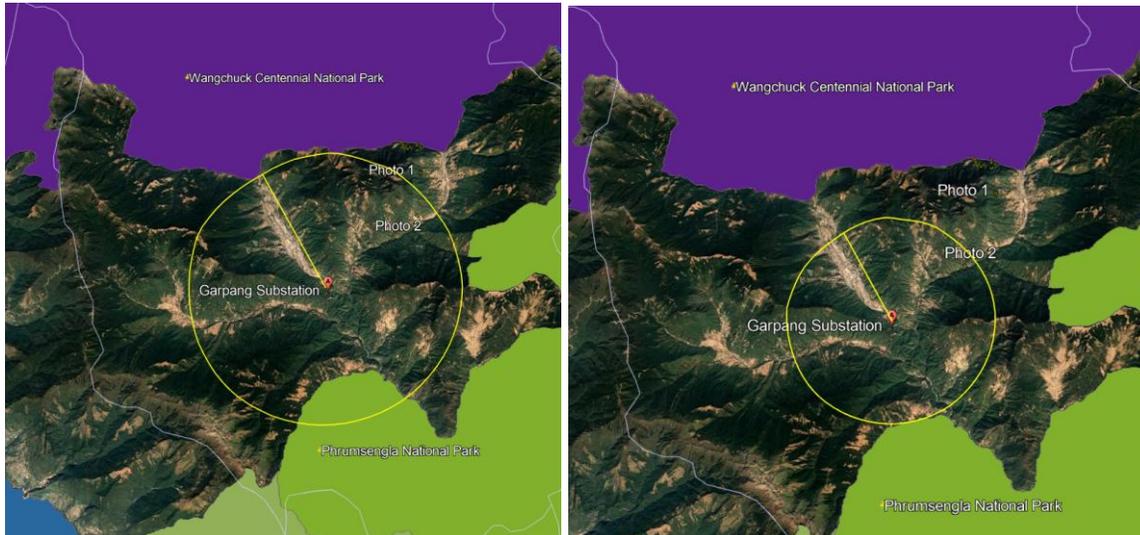
118. The 33/11kV Substation at Garpang, was constructed in 2008 to strengthen the distribution system of Bumthang Dzongkhag. The facility was designed to stabilize and strengthen the distribution network within the region. It currently serves as the primary energy hub for the four gewogs of Bumthang, ensuring reliable power supply for local residential, commercial, and administrative needs. The station receives power from two 33kV incoming lines originating from the Yurmoo and Kewathang Substations in Trongsa Dzongkhag, providing N-1 redundancy for

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<sup>9</sup> <https://www.adb.org/projects/documents/bhu-58265-001-iee>

the regional grid. There are 6 outgoing feeders of 33kV and 11kV lines that provide power to the four gewogs/blocks under Bumthang Dzongkhag.

**Figure III-2: Location of Garpang substation at a distance of 11.2km from WCNP and 7.6km from PNP.**



**Source:** Google Maps; DoFPS Protected Area kmz file (2025). Prepared by Consultant.

119. Future expansion. In alignment with the National Energy Policy 2025 and the Renewable Energy Roadmap (Department of Energy, MoENR), Garpang Substation is slated for a strategic technical transformation. It will evolve from a local distribution hub into a high-capacity Regional Pooling Station. This upgrade is essential to facilitate the evacuation of a significant renewable energy cluster for future solar projects in addition to 120 MW Wobthang Solar Farm (29 MW Tharpaling Solar Project, and the 33 MW Pedseling Solar Project and evacuating power from the upcoming Chamkharchu IV Hydropower Project).

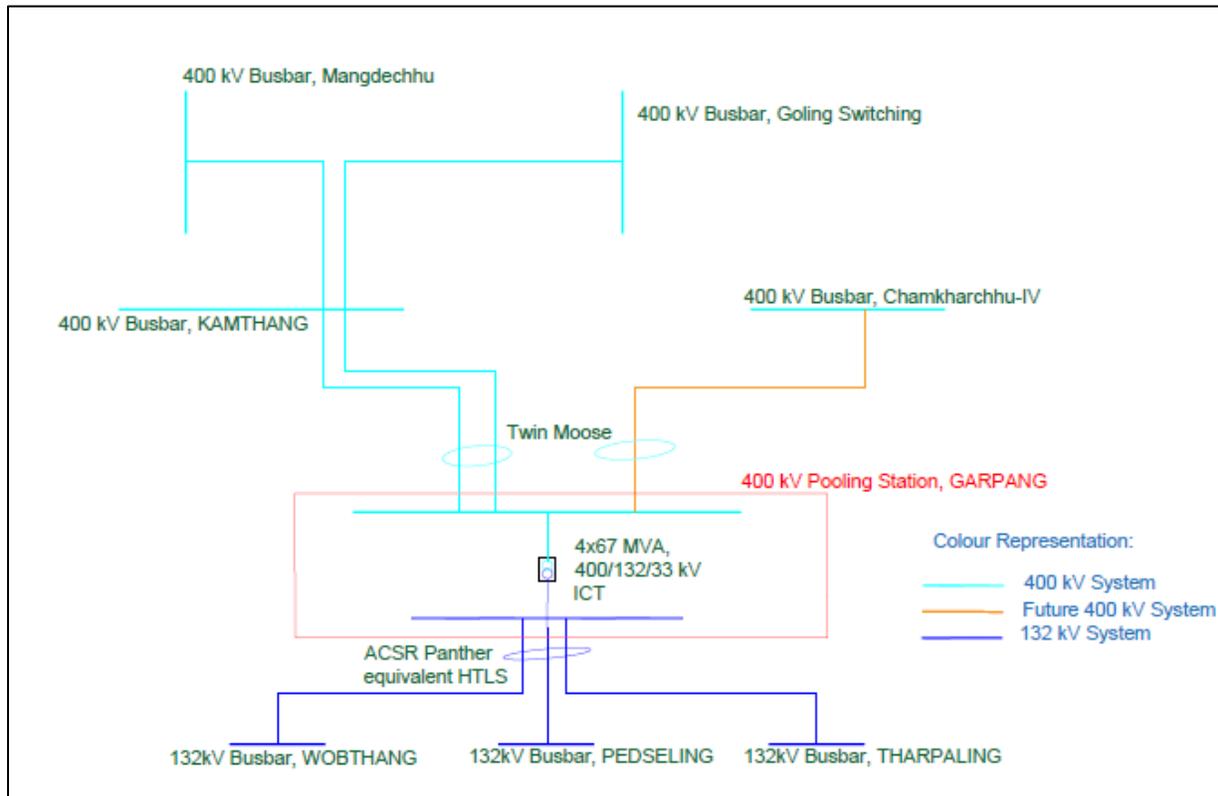
120. BPC is certified in ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018 with a dedicated Safety and Quality Unit (SQU) under the Corporate Strategy Division responsible for all related functions including internal compliance audits. The SQU carries out ISO auditing for BPC's QMS, EMS and OHSMS requirements annually. The last ISO audit for the 33/11kV Garpang Substation was carried out in 2022 and can be found in Appendix 3-1. Future ISO auditing is scheduled in the second quarter of 2026.

121. Appendix 3-2 presents an environmental audit of the Garpang Substation in Choekhor, Bumthang. The audit was conducted by the TA Consultant on February 20<sup>th</sup> (2026) to determine whether the substation is being operated in accordance with ADB's environment safeguard principles and requirements, to identify any past and present inadequacies in environmental, occupational and community health and safety management, to determine the need for corrective actions to bring the existing facility into compliance, and to recommend actions to be taken to improve and strengthen the substation's environmental, health and safety management. During the site visit, visual inspections were made, and interviews were conducted with the substation staff, and follow-up information was sought from the EGSS at Thimphu. Observations were made on key criteria: a) general management, b) waste management practices, c) hazardous waste

management, d) health and safety management, e) Emergencies and f) community health and safety. These criteria were translated into a checklist used to guide the audit.

122. Although overall the substation appeared to adequately apply BPC management systems, procedures, and guidelines, BPC staff appear to be adequately trained, and a GRM is in place, the audit has recommended a series of corrective actions to enhance site management. The CAP includes strengthening emergency response procedures, reviewing current bunding of transformers, enhancing the medical first aid response, and assessing the adequacy of fire equipment. Corrective actions are to be implemented within June 2026 with funds from BPC.

**Figure III-3: Single Line Diagram**



Source: Bhutan Power Corporation, 2025

**Photo II- Distant and close up view of Garpang Substation**



**Photo III- 1:Outdoor switchyard facilities Photo III- 2:indoor switchgear control room**



### **Access Roads**

123. The rugged and remote nature of several tower locations makes the construction of new access roads unavoidable. Consequently, 14 new access roads, totaling 19.2 km in length, will be constructed. These roads are vital for both the safe transportation of construction materials and to facilitate the necessary construction activities, as many sites currently lack viable access. To minimize environmental impact, the project's initial strategy for transporting heavy machinery and materials from staging areas to the TL Right-of-Way (RoW) work fronts will utilize existing infrastructure, including highways, farm roads, and feeder roads. All new routes will adhere to the specifications outlined in the *Road Classification and Network Information System, DoR, 2020*.

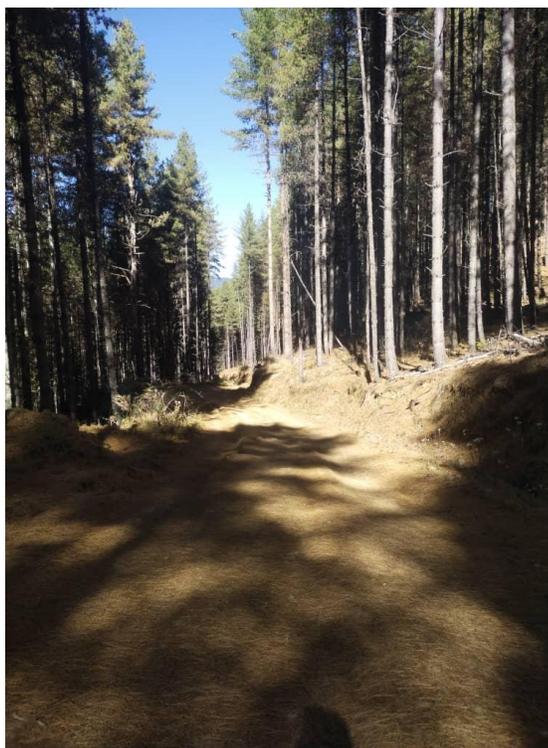
124. The roads will cross through 4.6ha of blue pine, 1.5ha of mixed conifer forest, 0.73 acres of shrub vegetation, 0.54 acres of meadows and very little broadleaf forest (0.004ha) and

settlement (0.05ha). Wherever possible, the roads have been aligned within the TL RoW, (1.5ha overlap between the Roads and TL RoW). Beyond the RoW, the roads alignment will traverse 6.7ha of land.

**Photo III- 3: Farm Road (Pangshing village) Photo III-4: Take off point-Trongsa to Bumthang highway**

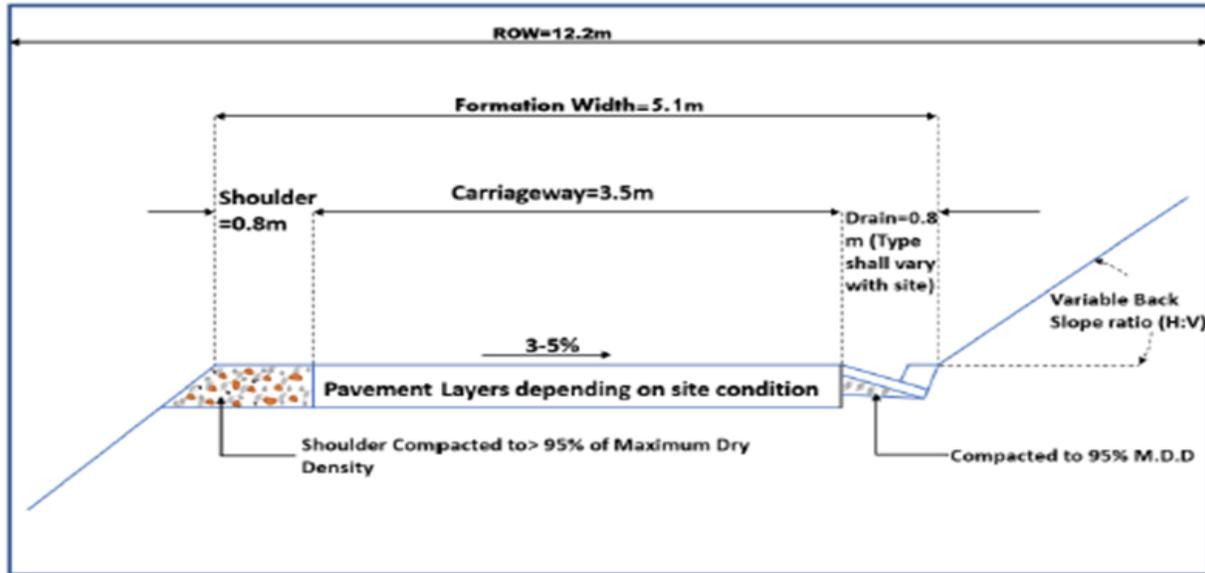


**Photo III- 5: Road take-off point, Dorjitse Lhakhang road Photo III-6: Joke village top**



125. The road will be designed as per the design standards for farm roads as set by the Department of Surface Transport<sup>10</sup>. The typical cross of the road is depicted in .

**Figure III-4:** MA typical cross section of a farm road (Source: DOR. 2020. Road Classification and Network Information System)



**Figure III-5:** Cross section of a farm road



(Source: DOR. 2020. Road Classification and Network Information System)

<sup>10</sup> DOR. 2020. Road Classification and Network Information System.

## Extended TL

126. The TL will evacuate power up to Garpang substation. From Garpang, the power will be evacuated through a 400kV D/C TL connecting to the existing 400kV D/C Mangdechu TLs through a Loop In Loop Out (LILO) arrangement, terminating to the existing Mangdechu Powerhouse Substation at Yurmoo under Trongsa Dzongkhag. The project is scheduled for construction in 2027 and budgeted in BPC's Five-Year Investment Plan 2026-2030.

127. As the National Energy Policy 2025 was only approved in Jun 2025, currently, there is no definitive plan on the alignment of TLs and no feasibility studies have been carried out to date.

128. ADB's Safeguard Policy Statement and Bhutan's national regulatory framework are broadly aligned. Accordingly, in the future, any expansion or upgradation of the Garpang Substation and associated transmission infrastructure will be subject to the applicable national approval and due diligence processes. BPC will avoid the acquisition of private land to the extent feasible. Where land acquisition becomes unavoidable, it will be undertaken in accordance with prevailing laws, rules, and regulations, including provisions for compensation, resettlement, and consultation with affected persons. Similarly, impacts on natural habitats will be avoided as far as practicable. Where new TLs or facilities are required, environmental assessments and biodiversity surveys, including avifaunal and seasonal ecological surveys, will be conducted to identify and avoid sensitive and critical habitats. Based on the outcomes of these assessments, appropriate mitigation measures will be incorporated into project planning, budgeted, and implemented.

## Contractor Facilities and Worker Camps

129. For the project, worker camps will be established on a shifting basis along the construction site, with the exact locations to be finalized by the EPC contractors. Sites for contractors' facilities and worker camps will be identified by the Project Management, the Gewog and the contractor. The suitability of sites will take into consideration proximity to the project site, avoiding or minimizing forest clearance, accessibility to access roads, and sources of water and electricity. Preference will be given to disturbed, degraded or non-productive land

## Water Requirement for the Project

130. Water requirement for the project has been estimated based on IS 1172 (1993), which specifies that for communities with populations less than 20,000 and with service connections to homes, the average water consumption is 70 m<sup>3</sup>/day. For laborer accommodation, water is required for domestic purposes such as drinking, cooking, and washing. For a workforce of 25 laborers, domestic water consumption is calculated to be 1.75 m<sup>3</sup>/day. In addition, water is needed for dust suppression, estimated to be 2 m<sup>3</sup>/day for the site, and for foundation works, including concrete casting, estimated at 6.4 m<sup>3</sup>/day per tower.

**Table III-1: Estimated Water Requirement per Day during Construction Phase**

S.No	Parameter	Quantity	Unit	Equivalent in barrels (200 L each)
1	Daily domestic consumption (25 × 0.07)	1.75	m <sup>3</sup> /day	9 barrels
2	Dust suppression	2.0	m <sup>3</sup> /day	10 barrels

3	Foundation works (per tower)	6.4	m <sup>3</sup> /day	32 barrels
4	Total Daily Requirement	10.15	m <sup>3</sup> /day	51 barrels

131. The contractor may prefer to carry sintex tanks (smallest is 1000L) to store the water at site rather than use 51 barrels. Also, if the source of the water is nearby, the need for tanks will be lower.

### **Construction Power Requirements**

132. Contractors are likely to use diesel power equipment for casting cement and diesel generators for lighting purposes.

### **Manpower Requirements**

133. Manpower requirements for the construction phase have been estimated based on the nature of activities, construction methodology, terrain conditions, and productivity norms. Construction and installation works will be carried out by specialized teams deployed at different work fronts, with manpower mobilized in a phased manner to match the construction sequence. Each active construction site will typically engage up to 25 workers, with team sizes varying by activity. Surveying and geo-investigation works will be undertaken by small, skilled teams of 3–9 personnel, while foundation excavation, benching, and foundation installation will require 6–15 workers depending on access conditions and whether materials are transported by head-loading or trucks. Tower assembly and erection activities will involve approximately 10 workers per tower, while stringing operations will require larger crews of 10–15 workers per section, particularly during rough and final sagging stages. Additional labor will be deployed for earthing works, clean-up, and site restoration activities. Manpower deployment across multiple activities will occur concurrently at different locations along the TL alignment, with workforce size adjusted based on terrain, accessibility, and construction progress, ensuring efficient execution while minimizing environmental and social disturbance.

### **Construction materials**

134. Construction of the 132 kV double-circuit TL will require a range of civil, structural, and electrical materials associated with tower foundations, tower erection, and conductor stringing. Key construction materials include reinforced cement concrete (RCC) for tower foundations; structural steel members for lattice towers; aluminum conductor steel reinforced (ACSR) conductors; optical ground wire (OPGW); insulators; hardware fittings; and associated accessories. Foundation works will require cement, sand, aggregates, reinforcement steel, formwork materials, and water, while tower erection and stringing activities will involve steel tower components, conductors, insulators, pulleys, ropes, and specialized tools and equipment.

135. Construction materials will be sourced through a combination of local and international suppliers. Locally available materials such as sand, aggregates, cement, and water will be procured from authorized suppliers in and around Bumthang Dzongkhag, subject to compliance with national regulations and approvals from relevant authorities. Specialized materials that are not manufactured domestically—such as tower steel members, conductors, insulators, OPGW, and stringing equipment—will be imported, primarily from regional and international manufacturers (e.g., India, the People’s Republic of China, and Italy), as determined by BPC and the contractor. Imported materials will be transported by road from entry points to designated

storage yards and subsequently distributed to tower locations using trucks or manual head-loading, depending on site accessibility. Material storage, handling, and transportation will be managed to minimize environmental disturbance, avoid spillage or wastage, and ensure occupational health and safety throughout the construction phase. Equipment and materials necessary for the construction of the TL are listed in Table III-2.

**Table III-2: Equipment Requirements**

SN	Activity	Equipment	Materials
1	Surveying (Check & Detail)	Total Station, Tri-pod, Umbrella, Tape, GPS, Knife, Power chain, Walki-talkies & vehicles	Survey markers and pegs
2	Geo-Investigation	Crow barr, spade, knife, Pickaxe, shovel	Soil and rock sampling tools
3	Material Transportation		
A	By head-loading	None	
B	By truck	Backhoe or excavator with Truck	
4	Excavation		
4.1	Benching	Excavator	
4.2	Excavation	Excavator	
5	Foundations		
5	Foundation installation	Concrete mixture	Tower stubs, stub-setting templates and jacks, form boxes/shuttering materials, cement, sand, aggregates, reinforcement steel
6	Assembling & erection of tower	Pulley, Derrick pole	Tower steel members, nuts and bolts, tower accessories, polypropylene ropes
7	Stringing (OPGW & Conductor)		
7.1	Stringing of conductors and earth wire Paying out	Tensioner and puller machines, turn table, drum mounting jacks, pulley blocks, dynamometer	ACSR conductor drums, earth wire, OPGW, insulators, hardware fittings, pilot wires
7.2	Jointing and compression works	Hydraulic compressor machine	Compression joints and sleeves
8	Earthing Works	Spade, shovel	Earthing materials
9	Cleanup and reclamation of affected areas	Bulldozer, vehicles	

### C. Construction Approach and Methodology

#### Desktop & Field Investigations

136. During pre-construction phase, BPC carried out desktop survey and walk-on survey to ascertain and finalize the TL route. Subsequently, several walk-on joint site visits were carried out involving concerned local government officials, local people and Forestry people for project site verifications and to obtain necessary approvals to go ahead with the detailed survey. All the necessary approvals and No Objection Certificates (NOC) for the proposed project were obtained after joint site verifications and consultations. Pre-construction activities also include site

preparation, setting up project offices, contractors offices and workers camps which will be completed prior to the beginning of the construction activities.

### **Land Acquisition**

137. No land acquisition is required as towers are located on private land. In total, the TL and access roads will impact 0.28 acres of land belonging to 4 households.

138. There will be temporary use of some land for the work areas of the contractors, their camps, and other facilities. These will be identified by the Project Management; the Dzongkhag and Gewog Authorities and it will be allocated according to Proximity to the project site,

- Minimal forest clearance required, and
- Accessibility to the roads as well as drinking water and electricity.

### **Clearing and Survey**

139. The initial step in TL construction will be the preparation of tower sites along the designated route alignment. This will involve clearing vegetation, surveying and creating access routes or roads to facilitate the transportation of materials and equipment to the locations. For the TL, vegetation clearance will be undertaken to establish a 27 m right-of-way (RoW), comprising 13.5 m on either side of the centerline. This activity will involve removal of ground cover, shrubs, and selective tree cutting to ensure safety clearance for the conductors. The impact will remain confined to the RoW footprint and will not extend significantly into adjacent forested areas or protected areas.

140. In parallel, a detailed TL survey will be conducted, including mobilization, preliminary alignment surveys, profiling, tower spotting, center pegging, line-of-sight clearing, and preparation of drawings for approval. Where necessary, a check survey will also be conducted to re-peg lost markers, update profile surveys, carry out additional RoW clearance, and submit revised drawings for approval. Geotechnical works will include excavation of trial pits with sampling, penetrometer tests where applicable, electrical resistivity testing, and laboratory analysis of soil, rock, and water samples.

### **Mobilizing Equipment and Delivering Materials**

141. Once access routes or roads have been constructed, the next step will involve mobilizing construction equipment and transporting materials to the site. This will ensure that all resources required for excavation, foundation works, and tower erection are available on time. Proper mobilization will be essential to maintaining project timelines and enabling smooth execution of construction activities. Stockpiles of material required for construction activities in the RoW will be carefully calculated so that they do not remain on site for extended periods of time.

142. Access road construction. To access tower placements in remote areas, 14 access roads totaling 19.2km will be built, to provide access for material transportation to the 57 tower locations.

### **Benching Works**

143. For this project, benching is required at specific tower locations situated in geologically unstable or steep terrain to secure the structures. The process involves cutting and leveling the

ground into horizontal steps with nearly vertical surfaces between them. This method is applied across various ground types, including soils, wet soils, soft/fissured rock, and hard rock. A key safety benefit of benching is the reduction of potential soil or rockslides, which safeguards workers during excavation. The estimated volume of excavated material resulting from benching these sites is summarized in Table III-3.

**Table III-3: Benching Volume for the tower locations**

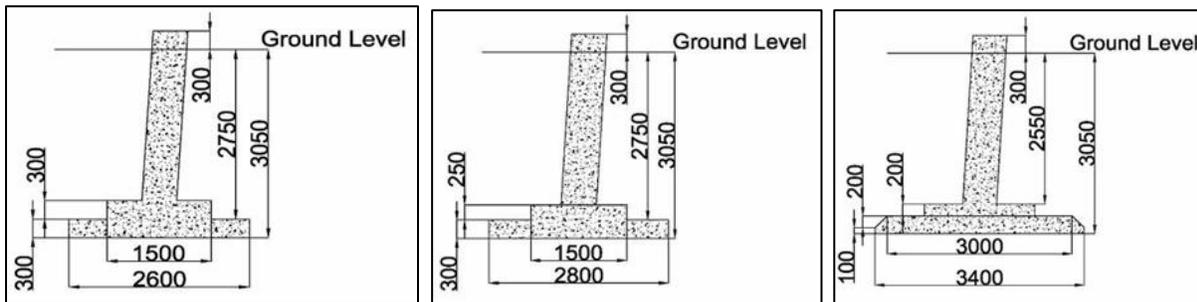
SN	Tower types	Structure Height (m)	Base Width (m)	Structure Base Area (m <sup>2</sup> ) at Ground Level	Benching Area in sq.m at foundation level	Average Benching Area in (m <sup>2</sup> )	Benching Vol. (m <sup>3</sup> ) for 19 nos of towers in unstable area
1	B	31.60	4.60	21.16	57.76	83.21	1,581
2	C	31.94	5.40	29.16	70.56		
3	D	32.84	6.60	43.56	92.16		
4	SP	41.30	7.60	57.76	112.36		

### Foundation Works

144. Transmission tower foundations will be designed to provide stability and adequate load-bearing capacity under diverse ground conditions. The process will include excavation, backfilling, shoring, dewatering, and proper disposal of excavated materials in accordance with specifications. For structural strength, lean concrete will be used in the foundation along with reinforcement to ensure durability and safe support of the tower.

145. Once the foundation is completed, stubs will be installed to connect the tower legs to the base. They will be fixed precisely with nuts and bolts to maintain correct alignment and ensure effective transfer of loads from the tower to the foundation. BPC uses standard foundation designs in conjunction with standard towers, utilizing pad and chimney RCC (Reinforced Concrete Cement) foundations. The specific shape of these foundations is illustrated in Figure III-6. Notably, these foundations feature a concrete cover thickness of 50 mm, allowing for the use of steel panel or wood panel formwork during construction

**Figure III-6: Tower Foundations**



146. Pit foundation digging will be done for the 4 legs of the tower. Tower foundation area may vary depending on tower type used and the terrain of the tower location. Most of the tower locations are accessible by existing roads. Thus, excavation in such locations will be done using excavators. Moreover, the construction work involved for the proposed TL is small in scale (involving the excavation of small pits for the tower foundations and installation of towers and

stringing of conductors) and the works will be conducted by small teams of workers manually as far as possible without the use of heavy vehicles and machinery. The estimated soil to be generated as a result of tower foundation excavation is worked out in Table III-4.

**Table III-4:** Expected volume of soil from the tower foundation excavation

<b>Tower Type</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>SP</b>
Foundation width (m) of one Leg of a Tower	2.9	3.1	3.5	6.2
Depth of Foundation/Height (m)	3.05	3.05	3.05	3.45
Total Foundation Area (width × width) × 4 legs (m <sup>2</sup> )	33.64	38.44	49	153.76
Volume of Excavated Soil (Area × Height) (m <sup>3</sup> )	102.6	117.24	149.45	530.47
No. of Tower Type to be used from 57 towers	14	14	14	15
Total Volume of Excavated Soil (m <sup>3</sup> )	1436.4	1641.36	2092.3	7957.05
<b>Total Excavated Soil from The Project (m<sup>3</sup>)</b>	<b>13,127</b>			

147. Construction of tower foundations and associated access roads will generate soil and rock from excavation and benching works. Given the mountainous terrain, transporting all excavated material to distant disposal sites would require additional disturbance, increased fuel consumption and high cost. Therefore, the Project will prioritize beneficial reuse of excavated material within the road corridor and tower sites, including the following.

- I. **Foundation Backfilling and Bench Stabilization.** Suitable material will be reused for backfilling tower foundations and stabilizing working platforms.
- II. **Road Construction Fill Material.** Excavated soil and rock will be used as fill for road formation, widening and embankment construction where geotechnically suitable.
- III. **Slope Reconstruction (Cut-and-Fill Balancing).** Material from cut sections will be used to build stable fill slopes, reducing the need for external borrow or disposal.
- IV. **Engineered Spoil Placement Sites Along Road Alignment** Where surplus material remains, designated spoil placement areas will be identified adjacent to the access road, ensuring:
  - a. Location on stable ground
  - b. Outside drainage lines and watercourses
  - c. Avoidance of agricultural land and settlements
  - d. Controlled slope geometry and compaction
- V. **Reuse of Rock for Structural Protection Works.** Rock material will be used for retaining structures, stone pitching, drainage protection and gabions.
- VI. **Limited Off-Site Disposal.** Transport to external disposal sites will be undertaken only if material is unsuitable for reuse or poses safety risks

## **Tower Erection**

148. The assembly of the tower structure will involve fitting together the metal framework, including tower arms and insulators. Each tower will be designed to bear its own weight along with the loads of conductors, accessories, wind forces, and seismic impacts. After the towers are erected, tower protection works will be carried out to strengthen the base. These works will include constructing gabion walls, crib walls, drains, and concrete covers, along with proper backfilling and compaction. Such measures will ensure the long-term stability and safety of the towers.

149. The foundation concrete must adhere to M20 grade specifications, signifying a cube compression strength of 20 N/mm<sup>2</sup> at the conclusion of 28 days. For the chimney and slab sections, 20 mm downgraded stone metal is utilized, while the pyramid sections employ 40 mm

downgraded stone metal. Uniformity is maintained in the footings across all four legs of a tower, regardless of down-thrust or uplift forces. The duration for casting and foundation work at each tower site typically ranges from 15 to 20 days, involving 15 to 25 workers depending upon terrain characteristics and accessibility. Daily construction necessitates approximately 60 liters of water per cubic meter, sourced locally through tanker deliveries and rainwater collection stored in on-site tanks. Each tower requires an average of 40 to 100 cubic meters of concrete for construction purposes.

## **Backfilling**

150. To the extent available, the selected surplus soils from the excavated materials shall be used for backfilling the finished foundation concrete pit. As soon as the work of foundations has been accepted and measured, the space around the foundation shall be cleared of all debris and filled with earth in layers not exceeding 15 cm, each layer being watered rammed and properly consolidated before the succeeding layer is laid. Each layer of earth shall be consolidated by ramming with approved mechanical compaction machines. Special care shall be taken to prevent any wedging action against the footing. The backfill shall be compacted to 95% of the maximum dry density obtainable in the standard Procter density test as specified in relevant standards. The excavation and placing operations shall be such that material when compacted will be blended sufficiently to secure best practicable degree of compaction, impermeability and stability. The stub setting template shall be opened only after the completion of backfilling.

## **Revetment**

151. At locations, for instance on slopes, where there are chances of soil erosion due to rainwater, a retaining wall shall be provided around tower foundation as revetment. The wall shall consist of broken stone pieces cemented with the help of 1:5 cement mortar and weep holes and filters. The revetment walls shall be finally pointed with 1:4 cement mortar. The empty space between revetment and foundation shall be filled by earth. Alternatively, RCC retaining wall, based on standard civil engineering practices, shall also be permitted. The design of the revetment and foundation shall be developed by the Contractor and approved by the BPC.

152. Due to the steep and rugged terrain of the project area, installation of conventional engineered drainage systems is often impractical and may destabilize slopes or require extensive excavation. Therefore, the Project will implement a terrain-adapted erosion control approach combining structural measures, natural drainage management and bio-engineering techniques. Practical measures include:

### **I. Utilization of Natural Drainage Patterns**

Tower siting and foundation design will avoid blocking existing natural runoff paths. Minor adjustments to tower placement or bench orientation will be used to maintain natural flow directions.

### **II. Surface Water Diversion Using Simple Measures**

Small diversion berms or shallow contour drains will be constructed upslope of tower foundations to redirect runoff away from structures without extensive excavation.

### **III. Dry Stone Pitching and Riprap Protection**

Locally available rock will be placed around foundations and retaining walls to prevent scouring and dissipate flow energy.

**IV. Gabion or Boulder Toe Protection**

Where necessary, gabions or stacked rock barriers will stabilize the base of slopes and prevent undercutting.

**V. Bio-engineering Techniques**

Disturbed areas will be revegetated using native grasses and shrubs to improve long-term slope stability and reduce erosion.

**VI. Localized Drainage Only Where Necessary**

Formal lined drains will be constructed only at locations with concentrated runoff or high erosion risk, based on site-specific assessment.

**VII. Inspection and Maintenance**

Sites will be monitored during construction and after major rainfall events, with corrective measures implemented if erosion is

### **Tower material delivery**

153. The materials for the construction of towers will be delivered from the storage yard directly to the site. The materials will be brought to the construction site by trucks or manually (head loading) depending on the accessibility. The contractor can lease private space/house and built storage yards at Jakar/Tang or use BPC's substation area for the storage of construction materials.

### **Installation of Tower and Line Materials**

154. Towers shall be installed by assembling the prefabricated components of the lattice structure, not earlier than 14 days after concreting and after such time that the concrete has acquired its full strength. After initial installation all tower bolts shall be checked to ascertain that all nuts are fully tight. Installation of each tower and line materials takes 15 days with 15 – 20 workers. All the tower installations will be done manually by assembling prefabricated components of the lattice structure. The entire stringing work of the conductors and OPGW shall be carried out by tension stringing technique manually or by using puller machines as shown in Figure III-1

### **Stringing of Conductors**

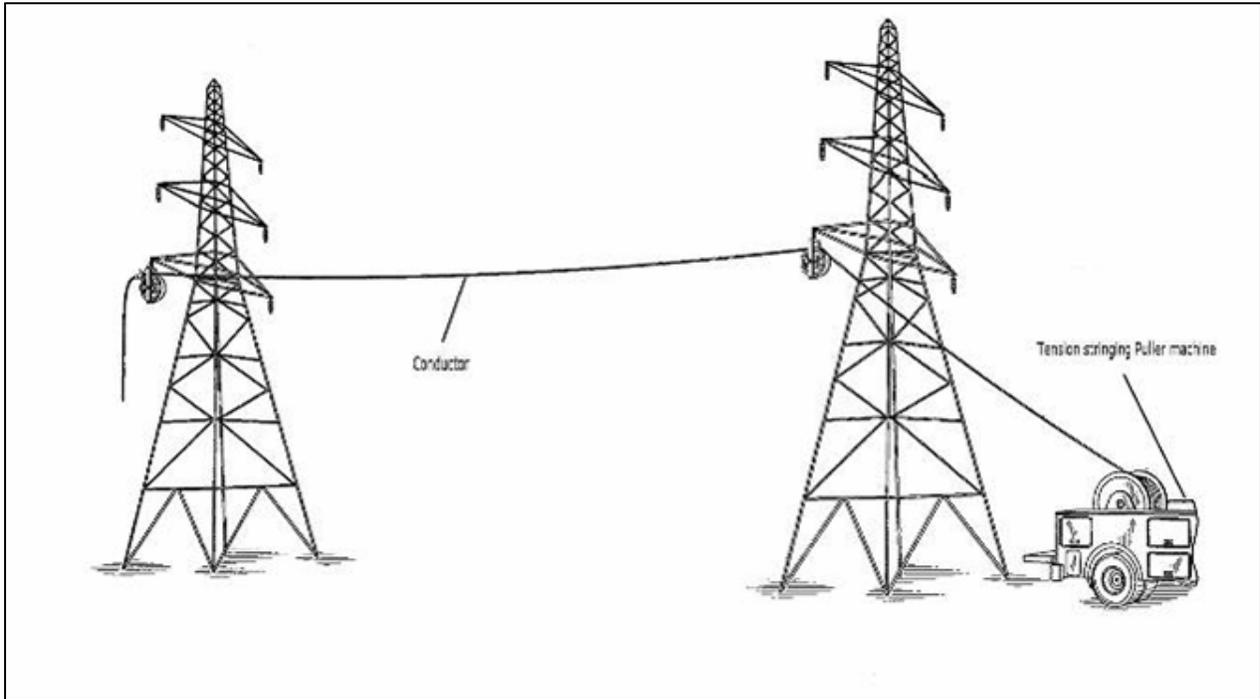
155. Stringing of conductors will be the final stage of TL construction, where conductors will be installed on the erected towers. The process will involve carefully laying out, tensioning, and securing the conductors to ensure proper sag, alignment, and electrical clearance, thereby completing the TL for safe and efficient operation. For the 132 kV line, ACSR Panther conductors will be used. These conductors will consist of 30 strands of 3.00 mm diameter aluminum wire and 7 strands of 3.00 mm diameter steel wire at the core.

156. In the hilly terrain and thick forested area with space constraints, where deployment of tension stringing machine is not possible, manual stringing may be adopted. The stringing works between two towers normally takes 3 – 7 days.

The conductor used for the 132 kV project will be Aluminium Conductor Steel Reinforced (ACCSR PANTHER) with 30/3.00 mm diameter of Aluminium wire and 7/3.00 mm diameter of steel wire inside (detailed specification shown in Source: BPC, 2025)

157. Table III-5). The stringing work will require 50 workers when the work is carried out manually, but use of a puller machine wherever possible might reduce the number of workers required.

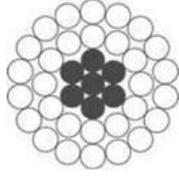
**Figure III-7:** Puller machine for stringing of TL conductor



Source: BPC, 2025

**Table III-5: Specification of TL Conductor**

Designation	212-AL1/49-ST1A (Panther)
Type	ACSR
Stranding (Nos / diameter)	Al: 30 / 3.00 St: 7 / 3.00
Creep period of conductor to be considered (years)	10
Overall diameter (mm)	21.0
Cross sectional area Al (mm <sup>2</sup> )	212.1
Minimum ultimate tensile strength (kN)	92.46
Weight (kg/km)	973.1
Direction of external lay	Right hand
Maximum DC Resistance at 20 degC (ohm/km)	0.13630

Grease	Required (Shell Ensis 356 or equivalent)*
Cross section	
Note:* Grease was used in the 220kV Chukha-Jamjee TL project.	

## Testing & Commissioning

158. After completion of works, final checking of the line will be carried out to ensure that all the foundation works, tower installation, stringing etc. have been done with strict adherence to the technical requirements and specifications. Insulation and continuity test of the TL, as well as earth resistance of each tower will be carried out before final commissioning. Finally, before the activation of the TL, a public announcement regarding the operations of the line will be made to the inhabitants in the vicinity through media and public awareness programs.

### D. Operation and Maintenances

159. The project will be operated and maintained by BPC following completion of the construction works. Activities undertaken during the project operations phase are minimal which will include clearing of overgrown vegetation and repairs of any defect that can be detected along the TL. BPC will undertake a regular maintenance and monitoring programme for the TL as per its Operation and Maintenance Manual 2017 which comprises of preventive measures and measures for breakdown.

160. The following preventive checks are planned to be carried out periodically along the TL:

- i. Trimming of tree branches along the corridor/right of way i.e. 27 m for maintaining adequate electrical clearances.
- ii. Visual inspections (through binoculars) and/or using Drones.
- iii. Insulators & hardware fittings
- iv. Conductor and ground wire, and their accessories such as vibration dampers, compression joints, repairs sleeves etc.
- v. Missing tower members (if any), nuts, bolts, etc.
- vi. Measurement of earth footing resistance for all towers periodically & taking necessary action by improving earthing arrangements as per site conditions in case of earth footing resistance is more than 10 ohms;
- vii. Checking anti-climbing device, phase plate, number plate, circuit plate, danger plate;
- viii. Checking for corrosion on tower members, tower earthing, etc. and taking necessary actions for Aluminum oxide painting;
- ix. Checking for foundation chimneys, coping etc.

- x. Checking for adequate conductor clearances at important crossings, conductor creep, etc.

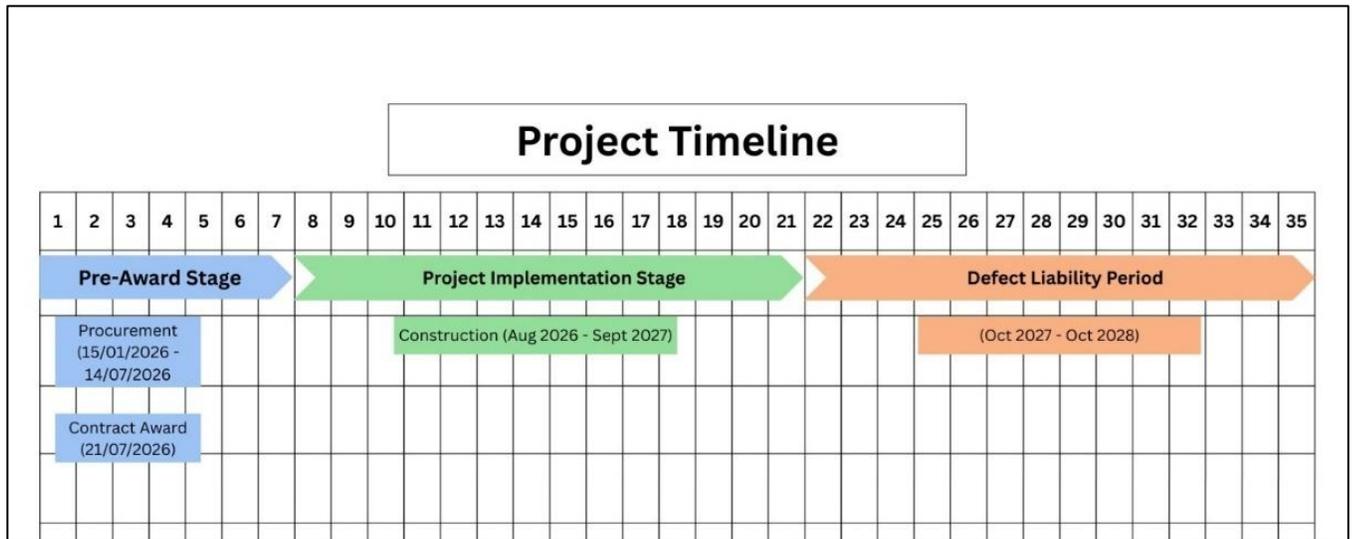
**Safety Measures for Operations**

161. All towers will be fitted with a galvanized barbed wire type anti climbing device on all faces of the tower at a suitable height in a suitable manner. Climbing step-bolts will be provided on one corner leg starting immediately above the anti-climbing device and continuing to the top for future maintenance purposes. The Danger Plate will be attached to each tower approximately 2 m above ground with the inscription of bone and skull symbol and the voltage of the line. The single red word “DANGER” will be also written in Bhutanese translation on the plate. Finally, before the activation of the TL, a public announcement regarding the operations of the line will be made to the inhabitants in the vicinity through media and public awareness programs.

**E. Project Schedule**

162. The preliminary design works have already begun and once the final approvals have been obtained, the contract works will be advertised. Site work is expected to begin as soon as contractors are selected. The construction work will be completed in 14 months as per the schedule below.

**Table III-6: Work Schedule**



## IV. DESCRIPTION OF THE ENVIRONMENT

### A. Background

163. The following sections elaborate on the facilities, activities, and resources required for the Project's construction and operation phases. The details are based on the information available at the time of this assessment and serves to aid the identification of the Project's E&S aspects and potential impacts.

164. The Wobthang solar farm is one among several other solar farm projects across the country currently at various stages of development, which have been approved by the Department of Energy as techno-economically viable and considered for feasibility study. The Druk Green Power Corporation Limited (DGPC), as the agency responsible for power generation, is processing the development of the 120 MWp Wobthang solar farm project. Bhutan Power Corporation Limited (BPC) as the implementing agency for transmission and distribution of electricity in the country, and in line with this mandate, is responsible for the planning, construction, and operation of transmission infrastructure required for the Project. BPC will facilitate the evacuation of electricity generated by the 120MW Wobthang Solar Farm

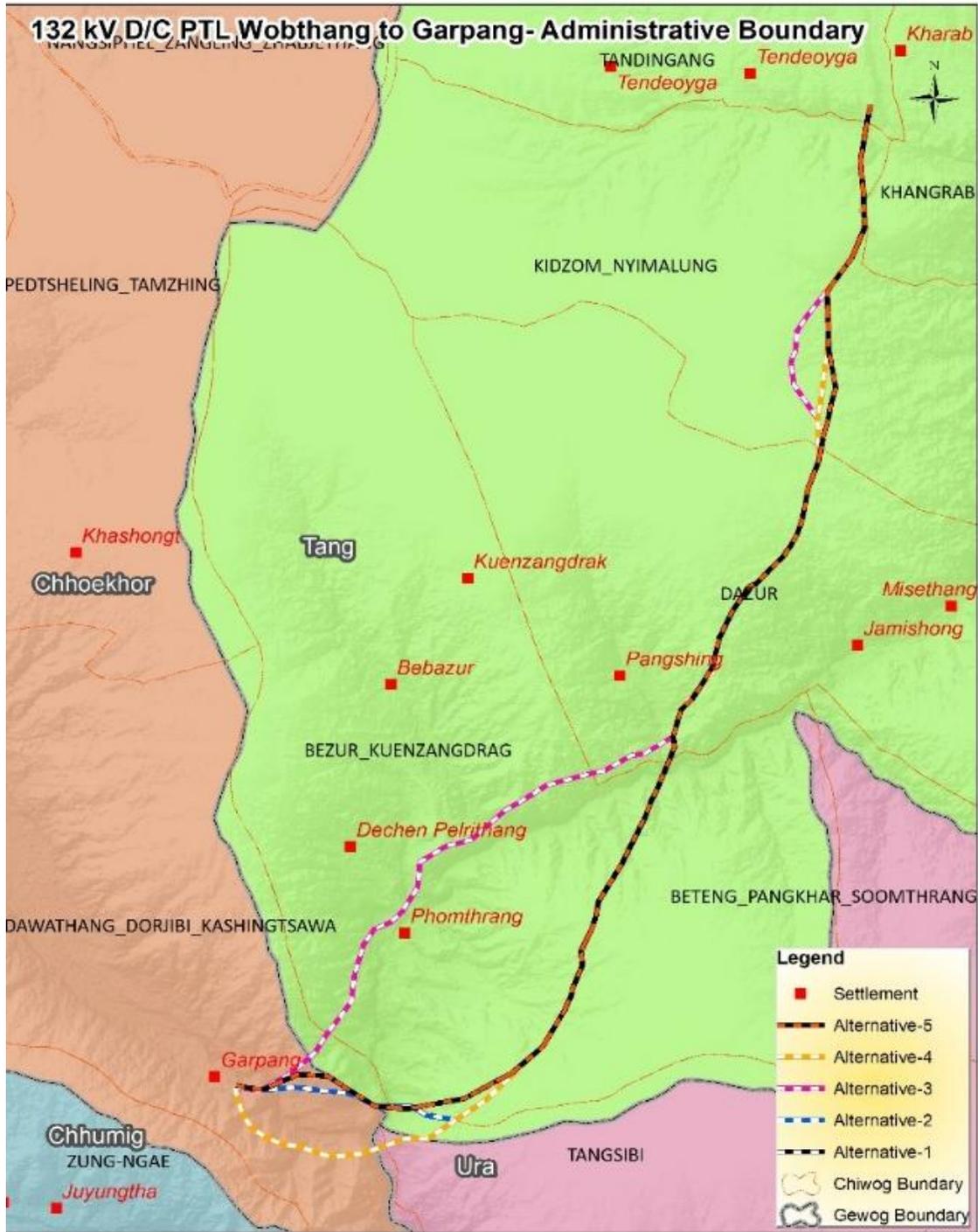
### B. Physical Environment

165. Bumthang Dzongkhag is located in the northern part of the country bordered by the dzongkhags such as Lhuentse to the east, Trongsa and Wangdue Phodrang to the west, Zhemgang to the south and Xizang to the north. It covers an approximate area of 2,667.76 square kilometers with an elevation ranging from 2400 to 6000 meters above sea level. The project is located in Tang and Chhoekhor gewogs in Bumthang.

166. Tang Gewog, situated in the northern region of Bumthang district in Bhutan, boasts an elevation ranging from approximately 2,800 to 5,000 meters above sea level, making it one of the highest gewogs in the area. Home to a small population of 2,278 residents, most of the settlements are found in the lower valley regions. The primary sources of livelihood for the locals revolve around subsistence farming and livestock rearing, particularly yaks in the higher altitudes. Notably, the Gewog places a strong emphasis on cultivating buckwheat and potatoes, which are key staple crops in the region.

167. Chhoekhor Gewog, recognized as the central gewog of Bumthang district, is often regarded as the heart of the region. With an elevation ranging from approximately 2,600 to 3,500 meters, it is lower than its northern neighbors. As the most populous gewog in Bumthang, home to 3,871 residents, it encompasses the district's administrative center and main town, Jakar. The area boasts a diverse range of income sources, including agriculture, government services, trade, and tourism, underscoring its vital role as the commercial and administrative hub of the district.

Figure IV-1: Gewogs in Bumthang.

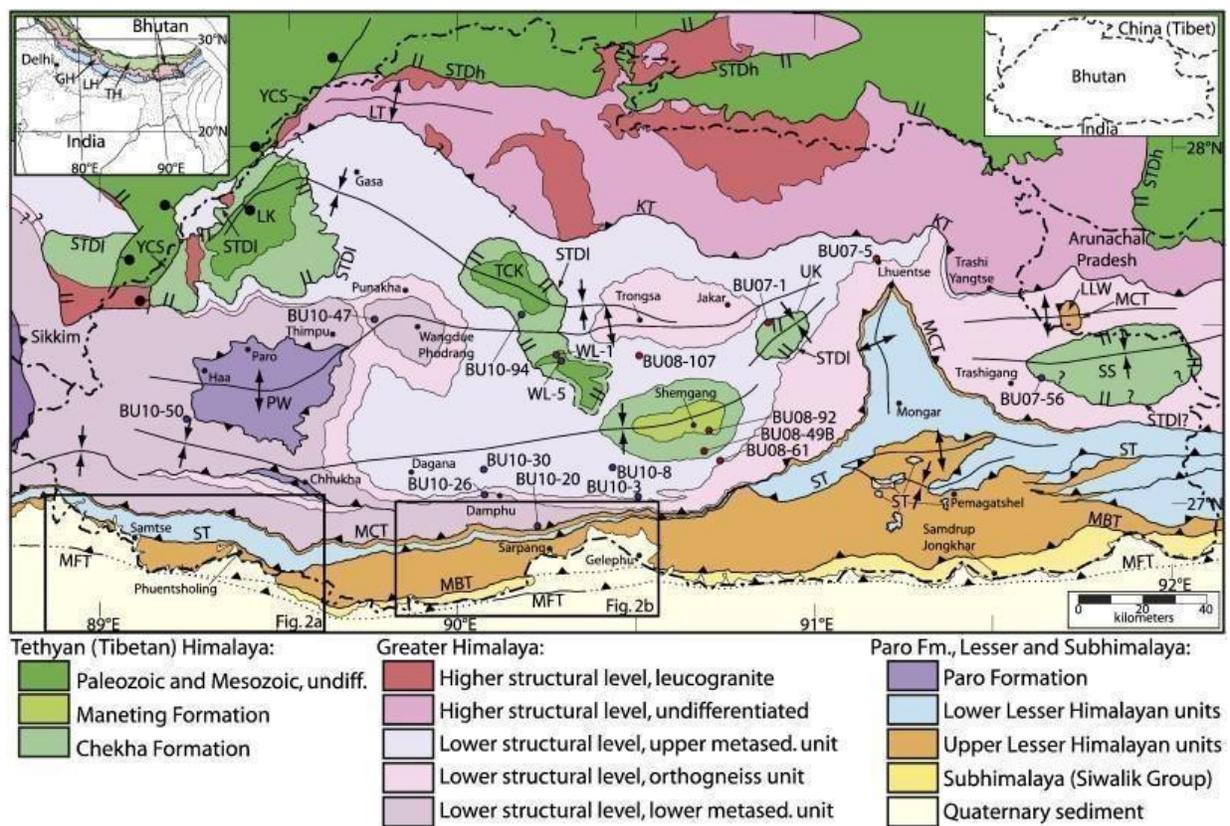


Source: Administrative boundaries from Bhutan Geoportal; alignment data from project survey drawings; prepared by GIS Consultant, PCS (2026).

## Topography, Geology and Soils

168. Bhutan has very rugged terrain with elevations ranging from 160 meters to more than 7,000 meters above sea level. Shaped by the geological uplift, lithological formations and rivers, the topography of Bhutan is dominated by several uneven and rugged crested mountain peaks in the northern region. The central region of the country is made up of deep and gentle valleys along rivers while the southern foothills are comprised of alluvial plains along the borders of India. The Himalayan fold-thrust belt/orogenic belt is traditionally divided into four from south to north. These include the Sub Himalayan (SH), Lesser Himalayan (LH), Greater Himalaya (GH), and Tethyan Himalaya (TH). Their bounding fault systems include the Main Frontal thrust, the Main Boundary thrust, the Main Central thrust and the South Tibetan Detachment system. All the major tectonostratigraphic units and the tectonic structures within the Himalayan orogenic belt are exposed in Bhutan. The Himalayan Orogeny's tectonostratigraphic sequences were defined by metamorphic grade changes due to the abrupt juxtaposition of higher-grade rocks over lower grade rocks, evolving as these orogeny-structures propagated southward during India's collision with Eurasia.

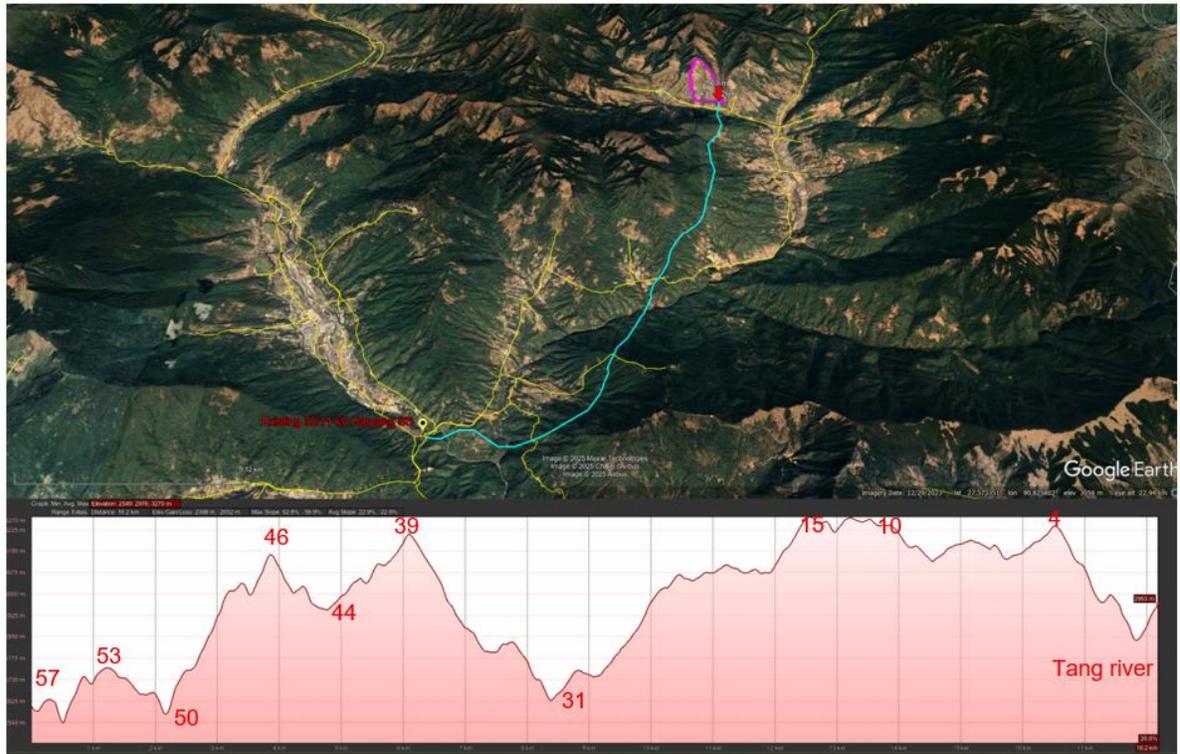
**Figure IV-2: Major techno stratigraphic units and tectonic structures (project area marked as star).**



Source: McQuarrie et al, 2013

169. The proposed route passes through state reserved forest, community forest, small streams, roads, and varied landscapes. The TL route traverses high-altitude terrain, starting at 2963m. The line descends to cross the Tangchhu along the valley three times. The line peaks in the middle sections, going up steep terrain between AP 16-AP 19, going up to 3275m and descending toward the substation. The line crosses the Chamkharchhu before it reaches Garpang substation where it drops down to 2610m. The terrain along the TL is visible in Figure IV-3: Map depicting elevation along the alignment.

**Figure IV-3: Map depicting elevation along the alignment**

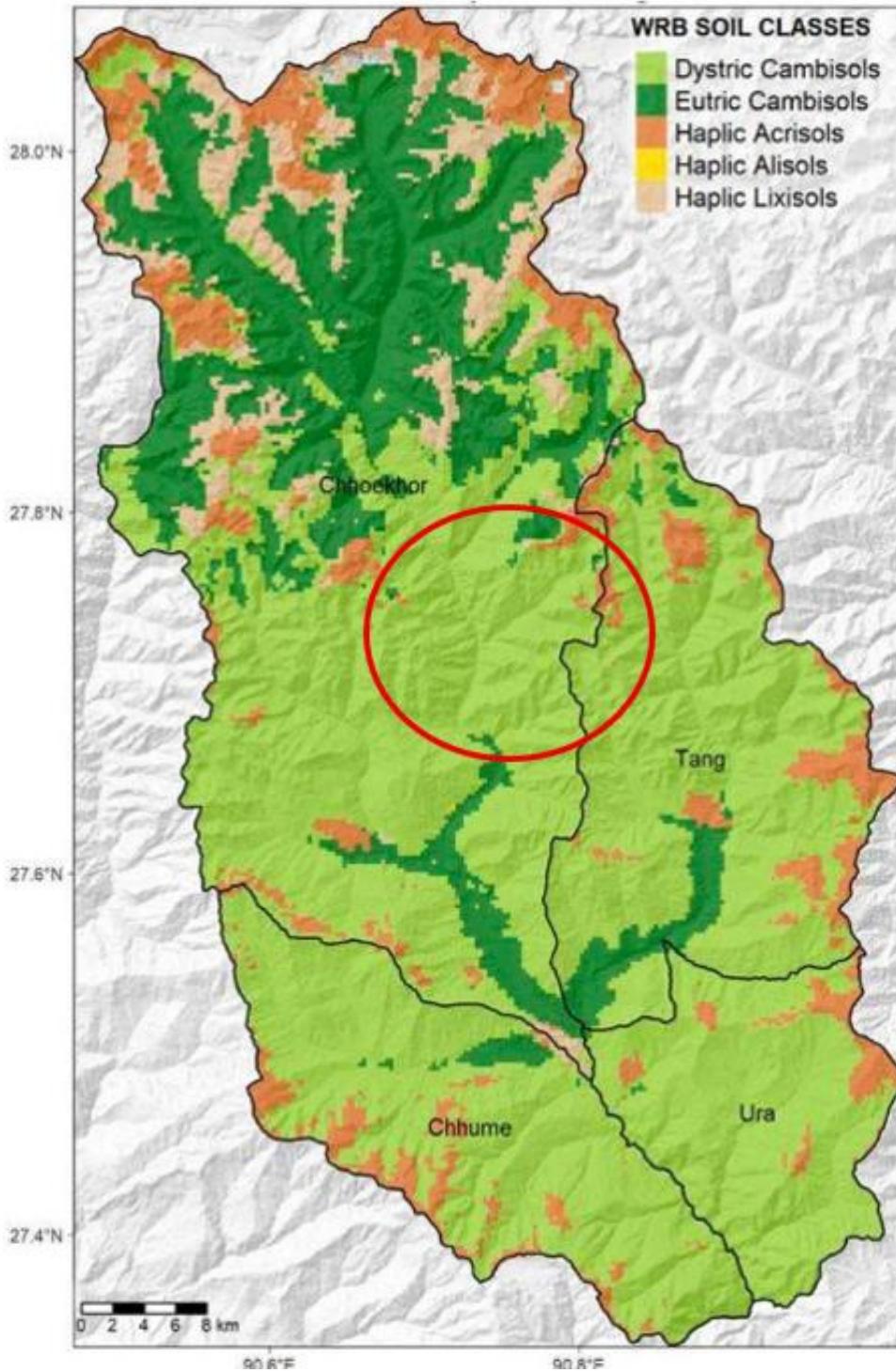


Source: Google Earth imagery, alignment data from project survey drawings; prepared by PCS (2026).

## Soils

170. There are five types of soil in Bumthang. Dystric Cambisols constitutes the most dominant soil type, and it is present generally present in mountains and forest dominated land cover within the temperate climatic zone. Eutric Cambisols occurs in valleys where land is used for agriculture. It also occurs in alpine climatic zone in the northern part of Chhoekhor gewog where the vegetation shrubs dominated. Within the project area, these are the two dominant soil types. Aside from these two, within the district, Haplic Acrisols is found on and along the ridges of the mountains and Haplic Lixisols is also generally found in alpine zone on mountains. Within the project area the soil is predominantly sandy loam to humic soil over topsoil and sandy clayey loam sub-soil.

Figure IV-4: Soils map of Bumthang



Source National Soil Services Centre, 2023. Technical report on the generation of national soil map of Bhutan using digital soil mapping techniques. Department of Agriculture, MoAL

171. Within Tang Gewog, Along the valley Eutric Cambisols are dominant, while on the higher or steeper terrain Dystric Cambisols are more common. Along the transmission alignment the soil is mostly highly developed soils with a humic-rich sandy loam surface layer and a sandy clayey loam subsoil. Towards Chokhor the soil is more Sandy and Clayey Loam.

## **Climate**

172. Bhutan experiences a monsoon type of climate with four distinct seasons of spring, summer, autumn and winter. Rainfall occurrence is comparatively higher in the southern region in the months between July to September. The highest total annual rainfall on record is 7220.3 mm with an annual average of 1900-2000 mm.<sup>11</sup>

173. The area through which the TL passes has cool temperate climate characterized by cold winters, and warm and wet summers. It has four distinct seasons of winter, spring, summer and autumn. The wide altitudinal range causes significant variation in temperature.

174. The summers here have a good deal of monsoonal rainfall, while the winters have very little. Summer begins in June and ends at the end of September. In Jakar, the average annual temperature is 5.8 °C/42.4°F. Approximately 3111 mm/122.5 inch of rainfall occurs on a yearly basis. Tang typically receives about 69.92 millimeters (2.75 inches) of precipitation and has 139.53 rainy days (38.23% of the time) annually.

## **Air and Noise**

175. Air quality data collected from five sampling sites (NA1–NA5) for wet season as mentioned indicate that concentrations of particulate matter (PM<sub>2.5</sub>, PM<sub>10</sub>, and total suspended particulates) were consistently low and well within the limits established by both the NEC (2020) and World Health WHO (2021) guidelines. The highest particulate levels were recorded at Site NA4, with PM<sub>2.5</sub> at 3.6 µg/m<sup>3</sup>, PM<sub>10</sub> at 5.2 µg/m<sup>3</sup>, and TSP at 8.5 µg/m<sup>3</sup>, all significantly below the respective standards. Gaseous pollutants such as nitrogen dioxide (NO<sub>2</sub>) and sulfur dioxide (SO<sub>2</sub>) were below detection limits at all sites, while carbon monoxide (CO) was negligible, with only a trace concentration of 0.02 µg/m<sup>3</sup> recorded at Site NA4. The overall low pollutant concentrations can be attributed in part to the sampling occurring during the wet season, which facilitates the removal of airborne particulates through precipitation and atmospheric cleansing processes. These findings suggest that the ambient air quality in the project area was good during the monitoring period, with minimal influence from industrial or combustion-related emissions (NECS, 2020).

176. Noise levels were measured in A-weighted decibels [dB(A)] across five monitoring sites, during both daytime (6:00 a.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 6:00 a.m.) and evaluated against National Environment Commission standards 2020 (Appendix 4-1). According to the standards, the maximum permissible noise levels are 55 dB(A) during the day and 45 dB(A) at night for sensitive areas, and 75 dB(A) during the day and 65 dB(A) at night for industrial areas. At Sites NA1, NA2, NA3, and NA5, both daytime and nighttime noise levels remained well within the prescribed limits for sensitive areas. Daytime noise levels ranged from 38 to 50 dB(A), while nighttime levels were between 30.8 and 42.6 dB(A). These values reflect relatively quiet ambient conditions, suitable for residential, institutional, or ecologically sensitive environments.

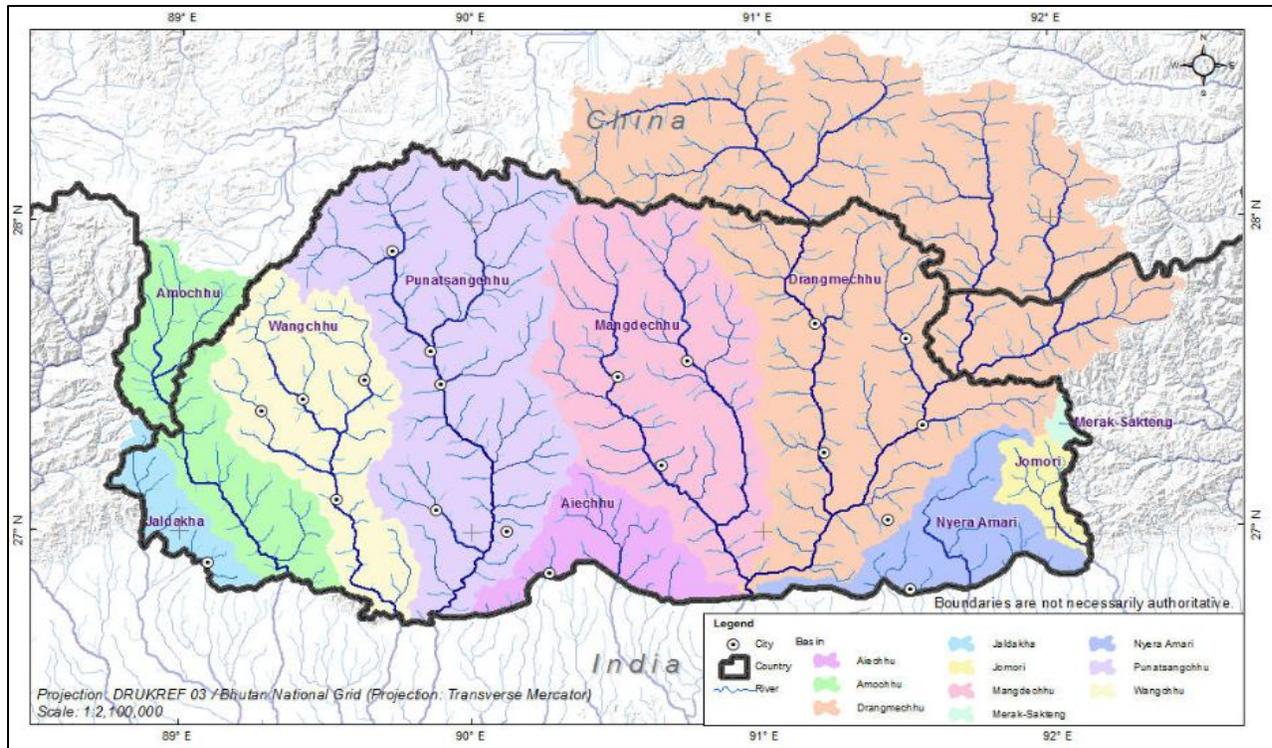
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<sup>11</sup> NCHM, Bhutan State of the Climate (2017)

## Hydrology

177. There are four major river systems in Bhutan – Amo Chhu, Manas, Punatsang Chhu and Wang Chhu. Most of the river discharge is fed by rainfall, supplemented by an estimated 2-12% glacial melt and another 2% from snow melt. The combined outflow of the rivers is estimated at 70,576 million m<sup>3</sup> per annum or 2,238 m<sup>3</sup>/s.<sup>12</sup>

**Figure IV-5: River basins in Bhutan**



Source: NECS, WRCD, National Integrated Water Resources Management Plan (2016)

178. The Chamkhar Chhu, the main river flowing through the Chokhor valley in Bhutan's North-Central Bumthang district, is a significant part of the regional hydrology. Its basin spans a considerable elevation range, from over 6,800 m at the Bhutan-People's Republic of China border down to 2,000 m at its lowest point. This river is formed by the convergence of three main tributaries: the Tang Chhu, the Chhume Chhu, and the Ura Chhu. The Tangchhu itself flows through the Tang valley, collecting water from high-altitude catchments in northern Bumthang before joining the Chamkhar Chhu near Jakar. Ultimately, the Chamkhar Chhu contributes to the Brahmaputra River in India, where it is known as the Manas.

179. The TL will traverse the Tangchhu multiple times and the Chamkarchhu river once before reaching the substation.

<sup>12</sup> NECS, WRCD (2016) National Integrated Water Resources Management Plan

## Surface Water

180. Generally, in Bhutan villages are situated along the slopes some distance from the river bed. Communities rely on smaller water sources such as springs, streams, lakes, ponds and marshes. Drying of these water sources is a common stressor for communities.

181. A study by the Watershed Management Division (WMD) of Department of Forests and Park Services (DoFPS) 2018 mapped 6555 water sources in 19 dzongkhags. The results indicated that about 35% (2317) of the water sources are in drying state, 2% (147) has dried-up and remaining 63 % (4091) are in similar condition as previous years. 331 water sources in Bumthang were mapped and assessed during the study and a majority (90%) were in similar condition to past years. The study also assessed the state of watersheds. 15 watersheds were mapped in Bumthang, 8 in degraded state, 5 in normal state and 2 in pristine state.

182. In Tang Gewog, most households depend on springs. The WMD study recorded 137 water sources in Tang Gewog in similar conditions to past years. 7 sources were in a drying state and 1 was completely dried.

183. Similarly, in Choekhor Gewog, although the gewog had many springs, 65% of the households depended on streams for their water needs. The WMD study recorded 91 water sources in similar conditions to past years and 12 were in drying state.

184. There are 15 water sources within 500km of the Project Components, of which 4 are located within Phomrong and Nangnang Community Forests. The 'Peling Drupchhu' (holy water) and 'Peling Menchhu' (medicinal water) can be found within Block 1 of the Phomrong community forest. The Peling Drupchhu is historically significant as the place where Terton Pema Lingpa meditated, and the wall there is believed to have been built by him. These water sources are also named as Khikharatho Drupchhu (Holy Water) and Gongkhar Menchu (Medicinal Water) located within the Community Forest boundaries<sup>13</sup>. Additionally, Nabchila water source is located in Block 2 of the Phomrong community forest. Locations are shown in the map below. In Nangnang community forest, there are two water sources located within the community forest named Jokhoe and Yurmung. There are an additional 5 water sources outside the community forest boundary but within 500m-1km of Project components: Shobethang, Chutshengang, Feetphong, Wamjoma 1 and Wamjoma 2.

185. In Nangnang community forest, there are two water sources located within the community forest named Jokhoe and Yurmung. There are an additional 5 water sources outside the community forest boundary but within 500m-1km of Project components: Shobethang, Chutshengang, Feetphong, Wamjoma 1 and Wamjoma 2.

186. In Nangnang community forest, there are two water sources located within the community forest named Jokhoe and Yurmung. There are an additional 5 water sources outside the community forest boundary but within 500m-1km of Project components: Shobethang, Chutshengang, Feetphong, Wamjoma 1 and Wamjoma 2.

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<sup>13</sup> Phomrong CFMP.

Figure IV-6: Location of water sources

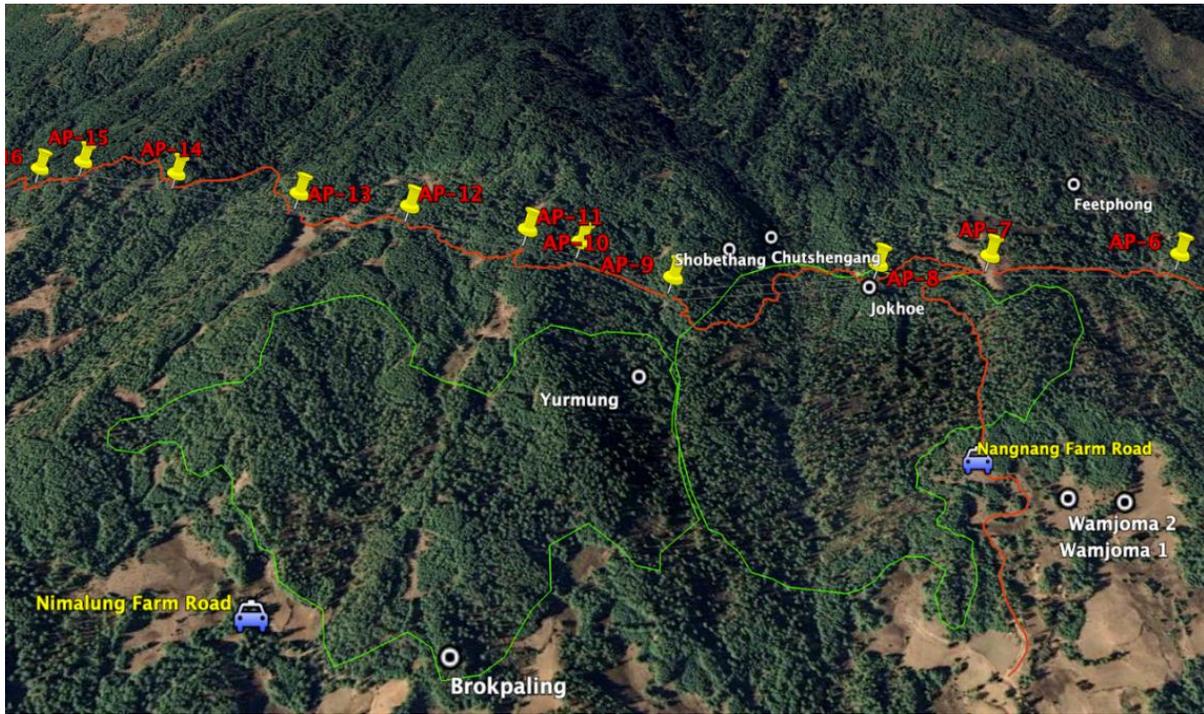
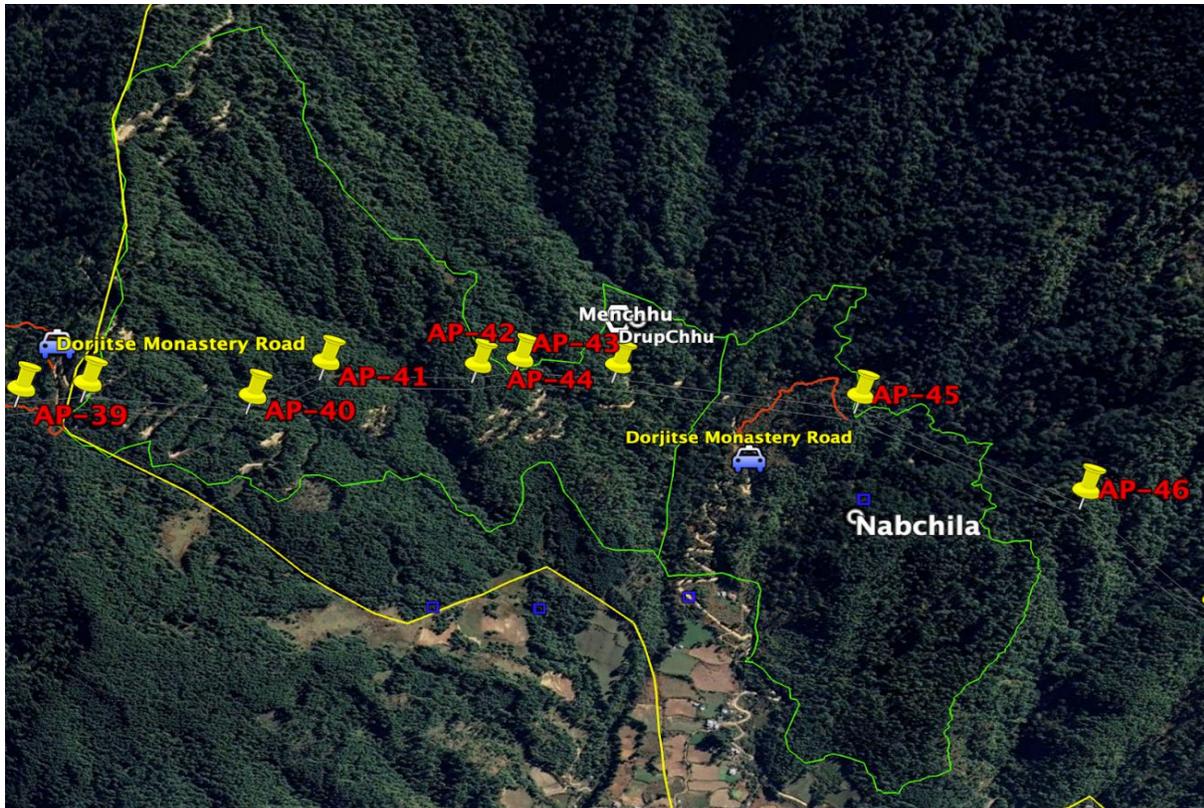


Figure IV-7: Location of water sources



**Source: Bhutan Power Corporation, 2025**  
**Water quality**

187. For the study, water quality samples were collected at nine sites, where aquatic biodiversity surveys were conducted. Out of three water quality parameters viz., biological, physical and chemical, the latter two were dealt with and studied in detail while only the microbiological parameters were studied for biological parameters. There were 31 water quality parameters studied from the water sampling sites (Appendix 4-1). Under the physical parameters, pH, Temperature, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Salinity, Turbidity and Electrical Conductivity (EC) were studied. The chemical parameters included Dissolved Oxygen (DO), Total Hardness, Chloride (Cl), Ammonia (NH<sub>3</sub>), Iron (Fe), Manganese (Mn), Copper (Cu), Magnesium (Mg), Fluoride (F), Nitrate (NO<sub>3</sub>), Phosphate (P), Potassium (K), Mercury (Hg), Arsenic (As), Zinc (Zn), Cadmium (Cd), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Sulphate (SO<sub>4</sub>), Sodium (Na) and Calcium (Ca). While under the microbiological parameters, Fecal Coliform, Escherichia coli and Total Coliform were taken into consideration (National Environment Commission, 2016).

188. Overall, the water quality parameters across all sites during the monsoon season indicate are within international and national standards. The water is soft, slightly acidic to neutral, and low in dissolved and suspended solids. Only one site had slight turbidity exceedance at W10.

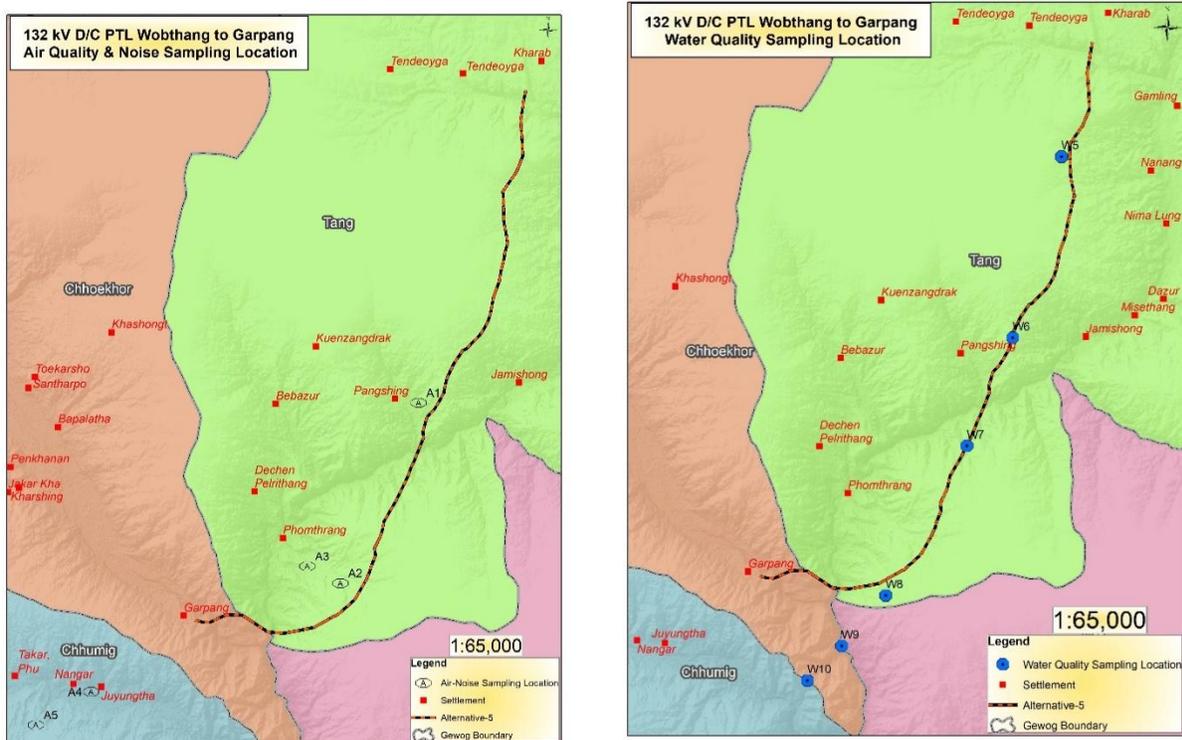
189. The chemical water quality in the study area during the monsoon season is largely within permissible limits for drinking and aquatic life, except for dissolved oxygen (DO) in some sites and iron (Fe) in all sites. Low DO in upstream sites (W1–W4) suggests reduced aeration during high flows, which could affect sensitive macro invertebrates. High iron concentrations, especially at W10, likely result from monsoon-driven soil erosion and runoff from iron-rich geology. Hardness, chloride, ammonia, manganese, and fluoride remain within safe limits, confirming that the water is chemically suitable for most uses, with minimal treatment needed for Fe removal. Most nutrient and trace element concentrations are within safe limits, except phosphorus, which is alarmingly high at several sites (W6–W10). This suggests significant nutrient loading from agricultural runoff, soil erosion, and organic matter decomposition during monsoon floods. While low nitrate minimizes the immediate risk of eutrophication, elevated phosphorus could trigger algal blooms during low-flow periods. Mercury, arsenic, and zinc remain negligible, indicating no industrial or heavy metal contamination.

190. Overall, phosphorus enrichment appears to be the major chemical concern in the monsoon season. All tested parameters—Cd, BOD, COD, SO<sub>4</sub><sup>2-</sup>, Na, and Ca—are within permissible limits, indicating no heavy metal contamination and low to moderate organic load in the monsoon season. However, sites W7–W10 show slightly higher BOD, likely from organic matter influx during heavy rains. Overall, the water remains of good chemical quality, with soft characteristics due to low hardness and major ions. The dominant concern remains organic load in downstream sites, which may affect oxygen-sensitive aquatic species.

191. While most chemical parameters fall within permissible limits, dissolved oxygen levels were found to be suboptimal at upstream sites (W1–W4). Additionally, iron concentrations exceeded World Health Organization (WHO) guidelines at all sampling locations, with the highest levels recorded at W10 due to monsoon-induced soil erosion. Phosphorus concentrations were notably elevated in downstream areas (W6–W10), suggesting nutrient runoff from agricultural activities and organic matter decomposition, which poses a risk of eutrophication during periods of low flow.

192. Microbiological analysis indicated widespread fecal contamination, with *E. coli* detected in seven out of nine sites and the highest coliform counts found at W10, reflecting significant anthropogenic impact downstream. Only W3 and W8 met microbiological standards, indicating that these sites are relatively undisturbed. The presence of *ecoli* indicates the water is microbiologically unsafe for direct use, necessitating disinfection and filtration. Continuous monitoring is essential to address downstream nutrient enrichment and organic load to mitigate long-term ecological risks.

**Figure IV-8:** Air quality and noise sampling locations and Water quality sampling location.



Source: Administrative boundaries from Bhutan Geoportal; alignment data from project survey drawings; map prepared by GIS Consultant, PCS (2026)

### Disasters and Natural Hazards

193. The assessment of the disaster risk of the dzongkhag for this plan is done by looking at the hazard, vulnerability and capacities at the dzongkhag as well as individual gewogs. The Hazard Vulnerability and Capacity Assessment is conducted by the Gups, GAOs, Mangmis, Tshogpas and the Dzongkhag Disaster Management Officer.

194. Bumthang Dzongkhag is vulnerable to various natural and man-made hazards. Repeated man-made fire incidents in the Chamkhar town have come as a stark reminder of how vulnerable the communities in the Dzongkhag are. Like other Dzongkhags in the country, Bumthang Dzongkhag has faced the brunt of two major earthquakes, a seasonal windstorm that destroyed houses and crops and which had serious implications on peoples livelihoods.

**Table IV-1: Hazard Assessment Table of the project Gewogs**

#	Hazard	Secondary Hazard	Occurrence	Probability of occurrence	History	Impact
1	Flash Floods	Landslide	Monsoon	High	1999 & 2009	Damaged agricultural land and farm road
2	Wind storm	Man-made fire	Dry season (Dec March)	High	2011, 2013, 2016	Rooftops blown away and crop damaged
3	Landslide		Monsoon	High		Damaged agricultural land and farm road
4	Forest fire	Man-made fire	From January to March	High	2015	Structural fire
5	Earthquake	Structure fire/forest fire/Landslide	Unpredictable	High	2009 & 2011	Major damage to houses and cultural property
6	Hailstones	Flood	Dry season	High	2017	Crop damage

Source: Draft Bumthang Dzongkhag Disaster Management & Contingency Plan 2023

195. As shown in **Error! Reference source not found.**, flash floods mainly occur during the monsoon season and frequently trigger secondary hazards such as landslides. Historical events have resulted in substantial damage to agricultural land and farm roads, underscoring the risk to farming and rural access and connectivity. Forest fires occur mainly during the dry season from January to March and are mostly human-induced and spread into neighboring forest. Although earthquakes are unpredictable, past seismic events in 2009 and 2011 caused major damage to residential structures and culturally significant properties. In addition to direct impacts, earthquakes pose a risk of cascading secondary hazards, including landslides, structural fires, and forest fire.

Windstorms are common during the dry season between December-March. Severe events in the past have damaged rooftops and crop. Although not as common, intense hailstones have caused crop damage, affecting agricultural productivity and food security

### C. Ecological Environment

#### Biodiversity Baseline

196. This section describes the biodiversity baseline conditions relevant to the project. It identifies the protected or internationally recognized areas, habitats, and species that may represent Priority Biodiversity Features (PBFs) under the ADB ESF Biodiversity and Sustainable Natural Resources Management Guidance Note (ESS6).<sup>14</sup> PBFs are biodiversity that are particularly irreplaceable or vulnerable, and include critical and natural habitat, threatened or geographically restricted species, important migratory or congregatory species, and areas supporting key ecological functions and connectivity.

<sup>14</sup> [Environmental and Social Standards Guidance Notes - ESS6: Biodiversity Conservation and Sustainable Natural Resources Management](#)

197. This biodiversity baseline has been developed through a combination of targeted field surveys, a review of available biodiversity datasets (e.g., IUCN, IBAT, national protected species, and published studies), consultation with national and international biodiversity experts, engagement with local communities, and coordination with relevant government agencies and conservation organizations. This approach ensures that both scientific data and local ecological knowledge inform the understanding of baseline conditions.

198. The project biodiversity baseline summarizes the data collected and assessed and presents the most important biodiversity receptors relevant to the project, inclusive of protected areas, habitats, and species. Taken together, this establishes the biodiversity context against which the potential project impacts will be assessed. In accordance with ADB ESF ESS6, the project is required to protect and conserve biodiversity. Where adverse impacts cannot be avoided, appropriate mitigation measures must be applied in line with the mitigation hierarchy. Mitigation for impacts on natural habitat and PBFs must be designed to achieve at least No Net Loss (NNL) and preferably Net Gain. For impacts on Critical Habitat, mitigation must demonstrably achieve a Net Gain in biodiversity relative to the baseline. The overarching objective is therefore to ensure the protection, management, and potential enhancement of all irreplaceable and vulnerable biodiversity.

199. The baseline first presents a summary of the Critical Habitat Assessment (CHA), which is followed by the legally protected and internationally recognized areas, then habitats and notable flora, and finally vulnerable and irreplaceable species. All field survey reports and assessments, including the full CHA are presented in the Appendices.

200. The TL will cross the Tangchhu and Chamkarchhu a number of times and other water courses along its length. In order to ensure there are no impacts to such features, the ecology they support and the ecosystem services they deliver, the project commits to avoiding all and any work within 20 m of any water and also a variety of protection measures and design principles that are set out in the Biodiversity Management Plan (BMP, Chapter D). As such, impacts on aquatic features are considered highly unlikely and are therefore not discussed further in this impact assessment.

### **Critical Habitat**

201. Under the ADB ESF ESS6 Critical Habitat refers to areas of exceptionally high biodiversity value that are essential for the survival of globally or regionally threatened species, restricted-range species, unique ecosystems, or migratory congregations. Identifying Critical Habitat early in project development is vital to ensure that sensitive biodiversity features are fully considered in project design, that avoidance and mitigation measures are properly targeted, and that compliance with ESS6 “no measurable adverse impact” obligation can be demonstrated. The process for identifying Critical Habitat is the Critical Habitat Assessment (CHA).

202. The Project CHA was undertaken in line with ADB ESS6. It combined desk-based screening (IBAT, IUCN Red List, KBAs and protected area datasets), stakeholder consultation, and targeted wet- and dry-season field surveys within the project’s Aol. Species and ecosystems were screened against ESS6 criteria using defined Areas of Assessment based on ecological relevance, habitat suitability, elevation and connectivity, supported by national datasets and expert input.

203. Two nationally protected areas, WCNP and Phrumsengla National Park (PNP), are within 5 km of the Project. Both are also identified as internationally important, are therefore nationally

protected and are also recognized as Key Biodiversity Areas (KBA). The project footprint is within the WCNP and they overlap by 370 m, although the Project is entirely within the National Park's Multiple Use Zone. The Project does not overlap PNP. A third KBA that is not nationally designated was also recorded within 5 km of the project area, the Bumthang Wetlands KBA, which is also internationally recognized as an Important Bird Area (IBA).

204. The desk-based screening identified 1,087 species within 50 km of the project, including 76 globally threatened species. Field surveys undertaken during the wet and dry seasons recorded one Endangered (EN) species, the Wild Dog (*Cuon alpinus*), and five Vulnerable (VU) mammal species: Asiatic Golden Cat, Common Leopard, Himalayan Serow, Sambar and Asiatic Black Bear. In addition, three IUCN Red-Listed tree species, all classified as Vulnerable, were recorded within the project area. No Critically Endangered (CR) species were confirmed during the surveys. Avifauna surveys recorded Near Threatened and Least Concern species only, with no VU or EN bird species identified, and all recorded herpetofauna were of Least Concern. One range-restricted bird, Bhutan Laughingthrush (Least Concern) was recorded but it, and no other species were present in numbers or concentrations approaching ESS6 critical habitat thresholds.

205. Based on quantitative assessment against all ESS6 criteria, no threatened or geographically restricted ecosystems occur within the project area, no species meet population or range-based thresholds, and the site does not function as a migratory, congregatory, connectivity, or evolutionary key area. Accordingly, the project is not located within Critical Habitat. Full details of methods, screening, and species-level assessments are provided in the complete Project Critical Habitat Assessment included in the ESIA appendices.<sup>15</sup>

## **Biodiversity Studies**

206. Research and field surveys were completed to establish the biodiversity baseline and to inform the associated impact assessment. Desk-based research comprised private and publicly available biodiversity data, including but not limited to IUCN Redlists, IBAT data within the surrounding 50km (Appendix 4-2), freely available natural and modified habitat maps and locally available data on species and protected areas. Consultation supplemented the desk-based data and provided locally relevant information. Consultees included the Department of Forests and Park Services (DoFPS), the Royal Society for the Protection of Nature (RSPN), and local communities.

207. Fields surveys were completed in August and December 2025 to account for seasonal variations in the habitats and species present. Surveys focused on habitat, flora, mammals, birds, reptiles, fish, amphibians and invertebrates. The surveys were documented in the following studies, which are provided in the ESIA appendices inclusive of all the field survey methods and results:

- College of Natural Resources, Royal University of Bhutan (2025) Environmental Services for 132 kV D/C Wobthang Solar TL Project. Provided data with respect to biodiversity during the wet season. Surveys completed with respect to a longer 68km option. Provided data on habitats/vegetation, avifauna, mammals, aquatic biology and herpetofauna (Appendix 43).

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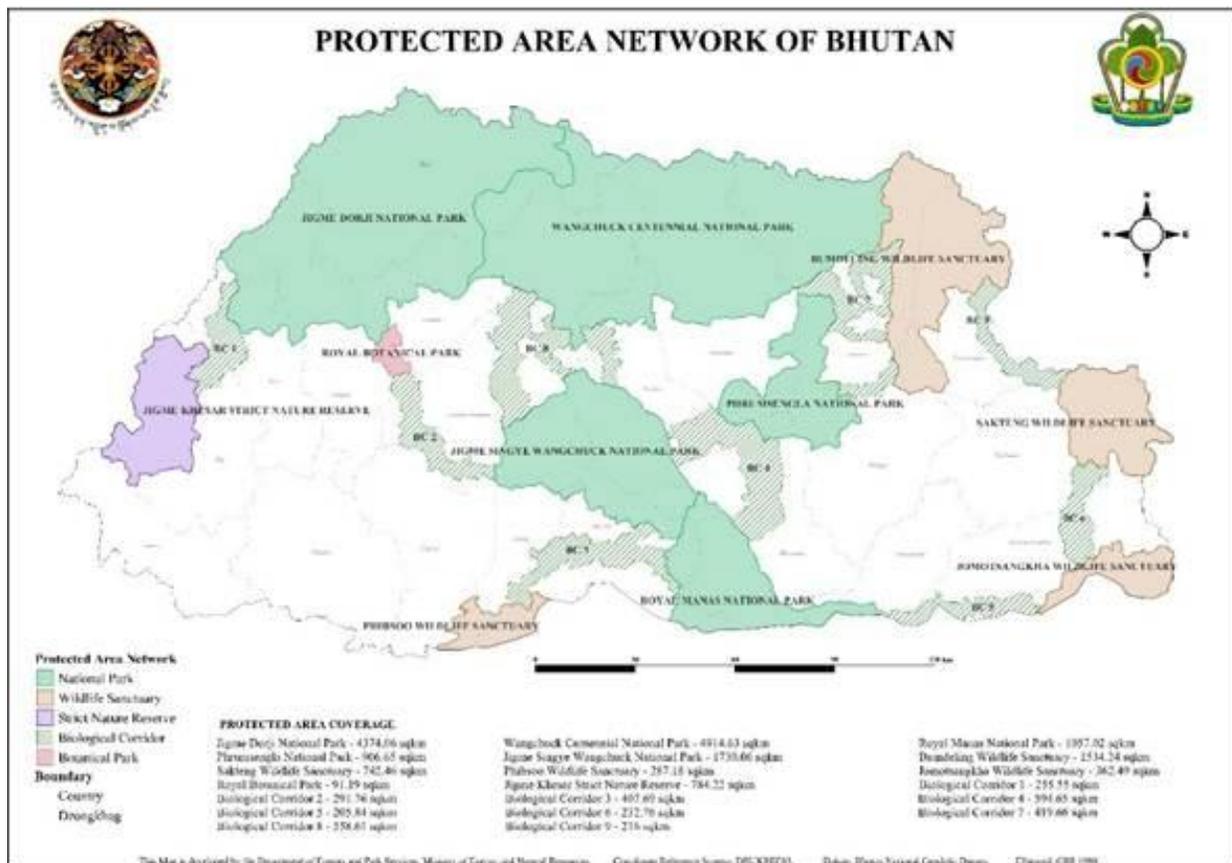
<sup>15</sup> This conclusion has been drawn given that the small 370 m section of the National Park within which the Project is located, is dominated by grazing pasture within the Park's Multiple use Zone, and therefore not pristine forest, and the AoA used for most vulnerable and irreplaceable species was the landscape scale water catchment area.

- Phuensum Consultancy Services (2026) Rapid Biodiversity assessment of the proposed Solar TL for the Wobthang Solar Project. Provided further biodiversity data for the dry season in Bhutan. Includes information with respect to vegetation, herpetofauna, lepidoptera and avifauna (Appendix 4-4).
- Phuensum Consultancy Services (2026) Vantage Point Survey Report Wobthang-Garpang TL Project. Provided vantage point bird survey data for the dry season. Target species were those considered to be at risk from impacts arising from the TL such as electrocution/collision. This included large-bodied birds (e.g., eagles and other raptors, cranes, storks), migratory species using seasonal corridors, and species with behaviours that increase risk (e.g., regular commuting between roosting and feeding areas, frequent ridge/valley crossings, flocking, low maneuverability, or reduced obstacle detection in low visibility) (Appendix 4-5).

## Protected Areas

208. Protected Areas (PAs) in Bhutan consist of five national parks, four wildlife sanctuaries, one strict nature reserve, nine biological corridors and one Royal Botanical Park (Figure IV-9: Protected Areas in Bhutan (source: Department of Forest and Park Services, 2025), covering 52% of the country's geographical area.

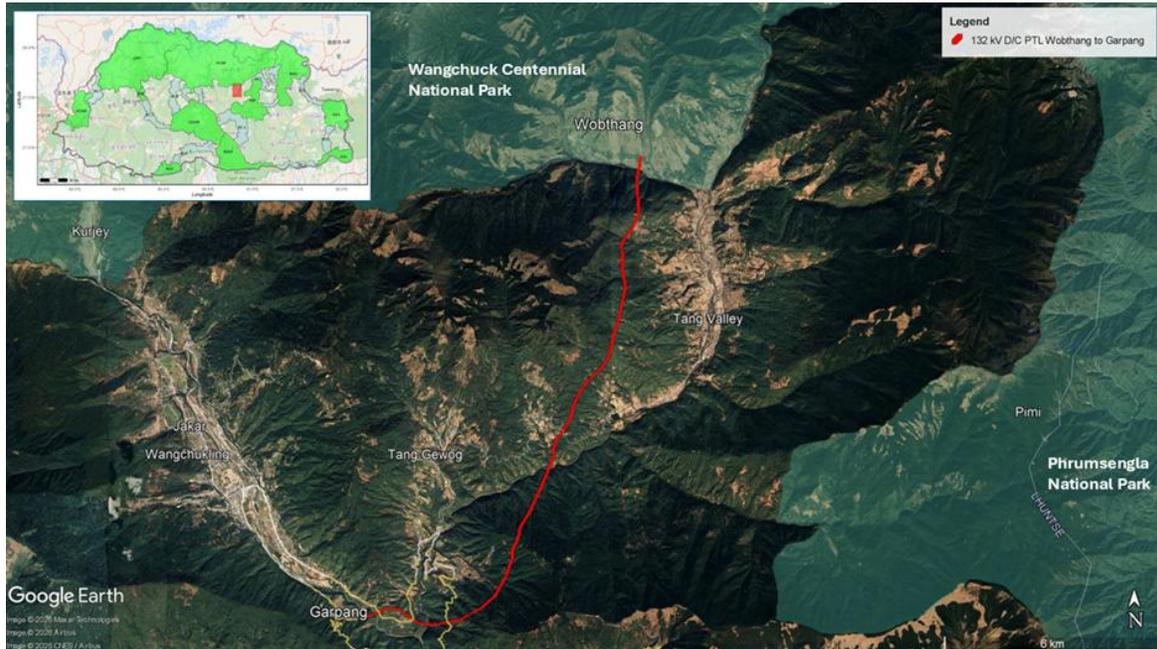
**Figure IV-9: Protected Areas in Bhutan (source: Department of Forest and Park Services,**



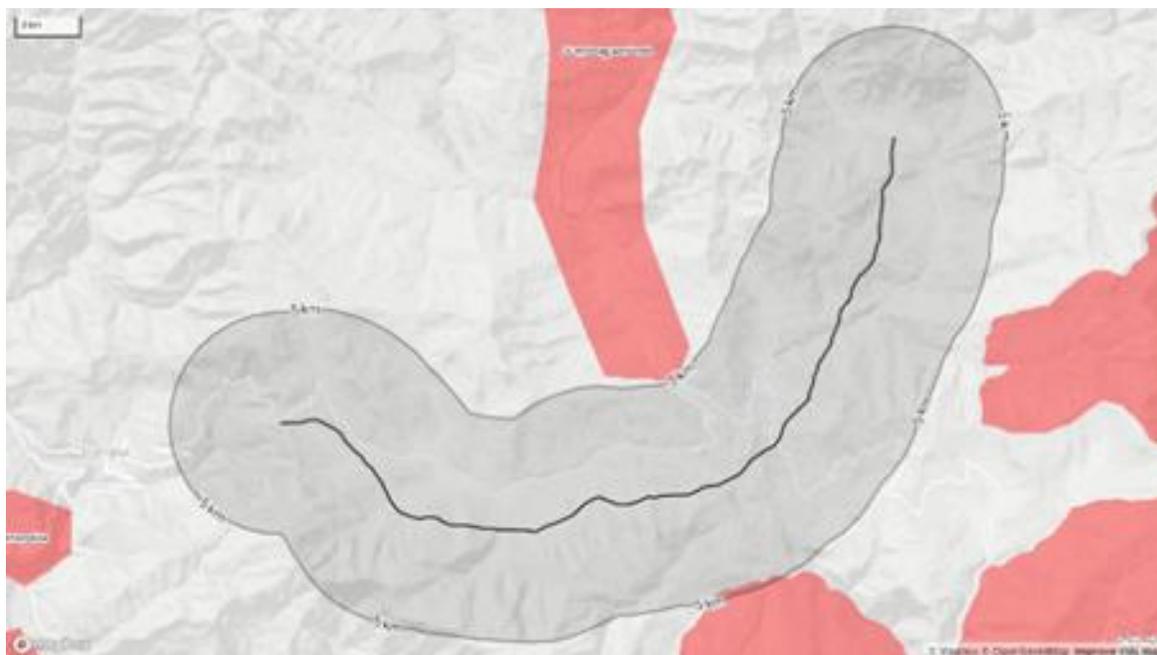
2025

209. There are two nationally protected areas within 10 km of the Project: WCNP and PNP. Project RoW is within WCNP, the northernmost end of the Project overlaps with the southernmost boundary of the National Park for 370m (Figure IV- 1). PNP is 5 km south of the Project RoW. Further details on these protected areas follow.

**Figure IV-10: Location of WCNP north of the Project and PNP to the east and south.**



**Figure IV-11: Location of Bumthang Wetlands KBA and IBA to the north of the Project**



210. In addition to the nationally protected areas, there are eleven internationally recognized areas, Key Biodiversity Areas (KBA) and Important Bird Areas (IBAs) within 50 km of the project. Of the 11 areas, 3 are within 10 km of the Project. Two are legally protected areas referenced above and are therefore both protected areas and KBAs. The third area is the Bumthang wetlands KBA and IBA. It is 5 km north of the site (**Figure IV-2**). Further information on the Bumthang wetlands follows.

211. All other KBAs and PAs are too distant from the project and, as a result, there are no direct or indirect ecological pathways by which impacts such sites from the construction/operation of the project could occur.

### **Wangchuck Centennial National Park (WCNP)**

212. The WCNP spans nine gewogs across five dzongkhags: Gasa, Wangdue Phodrang, Trongsa, Bumthang, and Lhuentse. In Bumthang, the gewogs of Chokhor and Tang fall within the WCNP park boundary. The park has a total area of 4,915 sq km and an altitudinal range of 1,350-7,500 masl. This variation fosters a wide array of ecosystems and rich biodiversity. The vegetation ranges from warm broadleaf forest to alpine meadows, with almost 85% of the park area under snow cover in the winter.

213. WCNP serves as the vital source of several streams and rivers, which are essential for the ecological health of downstream areas and support various hydropower projects.

214. The Forest Act and Regulations require that PAs are delineated into various management zones (core zone, transition zone, buffer zone, and multiple use zones) considering wildlife habitat, species richness, traditional right, dominant land use, and resource extraction areas, each with their own criteria and key functions.

215. The core zone of WCNP (40.2%) consists of landscapes with high conservation values where human activity and development is not permitted. The transition zone of the park permits some human activity like herding and seasonal cordyceps collection in high-altitude grazing land by nomadic communities, and religious and cultural sites. A majority of the park falls under the transition zone (53.11%). The buffer zone is a scaled area around transition and multiple-use zones to limit disturbances to the core zone from human activities. Around 2.2% of the park area falls under the buffer zone.

216. The multiple-use zone (4.49%) includes settlements, build-up areas, private registered lands and resource allocation areas for the protected area residents, where park management and residents strive for sustainable resource use. In WCNP, the multiple-use zone was demarcated as a 500m radius buffer from traditionally used areas like fields and settlements that individuals and communities have rights over. Traditional grazing lands called *tsamdros* of nomadic yak-herding communities also fall under this zone.

217. Data from IBAT shows that the WCNP is home to 693 species of vascular plants, 43 species of mammals, 251 species of birds, and 246 species of butterflies. It provides crucial habitat for several iconic and globally significant species, including the Bengal tiger (*Panthera tigris*), snow leopard (*Panthera uncia*), Tibetan wolf (*Canis lupus*), Bhutan takin (*Budorcas taxicolor whitei*), Himalayan black bear (*Ursus thibetanus*), Himalayan musk deer (*Moschus chrysogaster*), and Red Panda (*Ailurus fulgens*). 18 of the 43 mammal species are listed on the IUCN Red List (5 EN, 8 VU, 5 NT), as well as two reptiles, six plants and one fungi (*Cordyceps*).

218. In terms of avifauna, WCNP supports high-altitude avian species, such as the Raven (*Papilio castor* - LC), Himalayan Monal (*Lophophorus impejanus* - LC - nationally protected) and Satyr's tragopan (*Tragopan satyra* - LC). Out of the 251 species of birds recorded in the Park, 130 are confirmed to also breed within its boundary. IUCN Red List species like Pallas's Fish-eagle (*Haliaeetus leucoryphus* - EN) and the Black-necked Crane (*Grus nigricollis* - NT) have also been recorded.

219. The WCNP is of international importance supporting significant numbers and diversity of wildlife. The northernmost 370 m of the project construction footprint is within and therefore overlaps with the multiple-use zone on the southern edge of the WCNP.

### **Phrumsengla National Park (PNP)**

220. PNP is located circa 9.5km to the south of the project site. It shares boundaries with 10 gewogs of Bumthang, Mongar, Lhuentse, Mongar and Zhemgang Dzongkhags. Under Bumthang Dzongkhag, Chumey, Ura and Tang gewogs fall under the park's jurisdiction. The Park has an area of 905.05 sq km with an elevation range of 900 masl to about 4500 masl.

221. PNP's zonation follows the same criteria and functions as in WCNP, and areas of each are as follows: core zone (22%), transition zone (53%), buffer zone (12%) and multiple-use zone (13%). Core zones feature high-conservation value areas for species habitats, wildlife refuge sites, and important streams. Multiple-use zones are designated for resource allocation, ecotourism, construction of TLs, roads, government institutions and other developmental activities, agricultural farmlands, communal lands, and camping sites.

222. The PNP is internationally-recognised as a KBA in response to the wildlife it supports. This is reflected in IBAT data which shows a wide variety of plant species in the PNP. Around 1,000 species of plants with over 161 species of trees, 274 of shrubs and 316 of herbs, including medicinal plants and 23 endemic plant species are recorded occurring within the NP. Faunal species recorded include 70 species of mammals, 364 species of birds, and some 50 species of butterflies. Nine of the 70 mammal species recorded within the NP are listed on the IUCN Red List (four EN, five VU).

223. Out of the 364 bird species, five of the 364 bird species are listed on the IUCN Red List including the White-bellied heron (*Ardea insignis* - CR), Pallas's Fish-eagle (*Haliaeetus leucoryphus* - EN), Rufous-necked hornbill (*Aceros nipalensis* - VU), Beautiful nuthatch (*Sitta formosa* - VU) and Chestnut-breasted partridge (*Arborophila mandellii* - NT).

224. The PNP is of international importance as a KBA supporting significant numbers and diversity of wildlife including bird species that are large enough and wide ranging enough to use the area around the project site, in particular if migrating to the Bumthang Wetlands KBA.

### **Bumthang Wetlands**

225. The Bumthang Wetlands KBA were designated in 2004 as a habitat for the Black-necked Crane by BirdLife International, in collaboration with the Royal Society for the Protection of Nature. The site is now recognised as being of international importance due to the significant proportion of the global migratory population of this species that it supports during the wintering period.

226. The wetlands comprise a mosaic of marshes, wet meadows, riparian habitats, and associated river channels within the Bumthang Valley. These habitats provide critical foraging

and roosting areas for black-necked cranes, as well as supporting a wider assemblage of wetland-dependent birds, amphibians, and aquatic biodiversity.

227. Approximately 68.1% of the Bumthang Wetlands overlap with the boundary of WCNP, strengthening their conservation significance within Bhutan's protected area network. The remaining areas occur within a managed cultural landscape, where traditional agricultural practices play an important role in maintaining wetland structure and ecological function.

228. Overall, the Bumthang Wetlands represent a site of high ecological value at national and international levels, combining species of conservation importance with key ecosystem services and strong functional connectivity to surrounding protected habitats. It is within 5km north of the Project and is designated for the vulnerable and irreplaceable bird species it supports.

### **Priority Biodiversity Features – Protected Areas**

229. For the purposes of this assessment, the following protected areas are PBFs given their proximity to the project site:

- Wangchuck Centennial National Park (WCNP)
- Bumthang Wetlands
- Phrumsengla National Park (PNP)

### **Habitats**

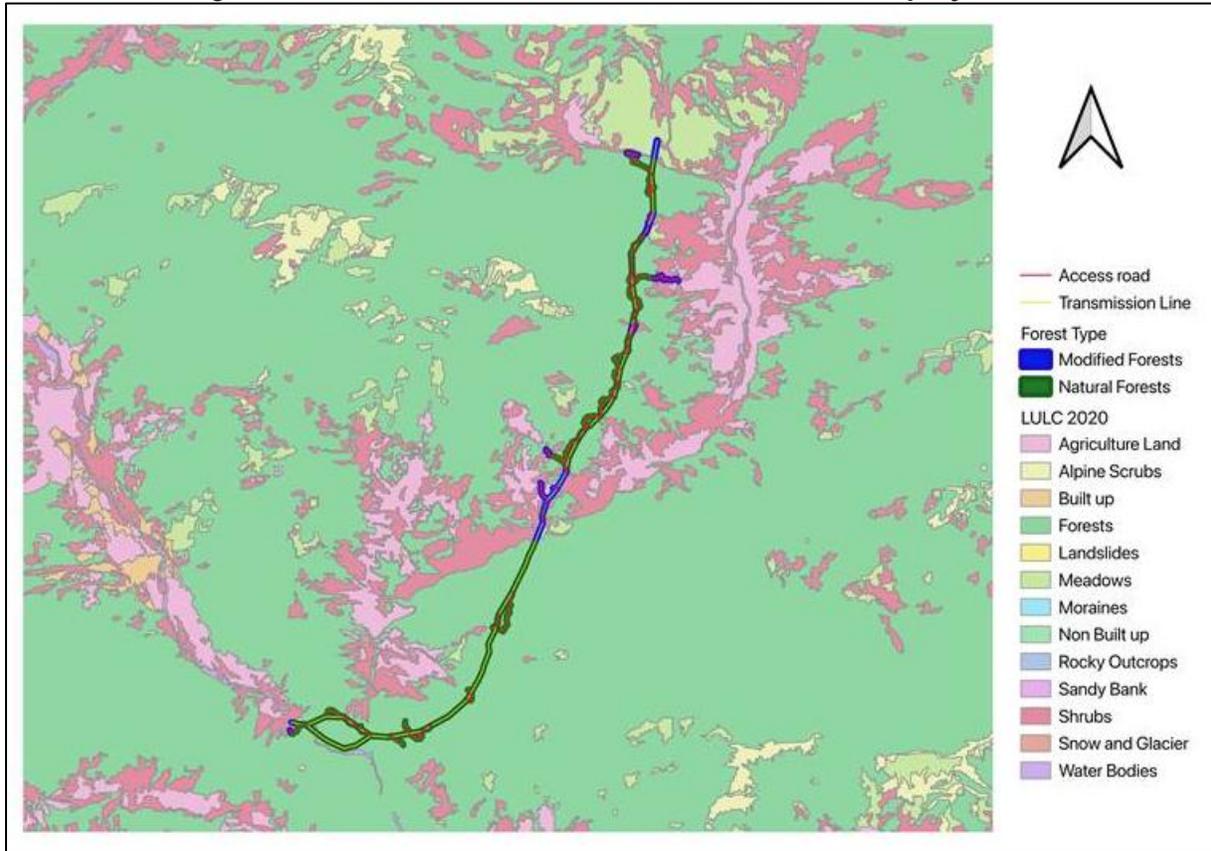
230. Under ESS6, habitats within the project area must be distinguished between Modified or Natural based on their ecological condition and degree of human influence. Projects affecting Natural habitat must avoid significant adverse impacts and achieve at least NNL, and preferably a Net Gain.

231. ESS6 defines Natural Habitat as: "...areas composed of assemblages of plant and animal species of largely native origin, where human activity has not essentially modified an area's primary ecological function and species composition." Modified Habitat is defined as "...areas that contain a large proportion of plant and/or animal species of nonnative origin, and/or where human activity has substantially modified an area's primary ecological functions or species composition".

232. The total area within the proposed construction footprint is 53.49 ha. Of the total area, the RoW for the TL is 46.7ha and that of the access road is 6.79ha. Desk-based analysis determined that 84% of the total Project RoW is Natural Habitat (44.84ha), and 16% as modified (8.65ha) (Figure IV-13.) The Natural Habitat along the alignment is dominated by blue pine (circa 38.6ha) with abundant mixed conifer (11.6ha).

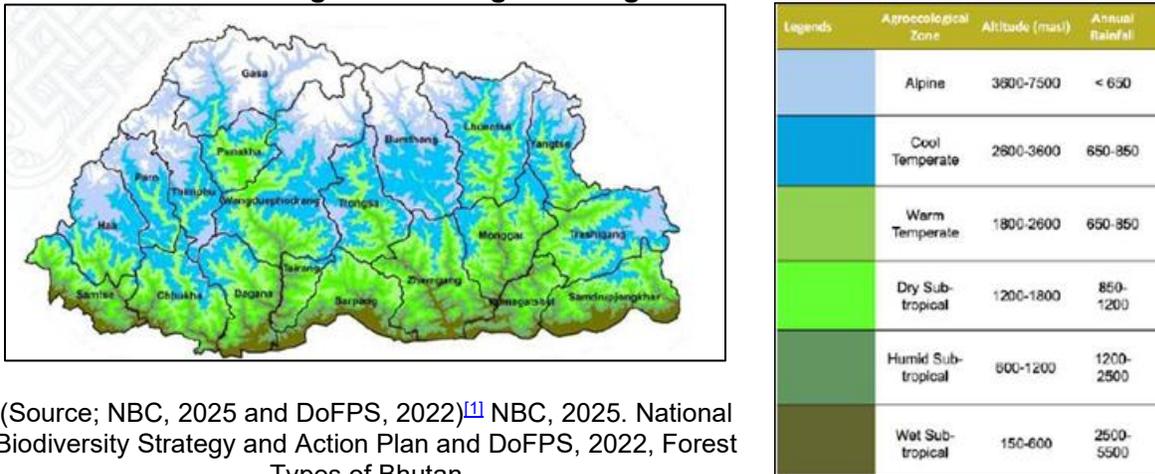
233. Contextually, Bhutan comprises six agro-ecological zones that extend from the wet subtropical lowlands to the alpine highlands (Figure IV-12). These zones are defined by pronounced differences in elevation, temperature, and rainfall, and they underpin the country's wide range of vegetation types, land-use patterns, and biological diversity (NBC, 2019, 2025).

Figure IV-12: Natural and Modified land cover within project site



Source: Map prepared by GIS consultant, PCS based on Land use Land cover data 2016.

Figure IV-13: Agro-ecological zones in Bhutan

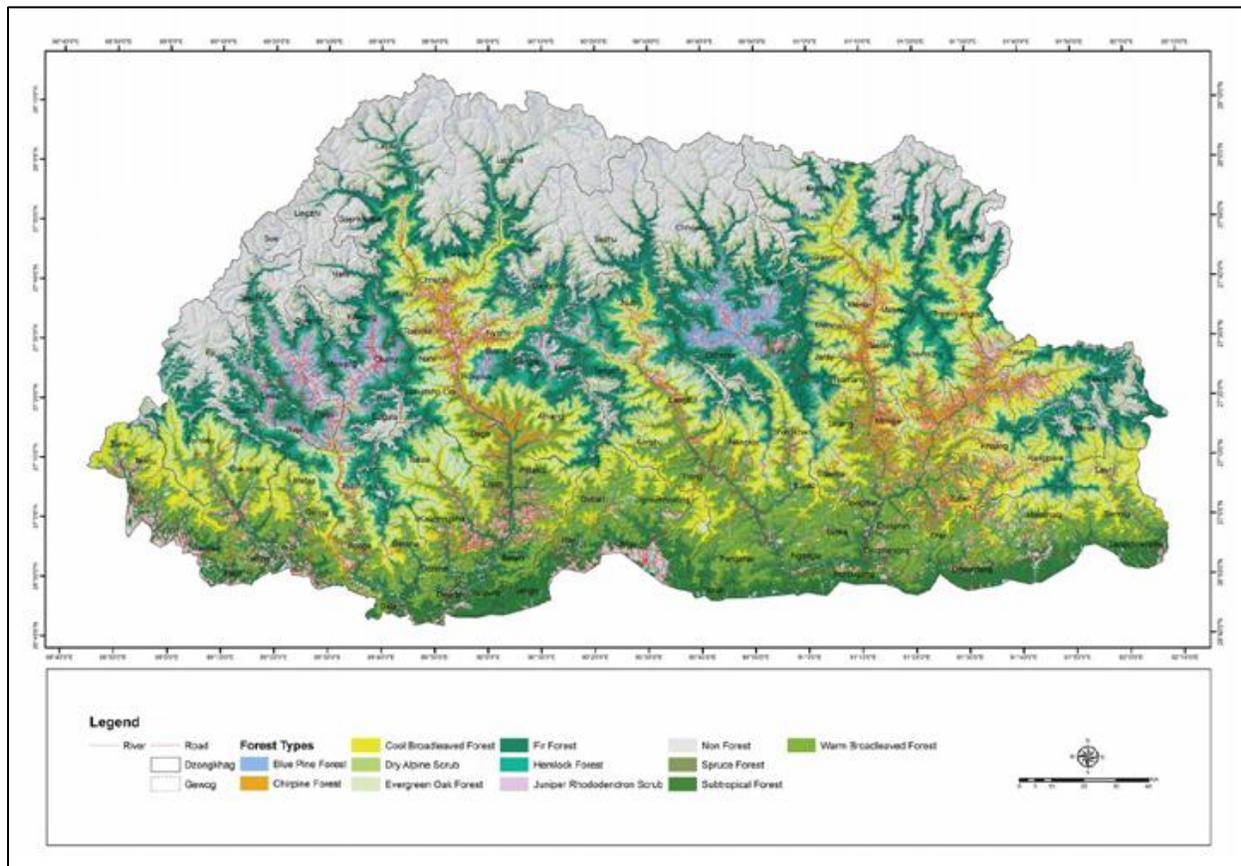


(Source; NBC, 2025 and DoFPS, 2022)<sup>11</sup> NBC, 2025. National Biodiversity Strategy and Action Plan and DoFPS, 2022, Forest Types of Bhutan

234. The forest cover in Bhutan (Figure IV-14) is estimated to be 69.71% (2.68 million ha) of the total land area, a decrease from 71% in 2016. 64% of the total forest is very dense (70-100% canopy cover), 14% is dense (60-70% canopy cover), 16% is moderately dense (40-60% canopy

cover), and 7% is open forest (10-40% canopy cover). Of all the forest types, broadleaved forest is the most widespread (68%), followed by coniferous forest (32%)<sup>16</sup>

**Figure IV-14: Forest Types in Bhutan**



Source: DOFPS 2022. Forest types of Bhutan. Maps and Statistics maps Forest Resources Management Division

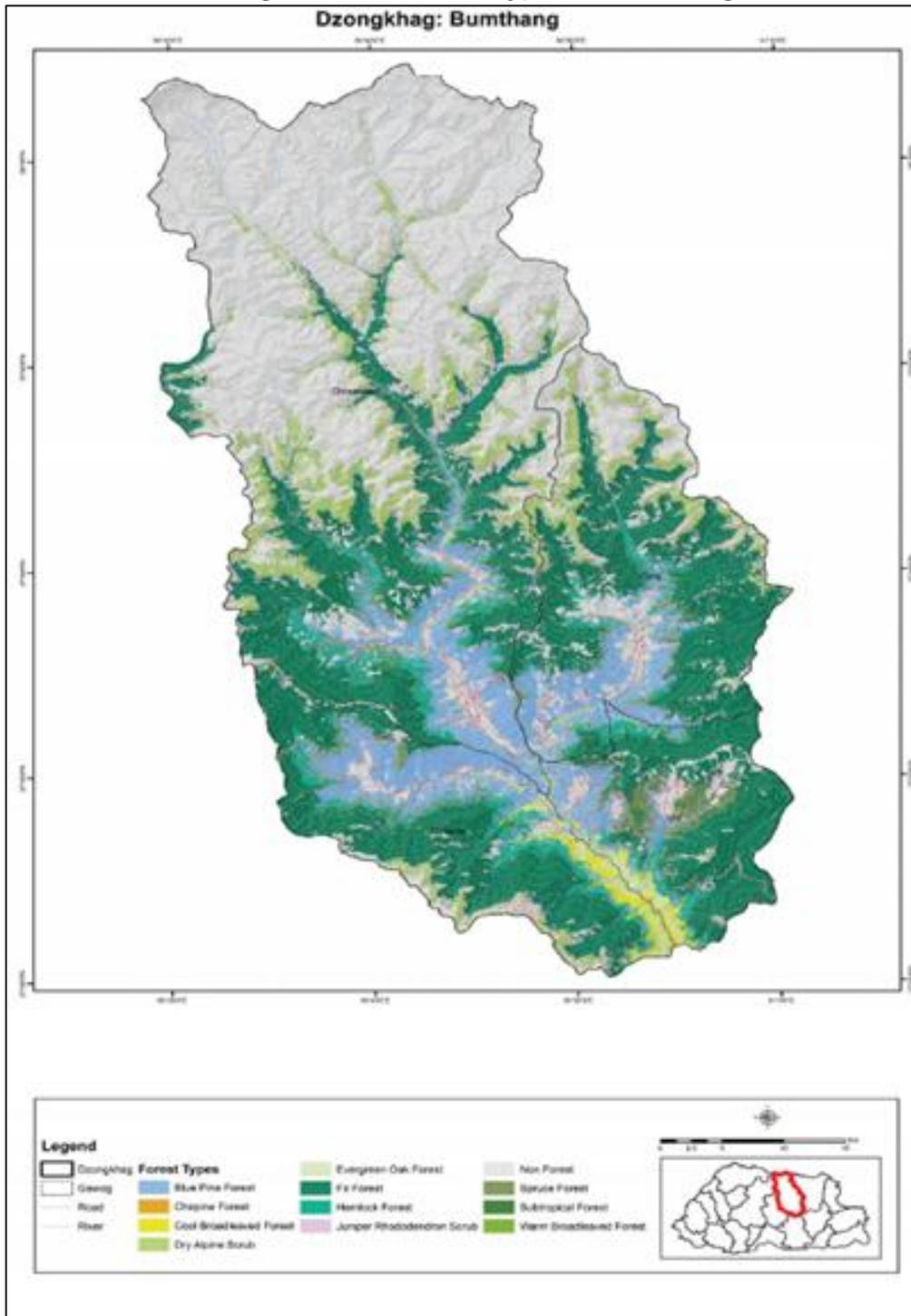
235. Contextually, Bhutan comprises six agro-ecological zones that extend from the wet subtropical lowlands to the alpine highlands (Figure IV-14). These zones are defined by pronounced differences in elevation, temperature, and rainfall, and they underpin the country’s wide range of vegetation types, land-use patterns, and biological diversity (NBC, 2019, 2025).

236. State reserve forest land is further categorized as Protected Areas (that are further categorized into various zones, including multi-use zones, as described above), Biological Corridors, Forest Management Units, Local Forest Management Areas (LMFA), Community Forest, Private Forest, etc. Within Bumthang, there are LFMA under every gewog. Compared to other districts, Bumthang has the third lowest forest cover (53.7% of the land area), after Gasa (20.56%) and Thimphu (45.18%).<sup>[1]</sup> Bumthang forests are dominated by conifer species, with Fir Forest accounting fo30.27% %, followed by Blue Pine Forest which is around 10.53% (Figure IV-16). Other forest types present in Bumthang are Hemlock, Spruce, Cool Broadleaved Forest,

<sup>16</sup> FMID, 2023, National Forest Inventory Volume I: State of Forest Report

and Juniper Rhododendron Scrub. Dry Alpine Scrub covers 7.63% 7.63 % of the district. [\[1\]](#)  
 Source DoFPS, 2023.

**Figure IV-15: Forest Types in Bumthang**



Source: DOFPS 2022. Forest types of Bhutan. Maps and Statistics maps Forest Resources Management Division

237. Within the project area, the two dominant forest types identified by surveys completed in 2025 were Mixed Conifer Forest and Blue Pine Forest (Figure IV-15).

238. Mixed Conifer Forest is generally considered a transitional forest between broadleaf and coniferous forest, and they usually occur in mid altitude ranges. In the current study area, this forest type is found between 2,800–3,260 m with canopy cover ranging from 53%–90%. The dominant trees are *Tsuga Dumosa*, *Pinus walliachina*, *Rhododendron arboreum*, *Populus rotundifolia* and *Enkainthus deflexus*. The understorey is mostly composed of *Daphne bholua*, *Rhododendron kesangiae*, *Yushania microphylla*, *Smilax* spp., and *Rubus fockeanus*.

239. Blue Pine Forest extends between the elevation range of 2,650–3,300 masl. The dominant tree species are *Pinus wallachiana*, *Salix wallichiana* and *Lyonia ovalifolia*. Frequently, bluepine forest co-occur with understorey species such as *Populus rotundifolia*, *Rosa macrophylla*, *Epipactis hellborine*, *Chimaphilia japonica* and *Polygonatum* sp.

240. Broadleaf forest is only found at a very small stretch (between 4.41-4.44km), near AP 11-AP 12. Here, species such as *Alnus nepalensis*, *Lyonia ovalifolia*, *Brassaiaopsis mitis*, *Quercus graffithii*, *Acer cappadocium* and *Exbucklandia populenea* were dominant.

Table IV-2: Habitat types along the TL and Road Alignment

Forest Type and Land use	TL (ha)
Blue pine	36.60
Mixed Conifer	11.60
Broadleaf	0.15
Kamzhing (agriculture)	0.15
Shrubs	1.10
Meadow	1.21
Other	0.55
<b>Total</b>	<b>53.21</b>

241. Within the project area, the degree of disturbance and habitat modification depends on the accessibility and proximity to settlements and private land. Areas that are more accessible from nearby logging roads, power tiller tracks, farm roads and foot paths show signs of tree felling, livestock grazing and presence of invasive plant species. Overall, the extent of habitat disturbance within the project site is spatially limited to areas around the access roads, trails and grazing areas.

242. From the northern end within the WCNP MUZ, the initial section of the TL is mostly modified habitat that comprises grazing land, the Tang-gewog access road, the Tangchhu (river), bridges with scattered vegetation that is mostly dominated by one species, blue pine *Pinus wallichiana* (Photograph IV-1).

**Photo IV- 1 and Photo IV- 2: Blue pine dominated forest and mixed conifer**



**Photo IV- 3 and Photo IV- 4: Modified habitat in WCNP**



**Photo IV- 5: Existing cattle bridge**



**Photo IV- 6: The Tangchhu river**



**Photo IV-7: Fallow private land at AP #7**



**Photo IV-8: Nangang community forest**



**Photo IV-9: Modified habitat**



**Photo IV-10: Areas damage by fire**



243. Another stretch where the forest is modified is where the TL passes close to Pangzhing village and through areas scattered with private land. Also, there is a 33KV distribution line traversing the site near AP 28 for which RoW has been cleared and the gewog road crossing (

244. Photo IV-11 and

245. Photo IV-11).

**Photo IV-11: 33kV line near the site**

**Photo IV- 12: Power tiller track**



246. The TL stretch inside Garabling Community Forest is mostly dominated by blue pine trees and includes an existing logging road. The stretch between AP 4-7 is also modified as it comprises of grazing land with little vegetative cover and also includes private land (Photographs 4-7 – 4-9). It is quite common to find remotely located private land being left fallow because of the lack of farm help and because of the distance from home. However, at any time, the owner may start cultivating the land or constructing structures. Closer to the villages, the forest is modified in the more accessible areas where the farm road passes through.

247. The field survey conducted in December indicates that the sites assessed along planned existing roads (especially at take-off points) are modified habitat and areas passing through Ngangang community forest.

### **Priority Biodiversity Features – Habitats**

248. For the purposes of this assessment, the 44.84 ha of Natural Habitat present within the project site is a PBF.

### **Trees and plants**

249. The flora encountered along the RoW for both the TL and access roads was surveyed during both the wet and dry seasons in 2025 (see the ESIA Appendices) using a 20x20m plot and 2x2m sub-plot sampling regime, as recommended in the Biodiversity Monitoring and Social Survey Protocol of Bhutan (DoFPS 2020). At least 41 plots were surveyed in the wet season and a further 41 in the dry season. Within each 20x20m plot, all the tree species along with their condition were sampled. Within each 2x2m sub-plot, all shrub and understory species were identified and recorded.

250. The proposed TL from Wobthang to Garpang predominately falls under mixed-conifer and blue pine forests with low to moderate diversity, indicating that tree species are largely dominated by a single species both along the access road and TL RoW. The dominant trees were *Pinus wallichiana*, followed by *Tsuga Dumosa*, *Hydrangea heteromall*. The canopy cover also varies from as low as 5% r at Nangnag to as high as 75% at Yerang. Within the project area, 14 different tree species (belonging to nine families), 55 shrub species (22 different families) were documented along the proposed TL. The most common families were Rosaceae (12 species) and Ericaceae (11 species) Families such as Aquifoliaceae, Asteraceae, Betulaceae, Buxaceae, Lamiaceae, Lauraceae, Smilacaceae, Symplocaceae, and Thymelaeaceae were less common, each represented by only one species. Ground vegetation comprised 68 herbaceous plants (34 families) of which the most dominant was Asteraceae (14 species), while many families were represented by a single species.

251. A total of 27 shrub species from 14 plant families were documented along the access roads. The most dominant family was Rosaceae with nine species. Less common families included Buxaceae, Caprifoliaceae, Fabaceae, Lauraceae, Poaceae, Salicaceae, Smilacaceae, and Thymelaeaceae, each represented by only one species. Ground vegetation comprised a total of 41 herbaceous species, representing 21 different families, were documented along the proposed access roads. The family Asteraceae was the most dominant, comprising 10 species. Several other families, including Polypodiaceae, Plantaginaceae, Ophioglossaceae, Lycopodiaceae, Juncaceae, Hypericaceae, Geraniaceae, Fabaceae, Dernstaedtiaceae, Boraginaceae, Asparagaceae, and Apiaceae, were each represented by a single species.

252. Of all the floral species, one was Endangered *Taxus wallichiana*, two were Vulnerable *Picea brachytyla* and *Populus rotundifolia* and one was Near Threatened *Acer sterculiaceum* under the IUCN Red List categories. They are also listed under schedules II and III of the national Forest and Nature Conservation Act (FNCA) 2023. The other nine species that are listed as Least Concern on the IUCN Red List are also listed on schedule II and II of the FNCA 2023. The schedules address different classes of forest/timber products and their protection from illegal felling.

### Priority Biodiversity Features – Flora

253. For the purposes of this assessment, the following flora are considered to be PBFs on the basis of their IUCN status:

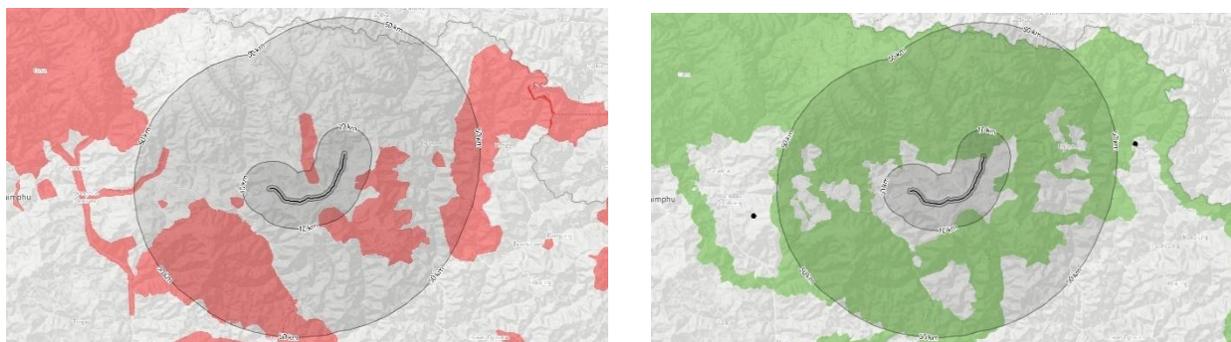
- *Taxus wallichiana*;
- *Picea brachytyla*; and
- *Populus rotundifolia*.

**Table IV-3: Floral species reported during the surveys for the Project**

Sl. No	Scientific Name	Common / local Name	FNCA Schedule	IUCN Status
1	<i>Taxus wallichiana</i>	Himalayan Yew, Ha-shing (Dzo), Keerang shing (Sh), Dhengre salla (Lho)	Special Class Timber	Endangered
2	<i>Picea brachytyla</i>	Spruce, Bashing (Dzo), Kalo salla (Lh)	III	Vulnerable
3	<i>Populus rotundifolia</i>	Not Evaluated	III	Vulnerable

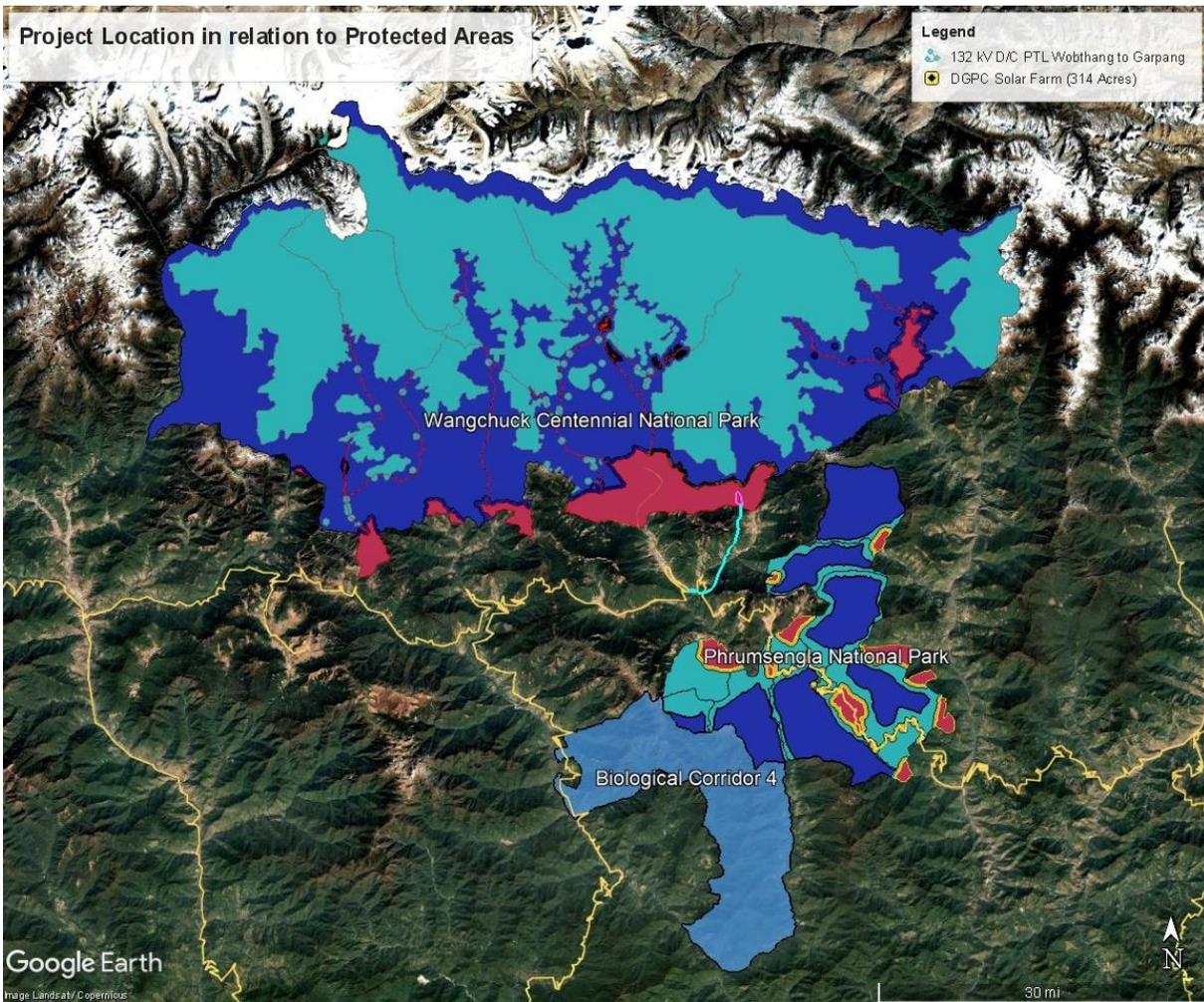
4	<i>Acer sterculiaceum</i>	Maple, Chalam-Shing/Sermalingshing (Dzo), Kapasey (Lho)	II	Near Threatened
5	<i>Betula utilis</i>	Himalayan Birch, Taab (Dzo), chhar-shing (Sh)	II	Least Concern
6	<i>Pinus wallichiana</i>	Bluepine, Tongphu (Dzo), chang-shing (Sh), Dhubi (Lho)	II	Least Concern
7	<i>Corylus ferox</i>	Himalayan hazelnut	III	Least Concern
8	<i>Hydrangea heteromalla</i>	Not Evaluated	III	Least Concern
9	<i>Ilex dipyrena</i>	Not Evaluated	III	Least Concern
10	<i>Lyonia villosa</i>	Shajula-shing (Sh), Lek angeri(Lh)	III	Least Concern
11	<i>Malus baccata</i>	Not Evaluated	III	Least Concern
12	<i>Accer cappadocicum</i>	Maple, Chalam-Shing/Sermalingshing (Dzo), Kapasey (Lho)	II	Least Concern
13	<i>Prunus rufa</i>	Not Evaluated	III	Not Evaluated
14	<i>Tsuga dumosa</i>	Hemlock, Sey shing(Dz), Tengre sallam(Lh),	III	Not Evaluated

**Figure IV-16: 10-50km buffer around the TL** (Source: IBAT PS6 & ESS6 Report. Generated under



licence 26117-97542 from the Integrated Biodiversity Assessment Tool on 03 December 2025 (GMT).  
[www.ibat-alliance.org](http://www.ibat-alliance.org)

**Figure IV-17: Location of the TL**



Source: Zonation Map from DoFPS, received in 2025.

## **Mammal Species**

254. The Himalayan geography of Bhutan is known to support a diverse range of mammal species including those of international conservation concern such as Snow Leopards, Tigers, Elephants and Red Pandas. This diversity is reflected in the IBAT data with a total of 104 mammal species recorded within 50km of the Project.

255. To establish the usage of the project area by mammals, including any of conservation importance, surveys were undertaken during both wet and dry seasons to account for variations in climatic conditions. The detailed results from these are reported in the ESIA Appendices. The surveys comprised a combination of direct observation and camera traps set up within survey plots along the RoW. Plots were located to coincide with visible mammal paths (in the wet season) and at a higher density during the dry season. Trap location was further informed by the presence

of animal signs such as tracks, scat or markings. Traps were set to record for a fixed period (up to 15 nights). Data were analysed to identify mammal usage recorded.

256. In total 13 mammal species were recorded across the two survey periods, five are vulnerable and one is endangered as per the IUCN Red List (Table IV-4). Sambar was the most common mammal species recorded across all survey locations with the most common apex carnivore being Common Leopard, see Photo IV- 13 to Photo IV- 21. All Photos were captured on camera traps.

257. In addition, although not targeted as part of the mammal surveys, it is likely that the project area and surrounding landscape support a range of bat species, including roosts of those that use trees.

**Table IV-4: Mammal Species of conservation reported during the survey for the Project**

Sl.no	Scientific name	Common name	Family	FNCA Schedule	IUCN status
1	<i>Catopuma temminckii</i>	Asiatic golden cat	Felidae	II	VU
2	<i>Panthera pardus</i>	Common leopard	Felidae	II	VU
3	<i>Capricornis thar</i>	Himalayan serow	Bovidae	II	VU
4	<i>Rusa unicolor</i>	Sambar	Cervidae	II	VU
5	<i>Cuon alpinus</i>	Wild dog	Canidae	II	EN
6	<i>Ursus thibetanus</i>	Asiatic black bear	Ursidae	II	VU



**Photo IV- 13 Red Fox**



**Photo IV- 14 Common Leopard Cat**



**Photo IV- 15 Common Leopard**



**Photo IV- 16: Asiatic Golden Cat**



Photo IV- 17: Sambar



Photo IV- 18: Barking Deer



Photo IV- 19: Wild Dog



Photo IV- 20: Himalayan Serow



Photo IV- 21: Wild Pig



Photo IV- 22: Yellow-throated Marten

### Priority Biodiversity Features – mammals

258. For the purposes of this assessment, the following mammals are PBFs on the basis of their presence or likely presence on site and their IUCN status:

- Asiatic golden cat
- Common leopard
- Himalayan serow
- Sambar
- Wild dog

- Asiatic black bear
- Bats assemblage (in line with the precautionary approach)

## Avifauna

259. Bhutan is globally recognized for its exceptional biodiversity and intact natural habitats, making it a critical stronghold for bird conservation. Its varied altitudinal gradients support a diverse avifauna, including numerous species of conservation concern such as raptors, cranes, and endemic songbirds. Within Bhutan, the landscape surrounding the project site is particularly important for birds due to its mosaic of forests, riverine corridors, and high-elevation habitats, which provide breeding, foraging, and migratory stopover sites which includes several KBAs such as the Bumthang Wetlands PNP. The IBAT data included records of 542 bird species within 50 km of the Project.

260. Recognising the importance of birds within the landscape surrounding the project, bird transect surveys were undertaken during both the wet and dry seasons as well as vantage point bird surveys that focused specifically on large-bodied, soaring species. These surveys included fixed-period recording at nine vantage points chosen for their geographic location and potential to view across the project RoW. Full methodologies and results of the bird surveys are provided in the ESIA appendices.

261. A total of 108 bird species were recorded during the wet season surveys. Of these, three are listed as Near Threatened (Table IV-5) with the remainder being Least Concern. Surveys during the dry season recorded 46 bird species, all of which were LC in conservation status. However, two species that receive full legal protection under Schedule I of the FNCA, the Satyr Tragopan and the Himalayan Monal, which were both recorded on two occasions (Table IV-5).

262. Three raptor species were recorded during the vantage-point survey: Himalayan Griffon (*Gyps himalayensis*), a large-bodied vulture listed as Near Threatened; Mountain Hawk-Eagle (*Nisaetus nipalensis*), a large bird of prey listed as Near Threatened; and Himalayan Buzzard (*Buteo refectus*), a medium-large raptor listed as Least Concern. Overall, detections were dominated by Himalayan Griffon (4-7 individuals across multiple vantage points; 1,605 seconds of recorded flight), while Himalayan Buzzard and Mountain Hawk-Eagle were each recorded once (515 and 485 seconds, respectively). Across all observations, raptor activity was concentrated mainly in the mid-high to high flight-height bands, with limited low-height use (recorded only in one griffon observation and the buzzard record), suggesting that most movements occurred above the lowest height zone during survey periods.

263. No black-necked crane was observed but the species remains of ecological significance in the local area given the proximity to the Bumthang Wetlands IBA, which is internationally recognized for its population.

264. Of the non-target species, 50 species were recorded. Species richness was highest at VP5 (20 species) and VP6 (19), followed by VP2 (18) and VP9 (17) (see Appendix 4-5). The lowest richness was observed at VP4 (9). The most widespread species were the Yellow-billed Blue Magpie (*Urocissa flavirostris*), recorded at all nine vantage points, and the Chestnut-crowned Laughing Thrush (*Trochalopteron erythrocephalum*), recorded at eight, indicating a core set of common montane birds occurring consistently across the survey area. Several other species were also broadly distributed, including Blue Whistling Thrush (*Myophonus caeruleus*), Green-backed

Tit (*Parus monticolus*), Spotted Nutcracker (*Nucifraga caryocatactes*), Large-billed Crow (*Corvus macrorhynchos*), and Red-billed Chough (*Pyrrhocorax pyrrhocorax*), reflecting frequent use of the surrounding forest–edge and open-slope habitats. None of the species recorded were listed as being of conservation concern.

**Table IV-5:** Avifauna species of conservation significance/legally protected reported during the surveys

Sl.no	Common name	Scientific name	FNCA Schedule	IUCN status
1	Himalayan Griffon	<i>Gyps himalayensis</i>	Not listed	NT
2	Satyr Tragopan	<i>Tragopan satyra</i>	I	LC
3	Himalayan Monal	<i>Lophophorus impejanus</i>	I	LC
4	Mountain Hawk-Eagle	<i>Nisaetus nipalensis</i>	Not listed	NT
5	River Lapwing	<i>Vanellus duvaucelii</i>	III	NT

### Priority Biodiversity Features – avifauna

265. Although NT (and therefore not Vulnerable or rarer), for the purposes of this assessment, the following avifauna are considered to be PBFs on the basis of their occurrence over the project site and potential for impacts with electrical infrastructure:

- Himalayan Griffon
- Black-necked crane
- Mountain Hawk-Eagle
- Black-necked crane (associated with the nearby Bumthang Wetlands)

### Amphibians and Reptiles

266. Bhutan has a rich diversity of herpetofauna (amphibians and reptiles) given its range of landscapes and the altitudinal variation. The herpetofauna of Bhutan includes frogs, salamanders, lizards, snakes, and turtles and features several endemic and regionally restricted species.

267. The IBAT data identified 100 species of herpetofauna (56 amphibian and 44 reptile) within 50 km of the Project.

268. Surveys for herpetofauna within the project area were undertaken during both the wet and dry seasons. Surveys during the wet season comprised both transect walks and visual encounter surveys. Additionally, techniques such as rock rolling, vocalization monitoring, and targeted habitat searching were also utilized. Surveys during the dry season included timed searches of survey plots along the project RoW. The survey methodologies and results are provided in the ESIA Appendices.

269. Herpetofauna diversity within the project site was found to be limited in both extent diversity and abundance. During the surveys, three herpetofauna species were recorded from the project site, all of which were considered to be of Least Concern conservation status (Table IV-6).

**Table IV-6: Amphibians and Reptiles reported during the survey**

Sl.No	Species	Common Name	Count	IUCN Red List
1	<i>Pseudoxenodon macrops</i>	Large-eyed False Cobra	1	LC (not listed in IBAT)
2	<i>Scutigera bhutanensis</i>	Bhutan Snow Toad	1	Data Deficit
3	<i>Ablepharus sikimensis</i>	Sikkim Ground Skink	1	LC

270. As a result, herpetofauna are not considered to be a PBF.

### **Invertebrates**

271. As with other taxa, the invertebrate diversity of Bhutan is considerable and includes over 6,000 species of insects alone. The true diversity of invertebrates is likely significantly under-recorded, however, due to limited systematic surveys, especially in remote areas. Several species are of conservation concern, including rare butterflies, dragonflies, freshwater mollusks, and pollinators. Many of Bhutan's invertebrates are endemic or restricted to the eastern Himalayan region, making the country a key reservoir of unique biodiversity. IBAT data identified 88 species of invertebrate within 50 km of the Project.

272. No systematic surveys of invertebrates were completed. Therefore, given the very limited data available, and the limited extent of the project spatially and temporally, no invertebrates are considered to be PBF.

### **Invasive species**

273. Bhutan, with its diverse ecosystems and rapidly changing land use, faces growing challenges from invasive non-native species. Although relatively few invasive species have been formally documented compared to neighboring countries, those established, such as certain alien plants, freshwater fish, and invertebrates, pose significant threats to native biodiversity.

274. Invasive plants can outcompete native flora, alter habitat structure, and disrupt forest regeneration, while introduced fish and invertebrates may prey on or compete with native species, affecting freshwater ecosystems. The main drivers of invasions include agriculture, horticulture, aquaculture, and accidental introductions, and climate change may further facilitate their spread.

275. Vegetation surveys for vegetation along the project site RoW during both the wet and dry seasons recorded several invasive plant species. The invasive and weedy species recorded include *Ageratina adenophora*, *Chromolaena odorata*, *Galinsoga parviflora*, *Crassocephalum crepidioides*, *Bidens pilosa*, *Solanum viarum*, *Euphorbia hirta*, *Oxalis corniculata*, *Trifolium repens*, *Plantago spp.*, *Rumex nepalensis*, and *Erigeron spp.* These species are commonly associated with anthropogenic disturbance and are known to colonize exposed soils and degraded areas rapidly.

276. The only true invasive species recorded was Croften Weed *Ageratina adenophora*, a native of Mexico imported into Asia as an ornamental plant. Consultation during the field mission further identified the presence of an invasive beetle that affects pine trees, the Pinewood nematode. It is transmitted by longhorn beetle species, and is present across the area. The beetle causes the pines to wilt and poses a significant risk to Bhutan's native pine forests.

## Priority Biodiversity Features

277. Although not formally a PBF, the presence of invasive species is considered within the impact assessment to ensure that the project accounts for this threat to biodiversity.

## Ecosystem Services

278. Ecosystem services are the benefits that people obtain from nature. They are generally categorised into four main types. Provisioning services include the goods ecosystems provide, such as food, freshwater, fuelwood, and medicinal plants. Regulating services are the natural processes that help maintain environmental stability, including water purification, climate regulation, and soil stabilisation. Supporting services underpin these systems by sustaining nutrient cycling, soil formation, and primary production (e.g. plant growth). Finally, cultural services encompass the non-material benefits that nature provides, such as recreation, spiritual value, and traditional knowledge. Together, these services are essential for human well-being, economic security, and the long-term functioning of natural ecosystems.

279. The forests and rivers of the Wobthang region provide essential ecosystem services that underpin the livelihoods and well-being of local communities and benefit communities in the wider region indirectly. Both the terrestrial forest and the rivers supply food, materials, energy, water, and cultural value to tens of thousands of people living in the steep valleys and hills of the area. They also sustain the ecological processes upon which the communities depend.

280. Of particular importance within Bhutan are the Community Forests. There are 824 Community Forest sites across Bhutan, covering an area of 111,954.57 hectares[1]. Bumthang has 38 community forest sites, covering an area of 3,971.03 hectares that are under the management of 1,029 households. The community forest sites are important to the community, not just as an important source of timber, firewood, or non-wood forest products, but also as a source of drinking and irrigation water. Areas where streams are located and biodiversity is recorded are protected as protection areas. There are three community forest sites within the project area, detailed in

281.

282.

283. Table IV-7. In total, the Project impacts a total of 9ha across the three community forest sites.

**Table IV-7: Community Forest in the Project Area**

#	Community Forest	Village(s)	Area (Ha)	Altitude (masl)	Net Production Area (Ha)	AAC timber m <sup>3</sup>	AAC non-timber m <sup>3</sup>
1	Phomrong - Total Block 1 + Block 2	Phomrong	135.32	2970-3400	104.51	174.7	69.94
2	Garablang community forest	Tandigang	71.64	2800-3100	64.39	89.6	35.3
3	Nangnang community forest	Nangnang and Kizom	54.86	3018-3127	47.26	88.7	26.1

284. **Phomrong Community Forest** is located near Phomrong village, about 15 kms from Chamkhar town and Bumthang Ura national highway passes through the village. The community forest has a total area of 135.32 ha of which 104.51 ha was identified as a net production area. The community forest area stretches from 2790 m to 3400 masl. Blue Pine and mixed conifer forest are two major forest types of the community forest. The community forest is divided into two blocks - Block 1 Kharamphai with young blue pine forest and Block 2 Kangsha with matured hemlock and mixed conifer forest. The Dorjitse Monastery Road passes through both blocks of the community forest. 34 resident households of Phomrong village manage the community forest. The Annual Allowable Cut (AAC) of timber trees is 174.7 m<sup>3</sup> on a standing volume basis with annual demand of 138.4 m<sup>3</sup>. Similarly, AAC of non-timber/firewood is 69.9 m<sup>3</sup> with annual demand of 48 m<sup>3</sup>. There is no issue of timber deficits.

285. **Garablang Community Forest** is located near Tandigang village, about 13 kms from Tang Gewog. Blue Pine and mixed conifer forest are two major types of forest in the community forest with Bluepine as a dominant species. The community forest has a total area of 71.64 ha/177.02 ac. of which 64.39 ha/159.11 ac. as net production area with average basal area of 15.77m<sup>2</sup>/ha for timber and 8.67 m<sup>2</sup>/ha of firewood respectively. The community forest is divided into two blocks and resident households of Tandigang village manage the Garablang community forest. The Annual Allowable Cut for timber trees is 89.63m<sup>3</sup> and 35.3m<sup>3</sup> for firewood (22 drashings, 30 Chams(log), 24 Tsims (fencing pole), 19 Dangchungs (flag post) and 24 firewood). However, there are deficits of firewood and cham sized trees which the community forest members adjust from other timber sources.

286. **Nangnang Community Forest** is located near Nangnang and Kizom villages and covers an area of 54.86 hectares. The altitude of the community forest ranges from 3018 m to 3127 meters above sea level. The main dominant species are blue pine trees followed by spruce, hemlock and undergrowth shrubs. The overall forest condition is good with even aged stands that have good potential for harvesting in future. The whole community forest of 54.8ha has been kept as one block owing its crop composition and homogenous stands. The Annual Allowable Cut of timber trees is 3133.36 m<sup>3</sup> on a standing volume basis with annual demand of 45.3m<sup>3</sup>. Similarly, AAC of non-timber/firewood is 26.1m<sup>3</sup> with annual demand of 56.6m<sup>3</sup>. which means there is deficit of firewood but the community forest members adjust through other timber sources.

287. Table IV-8 summarizes the types of non-wood forest/timber products collected from the forest. There is, however, no information on quantities collected.

**Table IV-8: Non-Wood/Timber Species and Resources Harvested by community forest (extracted from the management plans)**

Non wood timber produce	Garablung community forest	Nangnang community forest	Phomrong community forest
Mushroom	Yes (Exidia spp., Chanterelles – Sisi shamu); consumption and marketing	Yes (Exidia spp., Chanterelles – Sisi shamu); consumption and limited sale	Yes; free collection permitted for members
Leaf litter	Yes; ferns and litter collected for cattle bedding and manure	Yes; collection permitted as a limited activity	
Bamboo	Yes ( <i>Borinda grossa</i> ); cattle sheds, fencing, handicrafts	Yes; regeneration observed in open areas	Yes ( <i>Borinda grossa</i> , <i>Arundinaria racemosa</i> ); rural use
Wild berries			
Medicinal / paper plants			Yes; Satuwa ( <i>Paris polyphylla</i> ), <i>Daphne</i> spp.
Sand & stone			Yes; collection permitted with fees

Source: Management Plans of Garablung community forest (2024), Phromphong community forest (2019), and Nangnang community forest (2024) [DoFPS, 2024](#). Forest Facts and Figures.

288. In addition to the provisioning services referenced above, the project area supports a range of regulating and supporting ecosystem services typical of temperate forest landscapes in Bhutan. These include carbon storage and climate regulation, soil formation and nutrient cycling, erosion control and slope stabilisation, water flow regulation, pollination, and natural pest regulation. These services are inherent functions of the forest ecosystems that dominate the wider landscape and are sustained by the large extent of forest cover, ecological connectivity, and relatively low levels of land-use modification in the area. While these services are not directly quantified through primary field data, their presence is well established in the scientific literature for comparable Himalayan Forest systems and is recognized as part of the overall ecological value of the project landscape.

### Priority Biodiversity Features – Ecosystem Services

289. The ecosystem services in the project area highlight the extremely close connection and dependence between the local people and the forests. The forests provide energy, building materials, food, and income security, while the rivers sustain fisheries, agriculture, and drinking-water supplies. Their regulating roles in stabilizing soils, storing carbon, maintaining clean water, and buffering floods further underpins the dependence of rural livelihoods on forest and river-based benefits.

290. Given the degree of reliance on these services and their irreplaceable role in sustaining livelihoods and biodiversity, the ecosystem services, specifically provisioning services of the project site are very valuable to the local communities and are therefore of provincial importance. Ecosystem services are therefore considered to be a PBF.

## Summary of Priority Biodiversity Features

291. Following the review of the baseline biodiversity information, Table IV-9 provides a summary of the Priority Biodiversity.

**Table IV-9: Selection of Priority Biodiversity Features**

Priority Biodiversity Feature	Reason for selection
Wangchuck Centennial National Park	Protected Area within small section of NP.
Phrumsengla National Park	Protected Area close to the Project
Bumthang Wetlands	Nearby IBA and KBA
Natural Habitat	Loss of 44.84 ha of Natural Habitat
Protected or vulnerable trees	Presence of <i>Taxus wallichiana</i> , <i>Picea brachytyla</i> ; and <i>Populus rotundifolia</i> .
Protected or vulnerable mammals	Six species recorded in the area plus bats on a precautionary basis
Protected or vulnerable birds	Although not IUCN Vulnerable or rarer, the larger bird species are considered PBFs
Ecosystem services	Considered given degree of reliance of local population

### D. Socio-economic

#### Dzongkhag Profile : Bumthang

292. Bumthang Dzongkhag is located in the Northern part of the country bordering Lhuntse Dzongkhag in the East, Trongsa and Wangduephodrang Dzongkhag to the West, Zhemgang Dzongkhag to the South and the Xizang Autonomous region of the People's Republic of China to the North. Its total area is approximately 2,708.46 sq.km with elevation ranging from 2,400m to 6,000m above sea level. Around 59.3% of the Dzongkhag's total land area is under forest cover. Bumthang Dzongkhag consists of four Gewogs namely Chhoekhor, Chumey, Tang and Ura. It experiences a cold climate with warm summers and very cold winters. The region is home to two national parks, WCNP and Thrumshingla National Park.

#### Demographic Characteristics

293. As of May 30, 2017, the population of Bumthang Dzongkhag stands at 17,820, comprising 9,396 males (52.7%) and 8,424 females (47.3%) according to the Population and Housing Census of Bhutan (PHCB 2017). Approximately 62.7% of the population resides in rural areas, and the overall literacy rate is 73.1%, with a literacy rate of 67.9% among adults over 15 years old. Among males, 80.7% are literate, compared to 64.6% of females.

#### Economic Profile

294. Bumthang's economy is predominantly agrarian, with a focus on subsistence farming and animal husbandry. The main agricultural products include wheat and buckwheat, dairy products and honey, apples, potatoes and rice and wool. The dzongkhag is nationally renowned for its textile weaving, particularly the vibrant woolen fabrics known as yathra and mathra. In recent

years, tourism has contributed to socio-economic change in the Dzongkhag. The legalization of collection of cordyceps has also enhanced rural income particularly for highland communities. Further, the commercialization of Masutake mushroom and other medicinal plants have also further enhanced the purchasing power of people of upper Chhoekhor and Ura Gewogs. Tourism is a growing sector, with an increasing number of hotels, resorts, and homestays. Of the total population, 69.1% is economically active, with 59.8% engaged in urban areas and 60.9% in rural areas, comprising 69.1% men and 50.9% women.

## **Religion**

295. Bumthang Dzongkhag is rich in historical and sacred sites of significance. Buddhism established its roots here in the 8th century following the visit of Guru Padmasambhava. The birth of Padma Lingpa, a revered Terton King and ancestor of the Wangchuk Dynasty, further enhanced the spiritual importance of this region. It is home to ancient monasteries and sacred sites associated with notable figures such as Guru Padma, Longchen Rabjam, and Pema Lingpa.

## **Socio-cultural grouping**

296. The project area is occupied mainly by the Bumthangpa and Khengpa people. This is similar to all other gewogs in Bumthang.

## **Communities along Proposed TL**

297. **Tang Gewog:** Tang Gewog is located in the northern part of Bumthang district in Bhutan. The project crosses five chiwogs (Tandingang, Khangrab, Dazur, Kidzom Nimalung and Bezur Kuenzangdrag). The elevation in the gewog ranges from approximately 2,800 to 5,000 meters above sea level, making it one of the higher-altitude gewogs in the district. It has a relatively small population (2,278), with most settlements concentrated in the lower valley areas. The main sources of income are subsistence farming and livestock rearing, particularly yaks in the higher reaches, with a notable emphasis on growing buckwheat and potatoes.

298. **Chokhor Gewog:** Chokhor Gewog is the central gewog of Bumthang district and is often considered the heart of the region. The project falls on one chiwog (Dawathang Dorjibu Kashingsawa Chiwig). The elevation is generally lower than its northern counterparts, ranging from about 2,600 to 3,500 meters. It is the most populous (3,871) gewog in Bumthang, with the district's administrative center and main town, Jakar, located within its boundaries. Income sources are diverse, including a mix of agriculture, government services, trade, and tourism, reflecting its status as the commercial and administrative hub of the district.

## **Land Use, Agriculture and Industry**

299. The local economy primarily relies on subsistence agriculture, including both crop cultivation and livestock rearing. Key agricultural products include wheat, buckwheat, dairy products, honey, apples, potatoes, rice, and wool. Textile weaving, particularly the vibrant woolen fabrics known as yathra and mathra, provides a significant source of income. Additionally, tourism and the sale of products like Cordyceps and other medicinal plants contribute to the local economy and enhance the well-being of residents. Of the total population, 69.1% is economically active, with 59.8% engaged in urban areas and 60.9% in rural areas, comprising 69.1% men and 50.9% women.

300. The economy of Chokhor and Tang Gewogs is predominantly centered around agriculture, livestock, forestry, and local tourism, each contributing to the overall economic resilience of the region.

301. Agriculture plays a vital role in the local economy, with the primary crops including staple food items such as wheat, barley, and both sweet and bitter buckwheat. Additionally, cash crops like potatoes, apples, and a diverse array of vegetables are cultivated, providing essential sources of income for households. The livestock sector is also significant; it generates cash income through the production and marketing of dairy products like butter and cottage cheese. Furthermore, horses are utilized for transporting goods to areas that lack access via farm roads, enhancing market connectivity and contributing to local livelihoods.

302. Forestry resources, managed through state forestry initiatives and community forests, play an integral role in supporting the local economy. They provide essential timber and non-timber products that are crucial for construction, fuel, and various artisanal crafts, thus fostering local entrepreneurship.

303. Chokhor Gewog capitalizes on the collection and trade of Cordyceps mushrooms, further diversifying the economic activities. This collector-driven enterprise offers supplementary cash income, thereby supporting local households and enhancing their economic stability.

304. Overall, the economic landscape of Chokhor and Tang Gewogs is characterized by a blend of traditional and innovative practices that not only sustain livelihoods but also promote community development and cultural heritage preservation.

### **Access and transportation**

305. Tang Gewog is connected by a 17-kilometer road from the district headquarters. Villages are inter-connected by a network of 26 farm roads measuring about 43.3 kilometers. Chokhor Gewog is accessible by East-West National Highway (PNH-1) and the Bathpalathang Airport (Bumthang Domestic Airport), Gewog Road, and farm roads.

### **Access to the site**

306. While the start of the TL is accessible from the Wobthang farm road, the majority of the tower locations are not accessible. The project will construct approximately 19.42 km of new access roads, that will take off from the existing network of existing farm roads (Nangnang village farmroad, Jok village farmroad, Phangzing farmroad), Tang Gewog road, logging roads (Garablung Community Forest), Monastery Road (Dorjitse) and from the national Bumthang to Trashigang highway. Apart from the highway and Gewog Road, most of these roads are unpaved roads (refer photo1 below)

### **Education**

307. Chokhor Gewog is the most populated among the 4 Gewogs in Bumthang, it has 3 ECCD manned by 6 teachers with a total of 90 students. The ratio of male to female students is almost equal at 42 to 48 respectively. The Gewog also has 5 Primary Schools, 1 Lower Secondary School and 1 High School with a total of 2,187 enrolled students. All schools have an almost equal ratio of male and female students.

308. Tang Gewog has a smaller area by comparison spanning over 511 sq km. The Gewog does not host an ECCD and has 2 Primary Schools manned by 5 teachers with a student strength of 49 (23 male and 36 female).

**Photo IV- 23:** Existing Logging Road



**Photo IV- 24:** Nangnang farm road



309. Both Chokhor and Tang Gewogs have 7 and 4 NFEs respectively, however, the NSB data shows no record of enrolments.<sup>17</sup>

### **Health Facilities**

310. There are 2 Basic Health Unit (BHUs) with 64 staff and 4 ORCs located in Chokhor Gewog. Tang Gewog has a Traditional Medicinal Unit, 1 BHU with 6 staff and 4 ORCs. For more serious health treatment, patients go to Bumthang District.

### **Cultural Resources**

#### **Religious and Spiritual Landscape**

311. Bumthang Dzongkhag is widely regarded as the spiritual heartland of Bhutan, distinguished by its high concentration of ancient temples, monasteries, sacred landscapes, and pilgrimage sites of national importance. Jambay Lhakhang, one of the oldest Buddhist temples in

<sup>17</sup> NSB, Bumthang Gewog data 2019, <https://www.nsb.gov.bt/publications/gewog-data/>

the country, was founded in the 7th century as part of a network of temples built to subdue negative forces across the Himalayan region and continues to serve as a major religious and cultural centre. The dzongkhag is closely associated with Guru Padmasambhava (Guru Rinpoche), the tantric master credited with introducing Vajrayana Buddhism to Bhutan in the 8th century. Several sacred sites in Bumthang are linked to his activities, most notably Kurjey Lhakhang, where he is believed to have left sacred body imprints on rock. Monastic institutions such as Tamshing Lhakhang, established by Terton Pema Lingpa in the 16th century, remain active centres of religious practice, ritual performance, and community gatherings.

312. Cultural Sites. Every dzongkhag in Bhutan has a dzong, which is a fortified edifice built at strategic locations that serve as political and religious centres for the region. In addition, many Buddhist lhakhangs or temples, gonpas or monasteries, educational centres that house monks, choetens or stupas, drupchhus or holy water sites, mani or prayer wheels, are found across the landscape. *Lus* are subterranean beings that live in sacred places and are vulnerable to pollution. *Lu* appeasement is a common practice whereby the community seeks permission for any sort of development. It is believed that if the *lus* are not appeased, they can inflict pain, illnesses, or misery to the person or the entire community. *Nyes* are sacred sites/imprints that are considered the abode of a spiritual being or deity. *Nyes* inhabit natural landscapes and objects like mountains, rocks, lakes, springs, or trees. These are considered to provide spiritual blessings and the surrounding areas must be kept clean and free from impurities.

313. There are 271 sites of cultural and religious significance, 134 in Tang gewog and 137 in Chhoekhor gewog including monasteries, natural elements of cultural significance, stupas and others.<sup>18</sup>

**Table IV-10: Types of Cultural Heritage Sites in Tang and Chhoekhor gewogs**

Cultural Heritage Site	Tang	Chhoekhor
Dzong/fortresses	0	1
Lhakhang/monasteries	25	35
Nye and springs (drupchhu, cliff, boulders etc.)	11	9
Choeten/Stupas (Namgay, Jangchhub, Dangrim)	68	44
Prayerwheels	25	47
Nagtshangs <sup>19</sup> /ancestral homes	2	1
Traditional village (Tandingang)	1	0
Traditional bridge	2	0
<b>Total</b>	<b>134</b>	<b>137</b>

Source: Department of Culture and Dzongkha Development (2025)

<sup>18</sup> BPC from Bhutan NSDI system. <https://nsdi.systems.gov.bt/>

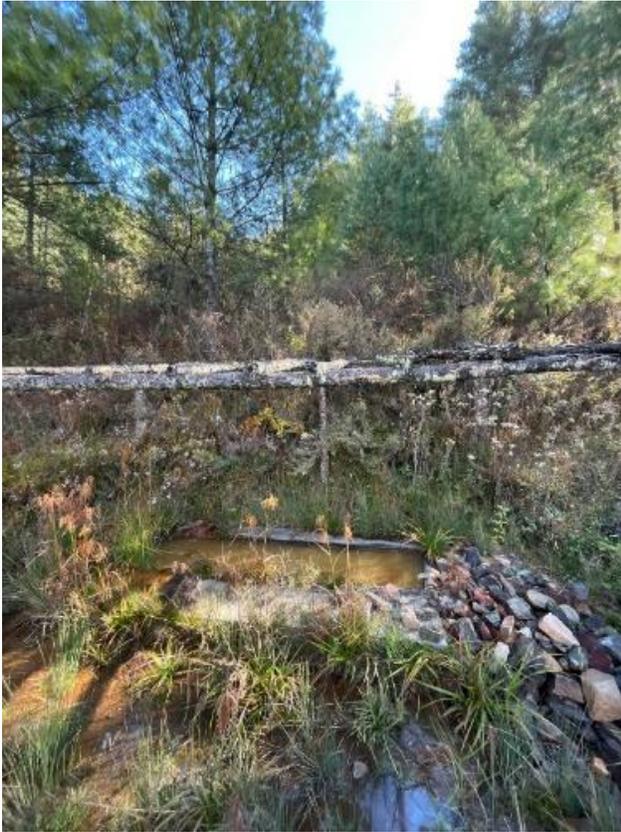
<sup>19</sup> Nagtshangs are traditional ancestral houses belonging to noble lineage families.

Figure IV-18: Location of Cultural Sites

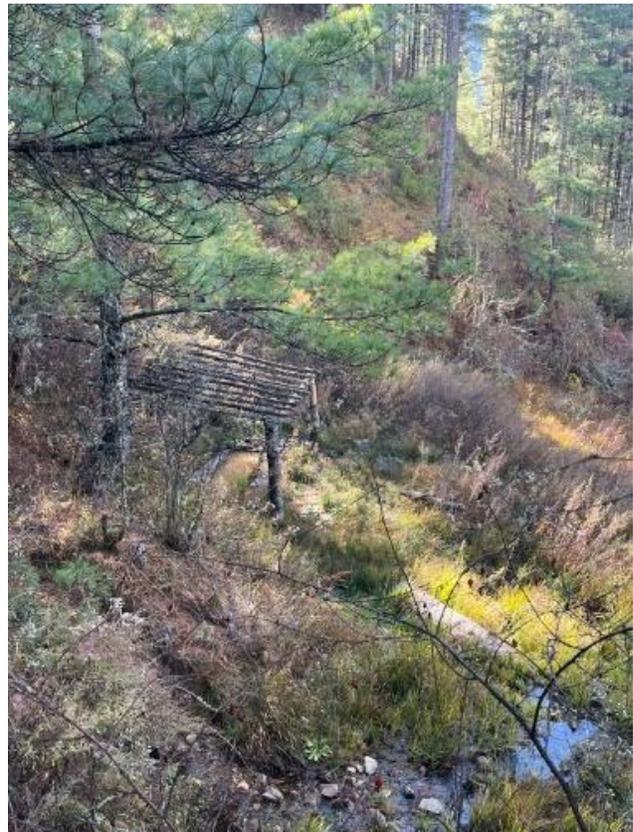


Source: TA Consultant

Photo IV- 25 & Photo IV-



26: Sacred Menchu near AP#28



Source: BPC Field survey

314. Out of the 271 cultural sites, 15 are within 500 m to 1 km of the Project components and may be potentially impacted from the construction and operation activities. 7 of the 15 impact sites are stupas and prayer wheels which are common across the landscape, while the remaining 8 are monasteries namely, Samcholing Nyendro Mediation Center, Guru Nangsay Zuelnen Phodrang, Shey Yoesel Choedzong, Phorbang Lhakhang, and Trashi Chhoeling Lhakhang.

315. Although Dorjitse Monastery is located more than 1.5 - 2.2 km from three access road take-off points, it is still included as a potentially impacted cultural heritage site as the take-off points are located on the only access to the monastery. Details are provided in Appendix 4-2. Streams and springs considered sacred ('Peling Drupchhu' (holy water) and 'Peling Menchhu' (medicinal water) are mentioned under surface water.

### Intangible Practices

316. Tang and Chhoekhor Gewogs in Bumthang observe several important religious festivals and prayer ceremonies that are integral to local spiritual life and cultural identity. These events follow the Bhutanese lunar calendar and are generally conducted at established lhakhangs and religious complexes. Chhoekhor Gewog includes Bumthang town and the district headquarters and hosts nationally significant religious sites such as Jakar Dzong, Kurjey Lhakhang, Jambay Lhakhang, and Tamshing Lhakhang. However, these major religious sites and associated festival venues are located well outside the Wobthang TL alignment and its area of influence.

**Table IV-11: List of Festivals Dates (2024)**

	<b>Festival Name</b>	<b>Bhutanese Date</b>	<b>Calendar Month</b>	<b>Location</b>
Tang Gewog				
1	Dorjitse Lamai Kuchoed	9th -11th days of 8th Lunar month	October	Dorjitse Monastery
2	Ugyen Choling Kangsoel	8th -10th days of 9th Lunar month	November	Opposite Project area
3	Tang Namkha Rabney	9th -11th days of 10th Lunar month	December	At the Gewog center
4	Chojam Rabney	14th-18th days of 10th month	December	At the Gewog center
Chhoekhor Gewog				
1	Padtsheling Kuchoed	19th -21st days of the 4th Lunar month	May	Outside project area
2	Kurje Tshechu	10th Days of 5th Lunar month	June	Outside project area
3	Tamzhing Phagla Chodpa	10th -12th days of the 8th Lunar Month	September	Outside project area
4	Thangbi Mewang	14th -16th days of the 8th Lunar Month	September	Outside project area
5	Jakar Tshechu	7th -11th days of 9th Lunar Month	November	Outside project area
6	Jampa Lhakhang Drup	15th -18th days of 9th Lunar Month	November	Outside project area
7	Ngang Rabney	15th -17th days of 10th Lunar month	December	Outside project area

Source: Bumthang Dzongkhag <http://bumthang.gov.bt>

## V. ANTICIPATED IMPACTS AND MITIGATION MEASURES

### A. Impact Assessment and Methodology

317. Potential risks and impacts are assessed based on how the Project has the potential to interact with resources/receptors spanning physical, biological, socioeconomic-cultural aspects. Information from the feasibility study, field surveys, environmental baseline samples, ecological surveys, social surveys, and stakeholder and community consultations was used to assess impacts. The steps of impact assessment comprise of:

- Impact prediction: to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities.
- Impact evaluation: to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor.
- Mitigation and enhancement: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- Residual impact evaluation: to evaluate the significance of residual impacts assuming effective implementation of mitigation and enhancement measures during project implementation

### Receptors

318. For the purpose of the impact assessment, the receptors for the impact assessment are the physical, biological, or socioeconomic-cultural features that are presented in the baseline information section. This includes the forest, biodiversity, soil, water, air, infrastructure, religious and cultural sites and the local community, with which the project will interact

319. The sensitivity/vulnerability or importance of the receptor depends on several factors such as the proximity, extent, duration and type of impact.

### Impact Categorization and Significance

320. A simple rating system is used for the assessment of the potential impacts which are the impacts of the project without the implementation of any measure. The potential and perceived environmental impacts and risks have been categorized as being of High, Medium, or Low significance based on Table V-1 and Table V-2. The Impact assessment is based on the same methodology used for DGPC's solar component to maintain consistency across interconnected projects.

**Table V-1: Environmental Impact Significance Factors**

Category of Factors	High*	Medium	Low
A. Importance Factors:			
Receptor Impact & Spatial Scale	National or Dzongkhag	Gewog/Village	Onsite or immediate vicinity (100m)

Category of Factors	High*	Medium	Low
Receptor Sensitivity and Resilience	No or minimal capacity to absorb proposed changes	Reasonable capacity to absorb changes	Very good capacity to absorb changes
Regulatory relevance and Compliance standards	Legally significant	Legally relevant but not significant	Not legally binding or regulated
<b>B. Severity Factors:</b>			
Magnitude of change expected	Large	Moderate	Minimal
Consequence of Impact	Critical	Moderate	Low or Negligible
<b>C. Likelihood Factors:</b>			
Probability	Certain	Likely	Less or unlikely
Frequency	Continuous	Intermittent or Occasional	Infrequent or Rare
Duration	Lasting beyond 3 years	Lasting 2-3 years	Lasting a few months or a year
<b>D. Other Factors:</b>			
Impact Reversibility	Irreversible	Reversible with effort over long term	Easily reversible over short term
Opportunities for Mitigation / New Technology	No or minimal opportunities to mitigate impacts	Reasonable opportunities to mitigate impacts	Abundant opportunities to mitigate impact with past experience

\* Net positive impacts are indicated as "Beneficial" in the risk matrix and scored as High

Source: Google Earth and ADB TA Consultant

**Table V-2: Environmental Impact Significance Determination Criteria**

Severity → Importance	High	Medium	Low
High	High	High	Medium
Medium	High	Medium	Low
Low	Medium	Low	Low

### B. Cumulative Impacts

321. Cumulative impacts are defined as the combination of multiple impacts from all existing projects in the area of the proposed project and anticipated future projects that may result in significant adverse and/or beneficial impacts that cannot be expected in the case of a stand-alone project. At point of writing, no other TL projects or major infrastructure project have been confirmed by BPC. As such, cumulative impacts have therefore *not* been further investigated. However, this section will be updated if confirmation of other TL projects or other major infrastructure projects is anticipated or confirmed.

### **C. Summary of Impact Rating for the Project**

322. The project's potential impacts on the key environmental parameters have been assessed and their significance determined using the methodology described above. A summary of the potential impacts of the project on the key environmental parameters and significance of these impacts is presented in Table V-3.

**Table V-3: Impact Rating**

Environmental Component / Receptor	Potential Environmental Impact and Risks	Project Phase	Severity, Likelihood and Other Factors	Significance prior to Mitigation	Significance post Mitigation
Protected Areas	Development within Wangchuck Centennial National Park (WCNP) comprises one pylon and 370 m of the RoW. Requires permanent loss of up to 153 m <sup>2</sup> (depending on pylon type) from open, degraded grazed fields and temporary loss of up to 1 ha from the same degraded, grazed fields from the Multiple Use Zone of WCNP. Temporary disturbance (noise, light etc.) from construction activities.	Construction and Operation	<b>Minor.</b> Impact certain and adverse but limited in extent and within an already degraded, MUZ area. Adds to cumulative impact of development activities in protected area.	Minor adverse	Negligible  After successful implementation of the BMP and the BAP
Habitat and Trees	The construction footprint is 53.49 ha of which 50.2 (94%) is forested and 44.84 (84%) is Natural Habitat. The Project area is dominated by blue pine with areas of mixed conifer. Only 0.4 ha will be permanently lost, other losses are temporary as the RoW will be revegetated (but no taller than 7 m). It is estimated that 15,500 trees will be felled. The exact number of trees will be finalized during the before construction. Vegetation clearance will affect three notable tree species, the Vulnerable <i>Picea brachytyla</i> and <i>Populus rotundifolia</i> , and the Endangered <i>Taxus wallichiana</i> . Some temporary disturbance (noise, light etc.) but limited in extent. National legislation requires compensatory tree planting. The Project has committed to replanting	Construction and Operation	<b>High.</b> Permanent and certain loss of Natural Habitat and vulnerable or irreplaceable trees. Regulatory requirements apply for tree cutting and vegetation removal and all losses will be compensated for at a ratio to 2:1.	Moderate adverse	Negligible  After successful implementation of the BMP and the BAP

Environmental Component / Receptor	Potential Environmental Impact and Risks	Project Phase	Severity, Likelihood and Other Factors	Significance prior to Mitigation	Significance post Mitigation
	100.4 ha of forest in collaboration with DoFPS.				
Wildlife	Loss of habitat, fragmentation, and disturbance for numerous vulnerable or irreplaceable species (particularly for large mammals and bats). Potential loss of resting places (roosts and burrows) during vegetation clearance and minor loss of foraging habitat. Increased noise and light disturbances	Construction and Operation	<b>Minor.</b> Permanent losses but most species will naturally disperse and the change in habitat structure (creating a narrow linear strip of short vegetation in the forest) could have minor benefits for some species by improving access and encouraging greater diversity in plants, invertebrates and small species, which could be prey.	Minor adverse	Negligible
Birds	Certain loss of nesting sites and foraging habitat, and possible loss birds if nests are destroyed during the breeding season. During the Operational phase, likely collision risk for larger vulnerable and irreplaceable species, including eagles, vultures and the black-necked crane for which the Wobthang Wetlands is protected.	Construction and Operation	<b>Moderate to high</b> severity if a rare species killed is high. Large bird species are generally long-lived with slow reproduction rates meaning the loss of one or few birds could adversely affect the location population and its conservation status.	Moderate adverse	Negligible  After successful implementation of the BMP and the BAP
Invasives species	Possible spread of invasives during vegetation clearance and operational habitat maintenance, particularly the Pinewood nematode. Further risk of introducing invasive species during habitat clearance and maintenance, e.g. on equipment and vehicles.	Construction and Operation	<b>Moderate.</b> There are already several invasive species at the project locations so risk of spread is high. Implement invasive species control measures.	Moderate adverse	Negligible

Environmental Component / Receptor	Potential Environmental Impact and Risks	Project Phase	Severity, Likelihood and Other Factors	Significance prior to Mitigation	Significance post Mitigation
Ecosystem services	Loss of 9 ha areas of trees from the Community Forests, which will be largely revegetated post-construction. In addition to the loss of other forests, which will adversely affect ecosystem services (e.g. soil stability, provision of timber and fuel, water retention etc)	Construction and operation	<b>Minor.</b> Community Forest areas are utilized by CFMG for timber harvesting. Legislation requires paid compensation for lost trees and the Project will also compensate by planting new forest at a ratio of 2:1.	Minor adverse	Negligible After successful implementation of the BMP and the BAP.
Air quality	Generation of dust during site clearance, excavation, material transportation, loading/unloading of raw materials and goods. Generation of oxides of nitrogen, sulphur dioxide and particulate emissions by plant, equipment, and vehicles	Construction, Operation and Decommissioning	<b>Low</b> Emissions will be localized to the construction site and the immediate vicinity of the access roads. These roads branch off from existing farm roads and highways but are situated away from settled areas. Construction and associated transportation activities will be limited in duration, lasting only a few months at any given location.	Low (Adverse)	Negligible
Noise and vibration	Generation of noise during site clearance and preparation, earth works, vehicle movements, influx of workers, other construction works especially if soil compaction/piling/blasting needed	Construction	<b>Low.</b> Magnitude will change if blasting is required, otherwise, temporary noise impact during construction, excavation and transportation limited to few months at each site.	Low (Adverse)	Negligible
Geology and soil	Excavation and compaction of top and subsoil for tower foundation and road construction	Construction	<b>Medium.</b> Segments of the TL is located on steep terrain. Benching will be required to secure structures and reduce risk of landslides. These are irreversible, confined to	Medium (Adverse)	Low (Adverse)

Environmental Component / Receptor	Potential Environmental Impact and Risks	Project Phase	Severity, Likelihood and Other Factors	Significance prior to Mitigation	Significance post Mitigation
			project footprints and area immediately adjacent		
Soil	Erosion of exposed soil due to surface water runoff especially during monsoon season, construction induced landslide	Construction	<b>Low.</b> Most of the area surrounding and below the road alignment and tower foundation is vegetation so risk of soil erosion is limited	Medium (Adverse)	Low (Adverse)
Water Resources, Quantity and Quality	Additional water resources required including potable water supply for project workers / operating staff. Water requirement for construction work	Construction and Operation	<b>Medium.</b> Magnitude expected is based on about 25 workers at a given location. Water requirements for construction will be limited to foundation works, dust suppression during road construction (near settlements). Workers and access road construction will be limited to few months. During operational phase the number of staff would be lesser compared to construction phase	Medium (Adverse)	Low (Adverse)
Surface water	Sediment laden runoff from exposed soil or stockpiles resulting in surface water pollution Workers' camp locations are not finalized yet but most probable that these will be located near streams which is a possibility given the need for drinking water	Construction	<b>Medium.</b> Magnitude of the runoff potential and consequence is limited to deposition of some sediments in valley on the south (this process also occurs naturally during monsoon at present)	Medium (Adverse)	Low (Adverse)

Environmental Component / Receptor	Potential Environmental Impact and Risks	Project Phase	Severity, Likelihood and Other Factors	Significance prior to Mitigation	Significance post Mitigation
	<p>Untreated effluent from project site/workers' camps causing surface or groundwater pollution</p> <p>Inadequate storage and spills or leaks of fuel, oil, or chemicals causing surface or ground water pollution</p>				
Natural Resources	Use of raw materials for construction (cement, aggregate, sand, steel etc.) through licensed suppliers	Construction	<b>Low.</b> In magnitude as no major civil construction required beyond tower foundation. Some access roads will be used temporarily, so will be equivalent to farmroad specifications. Future consultations with community members may result in some access roads enabling continued access and not being rehabilitated	Low (Adverse)	Negligible
Muck/Soil disposal	Inappropriate disposal of inert soil / spoil in the site and surrounding landscape	Construction	<b>Low.</b> Except where terracing is required, cut and fill balancing is considered reversible with potential temporary storage until residual soil is relocated to agreed site	Low (Adverse)	Negligible
Waste generation	Inappropriate disposal of solid and hazardous wastes generated from project site and workers' camps e.g., left over/used oils, lubricants, chemicals, e- wastes, etc.	Construction, to a lesser extent during O&M and Decommissioning	<b>Medium</b> due to limited sanitary / secured landfills /hazardous waste disposal facilities	Medium (Adverse)	Low (Adverse)
Impact on private and	There will be no need for land acquisition since no towers are located on private land.	Pre-construction	<b>Low.</b> Land impacted ranges from 1%-8% of total land owned by the households	Medium (Adverse)	Low (Adverse)

Environmental Component / Receptor	Potential Environmental Impact and Risks	Project Phase	Severity, Likelihood and Other Factors	Significance prior to Mitigation	Significance post Mitigation
community structures	The TL and road will impact 0.11 land belonging to 4 households will be impacted. No community structures or water sources are impacted		No other private structures are impacted		
Impact on community forest	3.6ha of forest land within 3 Community forest will be impacted by the TL and access road. community forest will lose between 7-12% of their area. The total number of trees within each community forest will be finalized during pre-construction.	Construction	<b>Medium.</b> community forest will lose productive land for future timber plantation but will benefit from additional access to the community forest area.	Medium (Adverse)	Low (Adverse)
Economy	Employment and economic opportunities for shops, and sale of local produce. May attract youth to remain in village	Construction	<b>Medium.</b> Since workers are spread across locations, positive impacts are also spread across settlements	Beneficial	Beneficial
Worker recruitment	The contractor will recruit both skilled and non-skilled workers. These will comprise of local workers from within the community, nationals from outside the gewog or foreign workers. Key risks with hiring of workers include discrimination in employment and pay, unfair terms and conditions of employment, lack of contracts, excessive overtime, delays, irregular or non-payments, risk of child labor or forced labor,	Construction	<b>Medium.</b> Employment and economic opportunities but risks of inadequate recruitment practices, lack of contracts, delayed payments and unfair work conditions	Medium (Adverse)	Low (Adverse)
Establishment of worker camps	Temporary worker camps will be established on a shifting basis. Exact locations will be finalized by the contractor but will be at the village or at the tower sites. Issues	Construction	<b>Medium.</b> Approximately only 25 workers are expected to be located at different sites.	Medium (Adverse)	Medium (Adverse)

Environmental Component / Receptor	Potential Environmental Impact and Risks	Project Phase	Severity, Likelihood and Other Factors	Significance prior to Mitigation	Significance post Mitigation
	related to worker accommodation and welfare.				
Occupational Health and Safety	Risks related to injury, accident and ill-health from activities such as operation of machinery, working on electrical installations, civil work, material transport, construction activities etc. Risk related to hazards of injury and accident related to fire and electrocution / electric shocks. Risk related to sanitation, hygiene and welfare of staff and labour, spread of communicable diseases and epidemics	Construction, Operation and Decommissioning	<b>Medium.</b> Major consequence if fatality or permanent disability occurs, but moderate number of workers, rare occurrence, and several opportunities for mitigation using safety management systems and control	Medium (Adverse)	Low (Adverse)
Community health and safety	Risk of injury to community due to access to construction of project spread of epidemics and diseases (HIV, etc.) from workers potential social conflict between community and workers leading to harassment or exploitation increase in project related traffic	All phases	<b>Medium.</b> Although work sites are located far from the village, but community access roads will be utilized. Social conflicts due to worker influx in Bhutan is not a common occurrence	Medium (Adverse)	Low (Adverse)
Community resources -water and electricity and sanitation	Construction of site office, worker camps and storage sheds, stockpile areas	Construction phase	<b>Medium.</b> Risk is short duration as workers will not remain more than a few weeks at any location, due to the nature of the project.	Medium (Adverse)	Medium (Adverse)
Change in Land use	Change in land use from forest, scrub and meadow areas to access road and tower foundation structures. Total area under access road is 7.7ha	Construction, Operation and Decommissioning	<b>Low.</b> Magnitude in terms of area of land involved in gewog context, irreversible land use change	Low (Adverse)	Negligible

Environmental Component / Receptor	Potential Environmental Impact and Risks	Project Phase	Severity, Likelihood and Other Factors	Significance prior to Mitigation	Significance post Mitigation
Physical Cultural Resources	<p>Local community believes that activities that create disturbances such as noise and vibration in this area could bring about sudden and adverse weather patterns such as cloud bursts.</p> <p>There are a couple of sites within the proximity to the site</p>	Construction phase	<b>Medium.</b> Risk is short duration as workers will not remain more than a few weeks at any location, due to the nature of the project.	Medium (Adverse)	Low (Adverse)
Chance finds	Potential chance finding of below ground cultural resources, including undiscovered paleontological or archaeological resources	Site Preparation and Construction	<b>Low.</b> It is unlikely and if encountered the risk of damage or impact is minimal as confined to project site and vicinity.	Low (Adverse)	Negligible

## D. Anticipated Impacts and Mitigation During Design and Pre-Construction Phase

323. This phase covers planning, design, and preparatory activities before the commencement of construction activities.

### General Risks

324. Potential environmental impacts during the pre-construction phase are primarily associated with the project design and final alignment selection where impacts may be exacerbated by poor planning and design. Updating impact assessment documents, the EMP and other relevant documents to reflect detailed design is key and will support more detailed planning of access roads alignments and transmission alignments. Oversight of such key information can impact, for example, estimates of excavated material and spoil generation, leading to inaccurate cost estimates and incomplete Bills of Quantities (BoQ). This, in turn, may result in under-provisioning for environmental mitigation measures in bid documents, increased variation orders during construction, and a higher risk of non-compliance with environmental safeguards due to cost and implementation constraints.

325. **Mitigation** to include the following:

- Finalizing designs for access road alignments, stream crossings, and the number and location of culverts etc. Access road alignment finalized through joint field verification with CFMG and DoFPS to minimize forest footprint and avoid important or sensitive sites (e.g. cultural, water sources, important community sites).
- Consideration of construction methods and logistics (ropeways, head-loading) due to isolated and challenging terrain in RoW requires careful assessment, training, and monitoring.
- Identification and approval for approved temporary and final muck/spoil disposal sites;
- Conduct a detailed structural assessment of load carrying capacity of existing bridges and if required provision for upgrade of the bridges to accommodate project vehicles in consultation with Department of Surface Transport and the Gewog
- Completion of site-specific geological and geotechnical investigations for tower and foundation locations.
- Ensure that cost of providing worker accommodation is incorporated in the Bill of Quantities (BOQ).
- Include costed EMP in the bidding documents and ensure the Bill of Quantities (BOQ) follow Guidelines for OHS.
- Organize and conduct pre-bid meetings with potential contractors. Topics must cover required compliance requirements (ADB and national requirements), budgeting for EMP provisions, need for dedicated personnel and experts (ESS expert, EHS expert and an ecologist) on the team, preparation of CEMP, self-monitoring and reporting requirements.
- Obtain all clearances and permits early in the process (e.g. from EC from the Department of Environment and Climate Change) to avoid delays in the bidding process (see Table V-4: Permits relevant to the Project)
- As required by the EC, within three months of receiving the Environment Clearance, prepare a detailed implementation plan and submit it to DECC for approval.

- Appoint required staff /experts as recommended in EMP and BMP (and later BAP). Contractors must ensure experienced and skilled staff (engineer/supervisors) are employed for the duration of the project.
- Contractors must comply with the EMP and any updates following national environment clearance, detailed designs, or in response to any unanticipated impacts
- Ensure that EHS Officers and focal persons attend awareness training and familiarize themselves with their responsibilities in EMP implementation, compliance with ADB and RGOB requirements, reporting procedures
- Contractor to ensure specialized training and inductions are conducted (see Table X-2) for staff and workers in collaboration with the local forest office, police, health personnel and gewog. This will include at a minimum consultation covering awareness on biodiversity conservation, prohibition on firewood non wood forest product collection, fishing, or hunting, awareness on HIV/AIDS, first aid; and culturally acceptable practices, disaster management and chance finds.
- Review the ESIA, EMP and BMP and prepare the Contractor Environment Management Plan (CEMP) with subplan. Ensure the approved CEMP is implemented in the process of carrying out the activities under the contract.
- Ensure all subcontractors and third parties, irrespective of being formally or informally employed by them, also comply with the final EMP and BMP and any updates to it, as well as their own CEMP and that this responsibility is cascaded down any chain involved
- Comply with any corrective action plan required and cover the costs where corrective action is required due to non-compliance on behalf of the contractor, its subcontractor or third parties.

**Clearances and Permits – Risk of non-compliance with regulatory requirements**

326. For the project to proceed, several clearances are required from various agencies and stakeholders. These must be secured as part of the ESIA process to minimize delays in both the national Environmental Clearance process as well as during construction. The BPC is in the process of seeking clearance from the Department of Forest and Park Services and has already secured some clearances. The roads will take off from highways, farm roads, logging and gewog roads, consent and the required buffer from these roads must be maintained. The status of the clearances received to date is provided in (Table V-4: Permits relevant to the Project).

**Table V-4: Permits relevant to the Project**

#	Requirement	Status
1a	Forestry clearance TL	Online application for TL submitted to DoFPS January 2026
1b	Consent for TL	<ol style="list-style-type: none"> <li>1. Consent from Tang Gewog: obtained on 26.11.2025 (<u>Appendix 5-1b</u> ). Consent is one time just for the project irrespective of duration.</li> <li>2. Consent from Chhoekhor Gewog obtained on 15.12.2025 (<u>Appendix 5-2</u>) Consent is one time just for the project irrespective of duration.</li> <li>3. <u>consent from Affected Persons: obtained on 09.06.2025 (Appendix 5-4 )</u> Consent is one time just for the project irrespective of duration.</li> <li>4.</li> <li>5. <u>Consent from Phromrong and Garabing CFMG (Appendix 5-8,5-8b,5-9,5-9b)</u> Consent is one time just for the project irrespective of duration.</li> <li>6.</li> </ol>

1c	Clearance for water abstraction	The clearance for water abstraction will be part of the overall project EC clearance (#1 of this table)
1e	Clearance for Religious and Cultural sites from DCDD	None required as no cultural heritage sites within the project area will be impacted. However, during pre-construction, consultation and mapping will establish if there are any potentially important tangible and intangible cultural heritage that may be in use by the local community.
1f	EC for TL	BPC to apply The expected date of EC decision for Red category projects is 90 working days. BPC will submit the ESIA in February 2026 so decision on EC is expected to be received by April 2026 after which a legal undertaking must be submitted by BPC within 7 days. EC will be issued for 2 years. The construction period is 14 months, so EC will not need to be renewed.
2a	Forestry clearance access roads	Online application for access roads submitted to DoFPS on 9 <sup>th</sup> and 15 <sup>th</sup> January 2026 Expected FC by mid of end of Jan or early Feb 2026
2b	Consent for Access Road Construction	<ol style="list-style-type: none"> <li>1. Consent from Tang Gewog: obtained on 26.11.2025 (<u>Appendix 5-1b</u>). <u>Consent is one time just for the project irrespective of duration.</u></li> <li>2. Consent from Chokhor Gewog obtained on 15.12.2025 to construct road: (<u>Appendix 5-2</u>). <u>Consent is one time just for the project irrespective of duration.</u></li> <li>3. Consent from Affected Persons: obtained on 02.12.2025 to 04.12.2025 (<u>Appendix 5-4</u>). <u>Consent is one time just for the project irrespective of duration.</u></li> <li>4. <u>Consent from CFMG (Appendix 5-5). Consent is one time just for the project irrespective of duration.</u></li> <li>5. Clearance for take-off from Highway from DoST was received on 28 January 2026. (Appendix 5-10). Considered valid for the duration of the project implementation.</li> </ol>
2c	EC for Access road construction	BPC to apply for EC together with the EC application for the TL. As roads are category B, IEEs for these will be submitted by BPC and EC clearance is expected within 30 days. EC will be issued for 2 years. It will not need to be renewed as road construction will be undertaken within the first 6months to a year to access the project sites.

327. Before initiating any procurement, all necessary clearances and permits must be secured and the conditions attached to these followed. For instance, at take Off points from highway, gewog and farm roads, BPC must maintain adequate buffer for future road widening and safety as per Road Act 2013 and the conditions of the Department of Surface Transport.

328. BPC shall share any associated terms and conditions of these clearances or permits with the contractor for their implementation. Required compliance reports detailing adherence to the stipulated Terms and Conditions must be submitted to the Competent Authority.

### **Compliance with ADB Requirements**

329. **Impact.** Despite BPCs general familiarity with the ADB Safeguard Policy Statement (SPS) and loan and national regulatory requirements, a significant risk to compliance may arise due to staff capacity, potential staff transfers and competing priorities, which can lead to gaps in meeting obligations under the ADB loan agreement, SPS 2009. With these existing conditions, BPC Environment Unit may be overwhelmed with ensuring oversight of the EMP implementation, timely submission monitoring reports and proper functioning of the GRM

330. **Mitigation.** BPC must undertake the following measures:

- Seek prior approval on the ESIA from ADB before disclosure
- Ensure staffing commitments as per agreed *Institutional Arrangements* for environmental and social safeguards implementation.
- Ensure sufficient funds are available to properly implement all agreed measures in the EMP.
- Disclose approved ESIA, updated ESIA, EMRs and other relevant documents.
- Incorporate all relevant provisions EMP, BMP, BAP, GRM and EMOP into bidding documents once approved by ADB.
- During pre-bid meetings, brief contractors on their responsibilities for EMP and BMP implementation, requirements to meet performance indicators as specified in the bid documents, and complying with all ADB loan covenants, national legislation and clearances.
- Upon selection, contractors to be trained on the EMP and BMP requirements, documentation and reporting procedures.
- Prepare and submit semi-annual EMRs for ADB review and approval as per required timelines and schedules.
- Report any accidents, fatalities to ADB within 48 hours as well as any unanticipated incidents along with corrective actions taken within one week

### **Social impacts**

331. BPC consciously prioritized avoidance of impacts upon private land and settlement areas. As such, social impacts are considered a

332. **Land Acquisition:** No land acquisition is required for the TL since no towers will be located on private land. A total of approximately 0.11ha of land will fall under the TL RoW and road construction, affecting four (4) households.

333. **Impact on Structures:** No structures will be impacted by the project as TL alignment is set along state forest. Access roads will not impact any structures.

334. **Impact on Livelihoods:** The project will not impact livelihoods as alternative land will be provided for community forest loss under the RoW.

335. **Physical Displacement:** The project will not cause any physical displacement or relocation.

**Table V-5: Details of the land impacted**

Plot ID	Gewog	Area owned	Affected Area (Acre)	Remarks
Private land impacted by TL				
TNG-3797	Tang	1.233	0.104	TL between AP 29 and 30
TNG-3039	Tang	1.57	0.034	
Sub-Total			0.138	
Private land impacted by access road				
TNG-3003	Tang	2.128	0.050	Track 11/Road 10
TNG-3797	Tang	1.233	0.050	Track 11/Road 10- same area as TL Row as the road is on the RoW
TNG-874	Tang	0.753	0.025	from Nangnang village

TNG-3012	Tang	0.901	0.016	Tang Gewog Road Crossing
Sub-Total			0.142	
<b>Grand Total</b>				<b>0.279</b>

AP = angle point

336. **Mitigation.** BPC has already completed consultation with affected persons and their consent (social clearance in the Bhutanese context) has been sought (Appendix 5-1b and 5-4). A comprehensive Resettlement Action Plan has been prepared to mitigate these impacts. The RAP outlines the eligibility criteria, entitlement matrix, and compensation and provisions for all affected persons.

337. The implementation of the Resettlement Plan and process for reallocation of substitute land and/or compensation to be paid will be carried out by PMU in coordination with the Gewog and Dzongkhag Administration (Land Record Officer) and will be completed before construction commences. The final transfer of the land title will be processed through the Gewog, Dzongkhag and National Land Commission Secretariat.

338. **Impact on Community Forest:** The project will impact three community forest areas: Phomrong, Garabling and Nangnang community forest.

**Table V-6: Details on impacts to Community Forest**

No.	Name of community forest	Gewog	Area	Project components	Area impacted by the TL (hectares)	Area impacted by roads (hectares)	Total area (hectares)
1	Garabling community forest	Tang	71.64	Ap 2 and access road to AP 2 and AP 3	1.52	0.38	1.90 (6.5%)
2	Phomrong community forest - Block 1 (Kharamphai)	Tang	77.3	Ap 39-42 and the access road to these towers	3.6	0.16	3.8 (12%)
3	Phomrong community forest - Block 2 (Kangsha)	Tang	57.02	AP 43-45 and the access road to these towers	1.6	0.004	1.6 (7%)
4	Nangnang community forest	Tang	54.86	AP 8 Proposed access roads for AP 7-9	1.3	0.42	1.71(7.8%)
<b>Total area impacted</b>					<b>8.03</b>	<b>0.97</b>	<b>8.9</b>

AP = angle point

339. **Garabling community forest.** The impact on this community forest is reduced through the use of existing logging road. The TL will impact 0.38 ha of the community forest

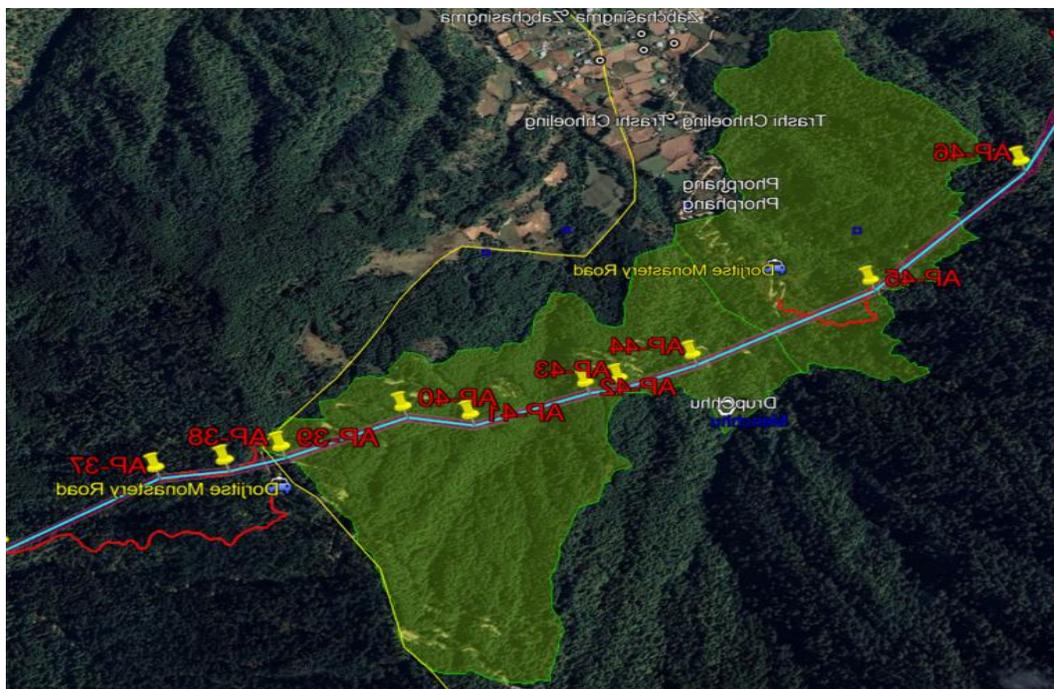
340. **Nangnang community forest.** This community forest will be impacted because it includes one tower as well as access roads for AP 4- AP 13. The stretch of the road from Nangnang farmroad to AP7-AP9 falls within the community forest. The area impacted under the community forest is 1.7ha

341. **Phomrong community forest** - Block 1 (Kharamphai) and Phomrong community forest - Block 2. The TL will traverse both blocks, from AP 40-43 in Block 1 and from AP 44-Ap 46 in Block 2. The total area impacted under each block is 3.8ha (Block 1) and 1.6ha (Block 2).

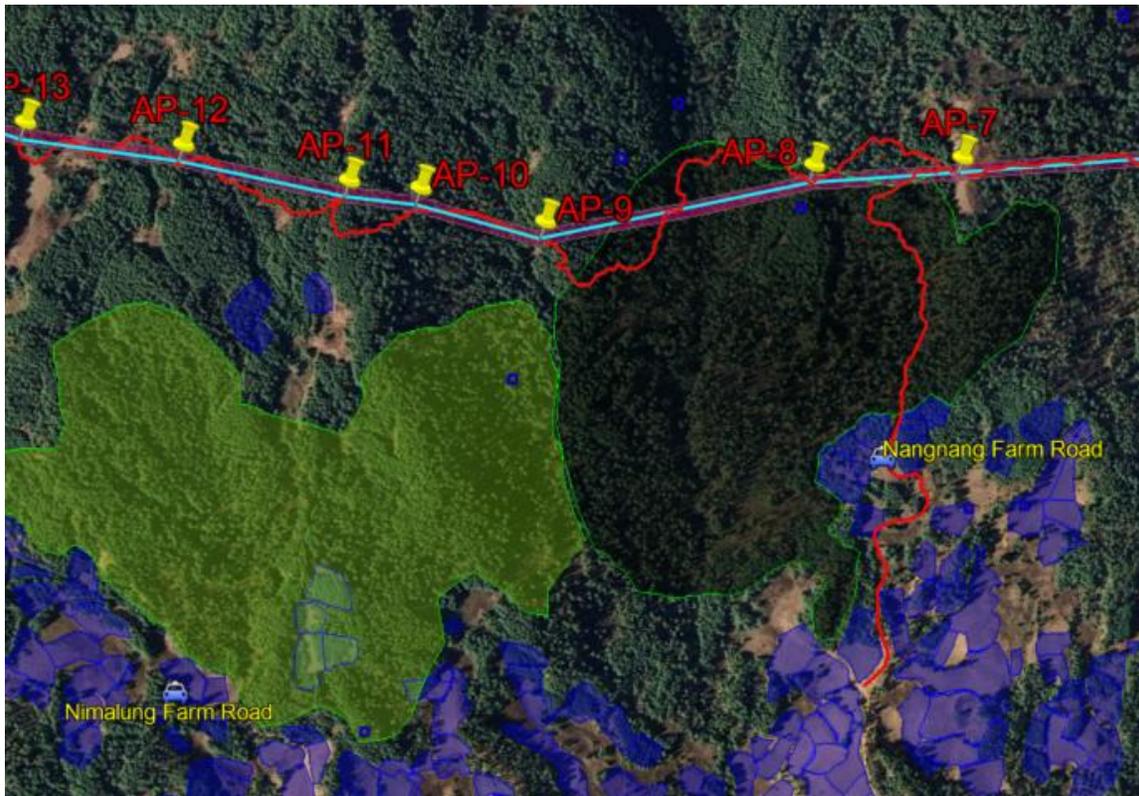
**Figure V-1: Garablung community forest and Phomrong community forest along TL and Access roads**



**Figure V-2: Phomrong community forest along TL and Access roads**



**Figure V-3: Nangnang community forest along TL and Access roads**



342. **Mitigation** by BPC

- Compensation for loss of timber will be paid in accordance with national rules and law.
- BPC in consultation with DoFPS will identify and include degraded areas within community forests for Compensatory Afforestation.

343. As suggested during consultation with CFMG members, BPC will recommend that the contractor involve community forest members to carry out tree felling and clearing to ensure minimal disturbance to areas beyond the RoW and avoid over-clearing. BPC and the Contractor shall provide technical oversight to ensure that the community forest members maintain clearing within the approved RoW. In case of damage to trees beyond the RoW, penalties will be applied as per the FNCRR 2023<sup>20</sup>. If CFMG members are involved in the clearing, a joint investigation team from BPC, the Contractor and the Forest Division Office will investigate the root cause of such deviation and fix accountability to those responsible.

344. **Mitigation** by Contractor

- Construction activities within Community Forests must be strictly restricted to the approved TL RoW, tower pads, and access roads, and no additional forest areas are cleared or trees cut.

<sup>20</sup> See <https://www.moenr.gov.bt/wp-content/uploads/2017/07/FNCRR-2023.pdf>

- Contractor personnel will be strictly prohibited from collecting fuelwood, timber, or non-wood forest products from Community Forests.
- Contractor will restore all degraded areas immediately after work is completed at each site

### **ESS6 Biodiversity Conservation and Sustainable Natural Resources Management**

345. All impacts on biodiversity receptors are assessed in detail and the requisite mitigation commitments summarized in the Construction phase (Section E).

#### **Change in land use**

346. See *ESS6 Biodiversity Conservation and Sustainability* section.

#### **Cultural Heritage**

347. Data provided by the Department of Culture and Dzongkha Development identified 15 cultural sites located within one kilometer of the project Aol. These include 7 stupas/prayer wheels and 8 monasteries (e.g., Samcholing Nyendro Mediation Center, Guru Nangsay Zuelnen Phodrang, Shey Yoesel Choedzong, Phorbang Lhakhang, and Trashi Chhoeling Lhakhang), springs and streams, specifically a Drupchhu (holy water) and Menchu (medicinal water) near Tower locations AP 28 and AP 44.

348. **Mitigation.** BPC avoided risks and impacts upon cultural resources and sites through data provided by the Department of Culture and Dzongkha Development and in consultation with local community members who also accompanied the survey team during walk over surveys. No cultural sites are directly impacted by the TL RoW or access roads.

349. Once final designs are developed, BPC will carry out consultation with community members to ensure that all important tangible and intangible cultural heritage have been avoided. A chance finds procedure will be developed and implemented by the contractor.

#### **Risk of Natural Hazards and Disasters**

350. **Impact.** The TL passes through steep terrain where vegetation removal and slope cutting, may destabilize slopes, increasing the likelihood of landslides and slope failure. These risks will be heightened during natural hazards such as earthquakes or extreme weather.

351. **Mitigation.** Each tower location will be assessed during the pre-construction phase to identify slope stability and geotechnical risks, and to determine any additional strengthening and stabilization measures that need to be incorporated into the final design. The design will also include consideration of increased wind loads, icing, storm intensity, landslide susceptibility, and freeze-thaw cycles.

352. Similarly, the alignment of access roads will be finalized only after identification and assessment of areas susceptible to landslides, slope instability, and erosion. Based on this assessment, road alignments will be adjusted, where feasible, to avoid landslide-prone sections. Where avoidance is not practicable, specific engineering and bio-engineering measures—such as

benching, retaining structures, enhanced drainage, or alternative access methods—will be identified and incorporated into detailed designs prior to commencement of construction.

353. Flood risk screening will be applied for stream crossings (e.g., Tangchhu/Chamkarchhu) and factor high hydrological loading, debris impact

#### **E. Anticipated Impacts and Mitigation During Construction Phase**

354. This phase covers planning, design, and preparatory activities before the commencement of construction activities.

#### **Worker recruitment and management**

355. The contractor will recruit workers from outside the local area and likely require foreign workers. Community members will likely be contracted to transport materials, act as labor, fell trees, or as general day workers. Contractors will need to be aware of RGoB's applicable laws, rules and regulations regarding recruitment and labor, and ADB's policy requirements on labour and working conditions to ensure a safe working environment.

356. **Impacts** associated with worker recruitment include:

- Inadequate work conditions where workers face health and safety risks from working in forested areas, risk of not knowing how to operate new machinery, lack of personal protective equipment suited to the nature of the work.
- Recruitment of children under the age of 18, discrimination in terms of wages, working hours, overtime hours, incentives or facilities, gender, opportunities, denial of freedom of association and collective bargaining.
- Risk of discrimination in employment and pay, unfair terms and conditions of employment, lack of contracts, excessive overtimes, delayed, irregular or non-payments, risk of child labor or forced labor, Gender-based violence, Sexual Exploitation, Abuse and I Harassment (SEAH).
- Inadequate living conditions where workers are not provided adequate accommodation that is suited to the climate, with safe drinking water, electricity and sanitation facilities and may face risk of diseases.
- Risks of conflicts between workers or workers and communities or grievances regarding working conditions of employment with no mechanism for resolving internal grievances or ensuring appropriate behavior

357. **Mitigation.** Will include the following:

- The Contractor will be required to prepare a Contractor's Labor Management Plan (LMP) as a key component of their CEMP. The plan will detail their procedures for managing all project workers in compliance with national law and ADB SPS. The LMP shall include measures to ensure equitable treatment of all workers, uphold non-discrimination irrespective of gender, age, ethnicity, religion, disability, or other characteristics and address harassment, and/or exploitation and gender-based violence.

- The Contractor will follow rules and regulations for foreign and local worker recruitment as shown in the “*Handbook on Recruitment and Employment of Foreign Workers in Bhutan*”<sup>21</sup>
- The Contractor will strive to be gender sensitive by ensuring equal pay for equal work for female workers, brief workers on gender discrimination and sexual harassment. All foreign workers will be screened at their point of entry for the more virulent and contagious diseases, including HIV/AIDS, TB, Malaria, and Dengu
- Contractors will provide all workers with clear, written employment contracts in an understandable language. These contracts will detail terms and conditions, including rights related to work hours, wages (compliant with national minimum wage laws), overtime, benefits, and leave, in full compliance with Bhutan's Regulation on Working Conditions, 2022, as well as a Code of Conduct.
- No person under the age of 18 shall be employed. Contractors must implement robust age verification procedures for all workers. Also, workers must not be forced to undertake hazardous work unless trained and provided with appropriate PPE.
- No person shall be forced to work. All workers shall be recruited voluntarily, and no worker shall be forced or coerced into work.
- Contractors are required to ensure there is no differentiation in wages based on gender, adhering to the principle of "equal pay for equal work".
- The contractor shall establish a functional worker grievance redress mechanism (GRM) distinct from the community GRM. This will allow workers to raise concerns regarding working conditions, terms of employment, discrimination and also deal with Sexual Exploitation, Abuse, and Harassment (SEAH) in a survivor-centric and confidential manner.
- The contractor must ensure that EMP requirements are cascaded down to all sub-contractors, regardless of whether they are formally or informally employed.
- ADB's standard bidding documents include a Code of Conduct (CoC) for contractor personnel to sign. It is important to ensure that the contractor ensures that all its personnel understand the CoC and signs it and the contractor maintain them as part of the contract records

### **Water Requirements and Supply**

358. **Impact.** The construction work and the presence of about 25 persons is not expected to create significant impact on the water supply. Water will be required for drinking, cooking, washing as well as foundation works (concrete mixing and curing works) and its associated activities (sprinkling/spraying and cleaning).

359. **Mitigation.** The Contractor will be required to ensure adequate water for domestic (drinking, cooking, washing and sanitation) and construction purposes. Depending on the location of the contractor facility and temporary worker camps, the water from the nearest stream will be tapped for ongoing construction works. Clearance for water abstraction will need to be obtained from Gewog administration. The contractor will be responsible for ensuring that the water source is not blocked, and all water supply pipes are maintained and repaired to prevent leakages or blockages.

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<sup>21</sup> RGOB. Regulations on Working Conditions, 2012

**Mobilization of construction equipment**

360. **Impact.** Operating vehicles and mobile construction equipment on the site presents significant safety risks, particularly where slopes are steep and access roads are narrow or absent. Using excavators on such gradients increases the risk of machinery accidents.

361. The mobilization of equipment can impact local communities through increased traffic. Oversized or slow-moving construction vehicles pose safety risks to local residents and can disrupt traffic and access along highways and farm roads. There is also a risk of damage to local infrastructure, such as rural roads, culverts, and water channels. Construction activities may lead to nuisance impacts, including noise, dust, and vibration. In areas where the terrain is too difficult and inaccessible for standard machinery mobilization, contractors will explore ropeway options to transport items like sand and aggregates.

362. **Mitigation.** The TL alignment avoids settlement areas and private lands, therefore reducing some risk. The contractor will implement a Traffic Management Plan, continue to consult local representatives during mobilization to identify issues to be rectified.

**Impacts on Streams and water sources**

363. **Impact.** The TL alignment crosses the Tang Chhu three times- between towers AP-1/AP-2, AP-31/AP-32, and AP-50/AP-51, the Chamkhar Chhu between towers AP-54/AP-55 near Garpang.

**Table V-7: Stream and river crossing along the TL**

S.No	TL	Stream/ River Crossing	Stream/ River Crossing
1	AP-1 & Ap-2	Tangchhu river crossing	
2	Ap-5 & AP-6	Stream crossing	
3	AP-6 & AP-7	Stream crossing	
4	Ap-8 & Ap-9	Stream crossing	
5	AP-31 & AP-32	Tangchhu river crossing	
6	AP 50 & AP 51	Tangchhu river crossing	
7	AP 54 & AP 55	Chamkhar chhu river crossing	
S. No.	Access Road	Stream/ River Crossing	
1	Track 7	Stream crossing	
2	Track 11	Stream crossing	

364. The construction of tower footings and the development of new access roads involve earthworks that will disturb soil, leading to a potential increase of sediment runoff, turbidity and total suspended solids in nearby streams and rivers. This may be further exacerbated by the removal of trees and undergrowth for the RoW and access roads exposing soil to erosion, especially on steep slopes.

365. The operation of heavy machinery near water bodies introduces the risk of chemical contamination, if there is spillage of fuel. Improper disposal of domestic sewage and open defecation by construction workers will contribute to microbiological contamination. The baseline

study already indicates the widespread presence of *E. coli* and coliform bacteria, attributed to sewage and runoff which will be further exacerbated if wastewater and sewage are allowed to run off directly into water bodies.

D. **Mitigation** to include the following:

- Develop and implement Sediment and Erosion Management Plan.
- Maintain a minimum 30m buffer from all rivers and 15m from streams respectively as per national requirements.
- Schedule earthworks during the dry season to minimize erosion by surface water runoff.
- Install silt fences (semi-permeable geotextile) along permanent streams or water bodies to prevent runoff.
- Restrict discharge of sediment laden surface water runs off directly into surface water.

### **Traffic**

366. **Impact.** The transportation of materials using existing farm, gewog, or logging roads may cause damage, increase traffic, and pose a heightened risk for pedestrians utilizing the road network, particularly during peak usage by community members such as to and from school.

367. **Mitigation.** The Contractor will prepare a Traffic Management Plan informed by a road/traffic assessment, detailing use of public roads to transport construction materials and tower parts to the tower pads/locations avoiding peak travel times and school starting and leaving hours when children walk along the road. The plan will include a) community pedestrian conflict points; b) transport related incident reporting protocols; c) vehicle roadworthiness and maintenance requirements; d) driver selection and fatigue management guidelines; and e) transport of hazardous materials (e.g. flammable).

368. Road condition monitoring and reinstatement shall be included in the traffic management plan of the CEMP. BPC and the contractor will document the pre-project condition of the access roads which will serve as the baseline for future comparison. The Contractor will be responsible for restoring any property damage that is caused by their works including damage caused by heavy construction traffic using existing access roads to at least pre-project condition at their own cost. Vehicles will adhere to the speed limit to avoid accidents and conduct regular vehicle maintenance.

369. The Contractor will provide prior information of details set forth in the Traffic Management Plan through public consultations and meaningful stakeholder engagement and ensure communities are aware of potential traffic related risks and impacts and also how to access the GRM to be able to submit complaints related to impacts on travel routes or road damage.

### **Impacts to Air quality**

370. **Impact.** Construction activities along the TL route and access roads are expected to cause a temporary, localized, and short-term decrease in air quality, primarily due to the generation of fugitive dust and exhaust emissions. These emissions stem from various operations, including site preparation, land clearing, the establishment of temporary facilities, (possibly) blasting, the movement of vehicles transporting materials and workers, the operation of heavy construction machinery, and wind-blown dust from uncovered material transport and muck dumping areas.

Specifically, the use of diesel-powered equipment and vehicles will release typical exhaust pollutants.

371. **Mitigation.** The contractor and material transporters will be required to adopt these measures:

- All construction equipment, vehicles, and stationary sources (including diesel generator sets) must be regularly serviced and maintained in good working condition in accordance with manufacturer specifications, must pass applicable emission tests, and must have maintenance recorded in logbooks.
- Avoid unnecessary idling of vehicles and machinery.
- Diesel generators used as power sources must comply with Bhutanese emission standards and good international industry practice, including appropriate stack-height design
- Instruct staff and workers to avoid burning of waste materials
- Construction activities shall comply with the national ambient air-quality standards and WHO guidelines for TSPM, PM<sub>10</sub>, and PM<sub>2.5</sub> at nearby receptors; additional mitigation measures shall be implemented if exceedances are detected.
- Site specific sediment management plan.
- Sealed wastewater systems in camps (no pit latrines), approved off-site disposal plan
- Hazardous materials and spill prevention plan.
- Water Quality Monitoring Plan
- Progressive slope stabilization immediately post-excavation

### **Dust Generation**

372. Dust will be generated from multiple construction-related activities, including excavation at the 57 tower locations and along access routes, movement of construction vehicles transporting materials and equipment, uncovered transport of construction materials, and wind-blown dust from exposed muck and excavated areas. Dust generation is expected to be more pronounced during the dry and windy season; however, the overall impact is anticipated to be low, as the project area is predominantly buffered by forest and vegetation and sites are located away from major settlement areas.

373. Although dust-related air quality impacts will be short-term and largely confined to the construction sites and transportation routes, users of the access roads and a limited number of households located along the transportation routes may experience temporary deterioration in ambient air quality due to dust emissions.

374. **Mitigation.** The Contractor will be required to implement the following dust control measures:

- Establish and enforce vehicle speed limits appropriate to road conditions (e.g., maximum of 20 km/h on unsurfaced roads) to minimize dust generation.
- Cover trucks transporting loose or fine materials (e.g., sand, soil, aggregates) and spoil with tarpaulin to prevent dust emissions and spillage during transport.

- Carry out dust suppression through regular sprinkling of water at excavation sites, haul roads, and other dust-prone areas, particularly during dry and windy conditions.
- Keep stockpiles of soil, aggregates, and waste materials covered to prevent wind-blown dispersal and erosion during rainfall and locate them away from adjacent properties where practicable.
- Ensure routine maintenance of all construction machinery and transport vehicles in accordance with manufacturers' specifications. Maintenance records shall be kept in a logbook and made available for inspection at least once every two months.

### **Noise impacts**

375. Noise and vibration impacts will be generated by the influx of workers, tree felling and vegetation clearance, use of machinery, excavation work, vehicles and material transporting trucks and access road construction and blasting.

376. Overall, noise and vibration impacts are considered low/negligible and will not cause significant disturbance to the surrounding environment, because work will be carried out away from settlements and buffered by vegetation. Noise impacts are anticipated to be of short duration and once the work at each access road or tower foundation is complete, there will be no disturbance.

377. **Mitigation.** To minimize noise impacts, the Contractor will undertake the following:

- Prior information on work scheduling will be provided to the local representative to be shared with the community
- The Contractor Representative (Liaison Person) will be available on-site, and their contact details will be provided to the local representative. This will allow residents to lodge any grievances to the contractor.
- All construction equipment must be kept in good working condition and machines generating loud sound stationed as far as possible from sensitive receptors.
- All vehicles and equipment shall be switched off when not in use and not kept idling.

### **Waste Generation**

378. **Impact.** The project will generate construction waste such as cement bags, packaging material, excess cement, sand and aggregate residue from tower footings and road construction; hazardous waste such as used oil, grease & lubricant from generators, domestic / camp waste (food, packaging, sanitary waste).

379. The nearest landfill for solid waste is at the landfill at Bumthang which is about 20-60 km away depending on the work and accommodation site. Inappropriate disposal of waste (including hazardous wastes) generated from project sites and workers' camps will pollute the surrounding environment, especially if waste is burnt or disposed onsite. In addition, inadequate sanitation and poor solid waste management at the workers' camps could promote the proliferation of vermin and other disease vectors, potentially leading to the transmission of diseases among workers and to surrounding communities.

380. **Mitigation.** The EPC Contractor shall undertake the following:

- Comply with the Waste Prevention and Management Act of Bhutan, 2009 and Regulation, 2012 (amended 2016), Applicable EHS Codes of Practice, IFC EHS General Guidelines – Waste Management and Hazardous Materials Management and the Basel Convention for any transboundary movement of hazardous waste
- Prepare a Solid and Hazardous Waste Management Sub-Plan as part of the Construction Environmental Management Plan (CEMP) prior to commencement of works. The plan must consider the existing capacity of Dzongkhag waste disposal facilities. The plan must cover waste minimization, segregation, collection, storage, transport, reuse, recycling, and final disposal for excavated and construction waste, scrap metals and packaging waste, domestic and biodegradable waste and hazardous waste (used oil, grease, contaminated soil, chemical containers). The plan shall apply to all construction sites, tower locations, access roads, pulling stations, and temporary workers' camps.
- Establish a segregated waste collection system prior to construction, especially at the worker camps so that waste is not mixed with hazardous waste.
- Brief workers on waste segregation and fines for indiscriminate disposal of waste. Apart from organic waste which can be dumped into pits and covered with soil all other waste must be taken out of the project site to either recycling agents, scrap dealers or to the waste disposal site.
- All waste shall be stored in designated and secure areas using appropriate containers (bins, drums, or cement bags) in a secure area to prevent these being opened by wildlife or blown off due to strong winds.
- Hazardous waste must be stored in a secure, roofed area with an impermeable floor. Disposal of hazardous wastes will be safely transported to a licensed facility as per international good practice.
- For off-site storage and disposal of wastes, the contractor must consult the District Environment Officer and make disposal plans accordingly.
- Spill response kits (absorbent pads, sand, containers) shall be maintained at all fuel and hazardous material storage locations. In the event of spills, immediate cleanup must be undertaken, and contaminated materials must be treated as hazardous waste
- Contractors must instruct staff and workers to not burn waste

### **Site preparation, sites offices, worker camps and material storage**

381. **Impact:** Worker camps will be established on a shifting basis, with the exact locations to be finalized by the contractor based on their convenience and workplan. Most probably, this will be at the Gewog Centre at Tang, or in the settlements close to the TL alignment.

382. Establishing other site facilities will require dedicated space for site offices, worker accommodation, material storage, machinery parking, and utility connections. At each location, it is expected that there will be approx. 25 workers that will require temporary drinking water, electricity, and sanitation services.

383. Poorly planned or inadequately managed construction camps may result in overcrowding and sub-standard worker accommodation with unsanitary conditions posing increased risks of communicable diseases, including for vulnerable groups such as female workers, pollution of soil and water bodies from untreated wastewater, greywater, and solid waste. Improper material storage will also cause environmental degradation.

384. **Mitigation.** Measures to be undertaken by the contractor are presented below.

- Where feasible, explore the option of renting existing homes/ buildings for offices and accommodation to minimize the project footprint and associated environmental disturbance.
- Contractors will prepare a Worker Accommodation Plan especially as teams will need to move from one location to another.
- Workers Accommodation Plan will include detailed sanitation design (number of toilets, treatment method, sludge disposal plan), specific siting criteria (distance from streams, flood risk).
- Design camps to be fully relocatable as work progresses.
- Worker and labor accommodation must be weatherproof and able to withstand cold conditions, snow or heavy rainfall.
- Locate camps on existing clearings or disturbed areas and within the RoW
- Use prefabricated, containerized, or modular units that can be assembled and dismantled with minimal foundations
- Equip camps with ventilation, fire extinguishers, and relevant safety appliances.
- Ensure that there are adequate water storage tanks to provide adequate and safe water supply
- Ensure adequate wastewater disposal systems are available/installed
- Ensure adequate vector control management to eliminate, prevent the breeding of, or reduce populations of vectors—insects (like mosquitoes, fleas) or rodents—that carry diseases to humans
- Use above-ground, temporary water and power connections that can be removed without trenching
- Provide portable toilets or containerized septic units with sealed holding tanks or compact soak systems, or construct pits with liners to prevent seepage into forest soils.
- If camps are not movable then these must be design based on ILO[1] or EBRD/IFC <sup>22</sup>, and national standards (Temporary Living Accommodation Standards in the Bhutan Schedule of Rates 2024) to ensure adequate habitable spaces, sanitation facilities, waste management, fire protection and control and other welfare requirements.
- All camps must be dismantled and relocated once work at a particular site is completed.
- Demarcate / map culturally sensitive sites and ensure a water source protection plan is in place consisting of the following: no disturbance/buffer zone, religious user consultation etc.
- Rectify all damaged community infrastructure

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<sup>22</sup> Workers' accommodation: processes and standards A guidance note by IFC and the EBRD (2009)

## **Worker health and safety**

385. **Impact.** Occupational Health and Safety risks associated with the Project are varied due to the challenging location, terrain, isolated RoW, and types of construction activities required to construct the TL foundations, pylons, and associated access roads.

386. **Mitigation.** To address OHS and Safety Risks, the Contractor will prepare a *Health and Safety Management Plan* (HSMP). The HSMP will be based on a H&S risk assessment through a facilitated workshop to be attended by PMU and PIAC during the detailed design so that it can inform both the detailed design and pre-construction OHS. HSMP will outline the procedures and responsibilities for preventing, eliminating and minimizing the effects of those hazards and risks, specifying how consultation, training and information are to be provided to employees at various workplaces. In addition, the contractor will also prepare a construction *Emergency Preparedness and Response Plan*.

387. Other measures include:

- Provide appropriate training and supervision to *all* personnel
- Ensure all staff comply with approved health and safety policies, procedures, safety programs, and work rules at all times.
- Clearly identify, mark, and barricade hazardous areas and equipment, including warning signs indicating electrical hazards and wiring sequences.
- Install safety signboards and symbols at all high-risk locations to alert workers and third parties.
- Maintain construction areas in good condition to ensure safe movement of vehicles and workers
- Ensure vehicles operate are fitted with functional horns, reverse alarms, lights, and mirrors.
- Provide all workers (direct, subcontracted, formal, or informal) with appropriate PPE, along with training on correct use, care, and maintenance, in accordance with IFC EHS Guidelines.
- Enforce PPE use through a disciplinary system, including removal from site for repeated non-compliance.
- Provide N95 dust masks or equivalent to workers exposed to vehicle exhaust, dust, and earthworks.
- Install fire extinguishers and firefighting equipment at all work sites and ensure these are checked and refilled as required.
- Ensure a qualified first aider and trained fire marshal are present on-site during construction activities.
- Keep a well-stocked first aid kits are at all work locations.
- Ensure all workers are aware of the key contact numbers for staff as well as emergency numbers (ambulance, hospital)

- Allow only trained and authorized personnel to install, operate, maintain, or repair electrical equipment.
- Provide transport arrangements to the nearest healthcare facility, including ambulance services for serious emergencies.
- Ensure all occupational injuries and illnesses are documented, reported, and compensated in accordance with Bhutanese regulations.
- Maintain a log of all incidents, near-misses, and accidents, and include these records in monthly monitoring reports.

### **Natural Hazards and Disaster**

388. Since Bhutan lies in Seismic Zone V, the project site like the rest of Bhutan is faces a high seismic risk and is therefore vulnerable to earthquake-induced ground shaking and associated structural damage.

389. Segments of the TL on difficult terrain or on maximum or steep slopes are likely to be more prone and landslides potentially triggered by monsoon rains are high probability.

390. The TL crosses Tangchhu river and Chamkarchhu river once. The Chamkarchhu may be subject to flash floods and scouring during extreme weather events, yet flooding risks are considered low as towers site locations are situated at higher elevations and not away from the bank of the rivers and camps and construction are restricted to work within 15m of streams and rivers.

391. Erosion and Scouring is a documented issue along the Chamkhar Chhu, with scouring observed on terraces and near bridges where protection walls are either absent or deteriorating. The TL crosses Tang Chhu at multiple points (AP-1/2, AP-31/32, AP-50/51). In Tang Gewog, flash floods during the monsoon are a "High" probability hazard, having previously damaged agricultural land and farm roads in 2009 and 2014<sup>23</sup>.

392. Bumthang has historically witnessed fires, especially in Chamkar town. Sites may be exposed to accidental fire hazards arising from electrical installations, equipment malfunction, or forest fire, which could pose risks to personnel, infrastructure, and surrounding vegetation.

393. **Mitigation Measures.** The design of the tower will takes into consideration climatic conditions and terrain stability. To further mitigate risk and impacts from natural hazards and disasters the following measures are proposed:

- Integrate disaster-resilient design standards (seismic design, slope stability criteria, drainage capacity) for all tower locations along with slope protection structures based on site specific assessments.
- Ensure safe setbacks for transmission towers from rivers and streams.
- Strengthen coordination between Dzongkhag, gewog, Royal Bhutan Police (for firefighting) and BPC, prior to construction, for emergency preparedness in case the need arises.

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<sup>23</sup> Bumthang, 2017. Draft Bumthang Dzongkhag Disaster Management & Contingency Plan

- The contractor shall prepare a construction Emergency Preparedness and Response Plan as part of the CEMP
- The Contractor must prohibit open burning and uncontrolled use of fire at construction sites and camps.
- Maintain firefighting equipment (fire beaters, extinguishers, water drums) at camps and work sites.
- Conduct awareness training for workers on forest-fire risks and emergency response procedures.
- Develop an Emergency Preparedness and Response Plan, which will include plans to respond to emergency scenarios (e.g. landslides blocking access, tower foundation collapse, wildfire, fuel-truck spills etc), developing site-specific evacuation maps, delineating muster points, instigating multi-agency coordination with RGOB emergency services.
- Assess risks from steep slopes, landslides, and unstable soils require geotechnical considerations which needs risk zoning, monitoring (e.g. visual inspection), instrumentations where needed (e.g. settlement markers), a geotechnical expert/supervisor issuing daily clearance for slope work.

### **Impacts on Community Health and Safety**

394. **Impact..** Members of the public may also be exposed to safety hazards due to active work areas, moving equipment and vehicles, diseases and other social risks associated with the influx of national and foreign workers, are risks of sexual exploitation, abuse, and harassment (SEAH).

395. **Mitigation.** To ensure community health and safety is adequately managed the following measures will be implemented:

- Place clear warning signs on access roads and at worksites to alert the public to construction and potential hazards.
- Install physical barricades at active construction sites to keep the public, animals, and vehicles out.
- Enforce safe driving, including adhering to project-specific speed limits, especially in settlements and on village roads
- Publicize the project's Grievance Redress Mechanism (GRM) in affected communities to enable prompt reporting and timely resolution of safety concerns, near-misses, or accidents. Share GRM procedures and contact details via accessible channels (e.g., notice boards, meetings, social chat channels) for rapid and effective community response
- Conduct orientation on the culture among the foreign and non-local staff and workers, create awareness on the sexual harassment and abuse and prepare and require workers to follow a Code of Conduct.
- Establish a clear chain of command and accountability framework for incident management, grievance handling, and reporting, ensuring that responsibilities are well defined and communicated to all staff and workers

- Screen all foreign workers at their point of entry for virulent and contagious diseases, including HIV/AIDS, TB, Malaria, and Dengue and coordinate with health officials to provide awareness training to staff and workers regarding HIV/AIDS and general health hygiene.

### **ESS6 Biodiversity Conservation and Sustainable Natural Resources Management**

396. The objective of this section is to identify, predict, and evaluate the potential impacts of the Project's construction activities on biodiversity and ecosystem services in accordance with ADB's ESS6. This includes assessing impacts on Critical Habitat and the biodiversity receptors that were identified as PBFs in the baseline chapters.

397. The assessment aims to determine the type, magnitude, duration, and reversibility of all construction-related impacts, distinguishing between permanent and temporary, and direct and indirect effects. For each receptor assessed, specific mitigation and management measures will be identified to avoid, reduce, or remediate adverse impacts, consistent with the mitigation hierarchy. The mitigation commitments are introduced in this assessment and detailed in the Projects BMP (Chapter D).

398. Following the theoretical application of the mitigation measures, the residual impacts (i.e. those that may remain after the mitigation) will be assessed to determine whether the mitigation is sufficient and aligned with the project's goal of achieving NNL for all-Natural Habitat and PBFs and Net Gain for Critical Habitat and where feasible for all other biodiversity. If there are no residual impacts, no further actions will be needed. If residual impacts are expected, additional conservation actions will be introduced. Additional conservation actions are Project commitments that go beyond the construction mitigation to help the Project achieve NNL or Net Gain for the respective receptor, and therefore alignment with ADB ESF. The additional conservation actions are introduced in this assessment and detailed in the Project's Biodiversity Action Plan (BAP).

399. The impact assessment considers all major construction activities associated with the project, including site preparation, vegetation clearance, infrastructure development, and the associated facilities. The primary sources of potential ecological impact during construction include:

- Permanent habitat loss to facilitate the newly built infrastructure e.g. pylons and TL RoW.
- Temporary land take as part of vegetation clearance for the TL RoW and existing access roads.
- Habitat fragmentation and loss of connectivity due to habitat loss and new infrastructure.
- Disturbance to fauna from increased noise, vibration, light, and movement.
- Pollution of air, soil, and water from construction machinery, waste, and sediment runoff.
- Increased risk of fire, poaching and illegal harvesting due to worker influx and improved access.
- Introduction and spread of invasive species.

400. Each of these impacts will be systematically assessed under the relevant biodiversity receptors, protected and internationally recognized areas, habitats, and species, with clear justification. Critical habitat will be assessed as part the relevant and corresponding heading (e.g. habitat or species).

## **Protected Areas**

### **Wangchuck Centennial National Park (WCNP)**

401. WCNP is a nationally designated protected area, and its boundary overlaps with the proposed project construction footprint. The Project will therefore result in direct habitat loss and permanent land take and associated temporary habitat loss and construction-related disturbance.

402. One transmission tower (AP-1), out of a total of 57 towers, and approximately the first 370 m of the TL are located within National Park. Permanent habitat loss within the park is limited to the footprint of the pylon foundations. The tower is assumed to have four footings, each occupying no more than 5 m<sup>2</sup>. The total permanent loss of land is therefore no more than 20 m<sup>2</sup> (0.002 ha). This loss is irreversible but extremely small in scale and highly localized. The RoW for the TL will occupy 370 m by 27 m, which will result in 1 ha of habitat loss, but the RoW will be encouraged to revegetation post-construction. It is acknowledged that trees will not be permitted to grow but a recent site visit confirmed that the proposed construction area has already been cleared and is actively used for livestock grazing, with an existing access track present. The area is within Park's designated 'Multiple Use Zone'. The vegetation loss will therefore be limited in that no trees will be lost, and the impacts will be temporary as vegetation will be encouraged to regrow (albeit not above 7m in height). The permanent and temporary footprint represents around 0.0002% of the total park area.

403. Temporary disturbance will also arise from construction activities, including noise, movement of workers, and the use of machinery. These effects will be short-lived and restricted to the construction period. Given the existing grazing pressure and established access route, baseline disturbance levels in this part of the park are already elevated.

404. In summary, the impact on WCNP is limited in extent and magnitude. The permanent impact is confined to a negligible area associated with the pylon foundations. The remaining impacts are temporary and reversible. The effects are localized, occur within a permitted Multiple Use Zone, and do not affect the wider ecological integrity of the Park. Overall, the impact is adverse but minor, partly permanent, mostly temporary, and not significant at either the Park or national level.

### **Phrumsengla National Park (PNP)**

405. PNP is a nationally designated protected area located approximately 5 km to the south and east of the Project and lies entirely outside the construction footprint. As such, there will be no direct habitat loss, land take, or physical disturbance in the National Park. The distance between the Project and the Park is sufficient to preclude direct construction-related impacts such as noise, vibration, dust, or visual disturbance.

406. The Park is located downslope of the Project area and is therefore hydrologically connected through local drainage and river systems. In theory, this presents a potential ecological pathway by which sediment, dust, or accidental pollutants could be transported downstream. However, given the very small scale of the Project, the limited construction footprint, and the temporary nature of construction activities, any such effects would be highly diluted before reaching the Park. The large spatial extent and ecological resilience of the National Park further reduce the likelihood of any measurable effect.

407. Accordingly, no direct impacts are anticipated, and indirect impacts via ecological pathways are considered highly unlikely and negligible in magnitude. There will be no measurable impact on PNP.

### **Bumthang Wetlands**

408. The Bumthang Wetlands are located approximately 5 km from the Project area and are designated, in part, for their importance to the Black-necked Crane. The Wetlands lie outside the Project footprint and will not be subject to any direct habitat loss or land take.

409. Given the mobility of the Black-necked Crane, there is, however, a potential ecological pathway by which construction activities could affect the species through temporary disturbance, for example noise or increased human activity or if the species were to pass near construction activities. However, the separation distance between the Project and the Wetlands, combined with the short-term and small-scale nature of construction works, means that any disturbance effects would be very limited. No work is proposed within crane foraging or roosting areas, and no sustained sources of disturbance will occur during operation.

410. On this basis, no direct impacts on the Bumthang Wetlands or their constituent species are anticipated. Any indirect effects on the Black-necked Crane are considered unlikely and, if they were to occur, would be temporary and negligible. Overall, the Project is not expected to result in significant adverse impacts on the Wetlands or the conservation features for which they are designated.

411. **Mitigation for Protected Areas:** The following mitigation measures represent the Project's formal commitments to avoid, minimize, and manage impacts on protected areas. They have been developed to ensure compliance with national requirements and ADB ESF ESS6 and to safeguard the ecological integrity of affected National Parks or internationally recognized areas. These commitments define the overarching approach and obligations to be applied throughout project planning, construction, and reinstatement. Detailed procedures, responsibilities, methods, and monitoring arrangements for each measure are set out in the BMP (Chapter D). The mitigation commitments include:

- Pylon locations, access routes, and construction methods will be planned to avoid sensitive areas, minimise land take, and use existing tracks where practicable.
- Vegetation clearance will be limited to the approved Right-of-Way and pylon footprints only. No clearance outside the pre-approved areas will be permitted.
- Clearly marked construction boundaries will be established, and all adjacent National Park areas will be designated as no-go zones.
- Vehicles and machinery will be restricted to approved access routes and work areas to prevent unnecessary disturbance or habitat damage.
- Contractor compounds, storage areas, and worker facilities will be outside the protected areas and all construction within 100 m will be approved by WCNP authorities.
- All temporarily disturbed areas will be rehabilitated following construction, with native or appropriate vegetation encouraged to re-establish in line with the WCNP's objectives.
- Where practicable, plants or fauna of conservation concern encountered during construction will be protected in situ, or relocated under expert supervision (but no additional surveys or assessments are required at this stage).
- Ongoing engagement will be maintained with local communities to manage access, grazing practices, and construction activities within the WCNP.

- All mitigation measures will be jointly monitored with WCNP staff, with corrective actions implemented promptly in the event of non-compliance.

412. **Residual Impacts – Protected Areas:** The proposed mitigation measures will substantially reduce avoidable and unnecessary impacts on the protected areas, particularly WCNP. These measures will minimize construction footprints, control disturbance, and promote post-construction reinstatement and revegetation within the TL right-of-way. Together, they will ensure that temporary habitat losses are reversed and that disturbance effects are short-lived and localized.

413. However, despite the application of the mitigation hierarchy and the implementation of robust mitigation measures, the permanent land take associated with the pylon foundations represents an irreversible loss of a small area of habitat within the National Park. While the affected area is extremely limited in scale, this permanent loss cannot be fully compensated through on-site mitigation alone. As a result, achievement of NNL cannot be demonstrated through mitigation measures only.

414. Consequently, a small residual adverse impact remains, comprising the permanent loss of up to 20 m<sup>2</sup> of habitat within a nationally designated protected area. Although negligible in magnitude and not significant at the WCNP or national scale, this residual loss requires additional conservation action to address the shortfall against NNL objectives under ADB ESF ESS6.

415. Additional conservation actions will therefore be developed and implemented through a BAP. These actions will be designed in consultation with the DoFPS and aligned with existing Park management priorities. Measures are expected to include targeted support for conservation and management activities within the Park, such as resourcing priority management actions, supporting community-based initiatives that contribute to Park protection (for example planting of non-timber forest products), provision of survey equipment and materials, and implementation of practical measures such as firebreak establishment and maintenance.

416. With successful implementation of the BAP, these additional actions will deliver measurable biodiversity gains that outweigh the small residual loss associated with the Project. Over time, they will compensate for the permanent land take and support improved conservation outcomes within the National Park. On this basis, the residual impacts are expected to be fully addressed, and the Project will achieve NNL of biodiversity at the Park scale through the combined application of mitigation and targeted conservation actions.

### **Natural Habitat**

417. The Project alignment passes through a range of land-use types, predominantly government reserve forest and community forests characterized by blue pine and mixed conifer stands. The vegetation within the Project construction footprint, which is 53.5 ha in extent, will be removed, of which 50.2 ha (c.93%) is forest. The forest cover for Bumthang Dzongkhag is 142,024 ha<sup>14</sup>, and assuming that all 'forested areas' are indeed forested as per National Forest Inventory (NFI) definition (canopy cover), the project losses will reduce the forest cover in Bumthang by c.0.036%. These losses will be equal to approximately 0.0048% of the national forest cover.

418. Of the 50.2 ha of forest, 44.84 ha or 84% of the total construction footprint is Natural Habitat. On a precautionary basis, this assumes that all vegetation within the RoW will be cleared. Of this total, only circa 0.4ha will be permanently lost beneath the footprint of the 57 transmission towers (i.e. comprising the four concrete footings of each pylon tower). The remaining area will be subject to temporary tree and vegetation clearance to facilitate the development but it will be allowed to

regenerate to a maximum height of 7m, i.e. not mature forest, but scrub and grassland. This new, more open scrubby habitat will likely provide benefits to some species. The vegetation management will increase the structural heterogeneity in an otherwise closed-canopy forest, support edge and early-successional plant species, pollinators, and some birds and mammals that use edge of habitats for foraging or movement. This linear area may also function as movement corridors for certain wildlife. The corridor created will not be closed-canopy forest, as exists in the current biodiversity baseline, however, it is considered to be functionally part of the existing forest, providing forest edge and associated ecotone opportunities.

419. Notwithstanding this, Bhutanese law requires that tree loss is compensated based on the area of forest lost, rather than number of trees. As such, the Project will provide an area of at least 100.4 ha of new forest planting in order to ensure legal compliance.

420. Further, in accordance with national requirements the number of trees being replanted must be carefully calculated to ensure appropriate compensation. The Project has already committed to a 2:1 planting ration with two trees being planted for everyone lost. Using an average number of 309 trees/ha for this area of Bhutan (informed from the baseline) and the clearance of 50.2ha of forest (both Blue Pine and Mixed Conifer) it is estimated that circa 15,500 trees will be lost (12,000 blue pine trees and 3500 mixed conifers). Assuming the replacement forest planting occurs to enable the Project to comply with Bhutanese law (i.e. the 100.4 ha of new forest), this would require the planting of circa 31,000 trees that would ensure this impact is compensated.

421. In addition to the loss of Natural Habitat, indirect impacts may also occur during construction from dust generation, temporary disturbance including noise, movement of workers, and the use of machinery. These effects will be short-lived and restricted to the construction period. The potential for forest fires is also likely to increase due to increased human activity, possible open burning, and the increasingly dry ground conditions brought about by tree removal. In the absence of control measures, the extraction of non-timber forest products (NTFPs) and fuelwood demand may also increase.

422. In summary, the impact of the Project on Natural Habitat is limited in extent and magnitude. The permanent impact is confined to a negligible area (circa 0.4ha) associated with the pylon foundations. The remaining impacts are temporary and reversible, and the Project has committed to planting at least 31,000 trees and the associated creation of 100.4 ha of reforestation. The maintenance of replanted trees will continue for five years. Any trees that do not survive during the five-year period will be placed with another sapling. For the avoidance of doubt the commitment to reforest 100.4 ha is separate to and therefore, in addition to, the natural revegetation of the RoW post-construction. Overall, the impact to natural habitat is considered adverse but minor, partly permanent but mostly temporary, and not significant.

423. **Mitigation for Habitats:** The following mitigation measures represent the Project's formal commitments to avoid, minimize, and manage impacts on Natural Habitat. They have been developed to ensure compliance with national requirements and ADB ESF ESS6. These commitments define the overarching approach and obligations to be applied throughout project planning, construction, and reinstatement. Detailed procedures, responsibilities, methods, and monitoring arrangements for each measure are set out in the BMP (Chapter D). The mitigation commitments include:

- Project layout, access routes, and construction methods will be designed and planned to minimise land take, avoid sensitive areas and use existing tracks where practicable.

- To ensure legal compliance, BPC will enter a MoU with the DoFPS and fund compensatory afforestation of at least 100.4 ha on degraded land identified by DoFPS.
- No works, including felling of trees, will occur within 15m of water.
- Vegetation clearance will be strictly limited to the approved RoW and the pylon footprints.
- Vehicles and machinery will be restricted to approved access routes and work areas only.
- All temporarily disturbed areas will be rehabilitated following construction to promote natural regeneration with native or appropriate species. Such activities will need to occur as soon as feasibly possible to prevent colonization of invasive species (see BMP for more details).
- Species of conservation concern will be protected in situ where practicable or relocated under expert supervision if required.
- Engagement with local communities will be maintained to manage access, grazing, and indirect pressures within the Project area.

424. Reforestation or afforestation sites have not yet been confirmed but initial consultation with the DoFPS and the CFMG's have indicated various degraded lands are available in the surrounding landscape, as summarized in Table V-8.

**Table V-8: Proposed sites for afforestation within the project gewog and in Bumthang**

Name of proposed afforestation site	Area	Gewog	Remarks
<b>Areas within Bumthang Forest Division</b>			
Shobum	25.4 hectares	Tang	Located within the Rudongla FMU. This is the most strategic site for the current project because it is located in Tang Gewog, the same gewog hosting the majority of the Wobthang solar TL Moderately suitable area -score 3
Rodungla	Multiple plots, totaling 20.4 hectares	Tang	Within Rudongla FMU. Same as above but note scoring. Note: Marginally suitable area-score 2
Dorjeebee/Dorjibee	Multiple plots totaling over 45 hectares	Chokhor	Located in Chokhor Gewog, near the termination point of the TL (Garpang). Note: Marginally suitable area-score 2
Pangtoed Lhakhang and areas within the Karshong FMU	9 hectares (0.729 + 5.769+2.526)	Chumi	Karshong FMU Moderately suitable area -score 3
Willing	13.7 hectares	Nubi	This is in Trongsa District and falls in Nubi FMU Note: Moderately suitable area -score 3
<b>Areas within Wangchuck Centennial National Park</b>			
Ney	3.8 hectares	Gangzur gewog	This is in Lhuentse District Note: Most suitable are-score 4
Mangdechhu top to Trongsa	2.7 hectares	Nubi	This is in Trongsa District Note: Marginally suitable area-score 2

425. **Residual Impacts – Natural Habitat:** The proposed mitigation will substantially reduce avoidable and unnecessary impacts on Natural Habitat. These measures will reduce the construction footprint, limit disturbance, and support effective reinstatement and revegetation within the TL right-of-way following construction. Collectively, they will help ensure that temporary habitat losses are restored and that disturbance effects remain short-term and localized.

426. However, despite the application of the mitigation hierarchy and the implementation of robust mitigation measures, the permanent land takes associated with the pylon foundations, 0.4 ha, represents an irreversible loss of a small area of Natural Habitat. The Project has committed to replant 100.4 ha of new compensatory forest, which is more than enough to offset the 0.4 ha but ecologically, it is not sufficient to compensate for the permanent loss of 0.4 ha of forest and the loss of up to 50.2 ha of mature or semi-mature forest. Replacing 50.2 ha of mature and semi-mature forest cannot be fully compensated ecologically by planting 100.4 ha of young saplings, as the latter lack immediate ecological equivalence in terms of structure, species interactions, carbon storage, and habitat function, and will require decades to reach comparable maturity. As a result, achievement of NNL, the minimum requirement for the loss of Natural Habitat, cannot be demonstrated through mitigation measures only.

427. Consequently, a residual adverse impact remains. Although negligible in magnitude and not significant in ecological terms, this residual loss requires additional conservation action to address the shortfall against NNL objectives under ADB ESF ESS6. Additional conservation actions will therefore be developed and implemented through the BAP. These actions will be designed to compensate for the loss of habitat (i.e. the forest) and will comprise supplementary conservation actions targeting areas of existing forest that are degraded or at risk, e.g. from unsustainable harvesting or fire. The actions will be developed in collaboration with DoFPS and will be sufficient to quantify NNL, if not a Net Gain.

428. With successful implementation of the BAP, these additional actions will deliver measurable biodiversity gains that outweigh the small residual loss associated with the Project. Over time, they will compensate for the permanent land take. On this basis, the residual impacts are expected to be fully addressed, and the Project will achieve NNL of biodiversity through the combined application of mitigation and targeted conservation actions.

### **Trees and Plants**

429. Field surveys frequently recorded two IUCN Vulnerable tree species, *Picea brachytyla* and *Populus rotundifolia*, and one IUCN Endangered tree species, *Taxus wallichiana*. The three species will therefore be subject to direct loss as part of the vegetation clearance. *Picea brachytyla* and *Populus rotundifolia* are both moderately fast growing, tall trees that can grow to 25m+ in height, are therefore not suitable for replanting, or natural regeneration within the RoW post-construction. They will therefore be permanently lost. *Taxus wallichiana* is slower growing and is generally shorter but is also unlikely to regrow in the RoW. In line with the precautionary approach therefore, all three species will be permanently lost from the RoW. Notwithstanding this, within the context of the landscape and the extent of forest dominated by these species in the area (the forest cover for Bumthang Dzongkhag is estimated at 142,024 ha), the loss of mature specimens of these species is adverse, but minor in magnitude and not significant.

430. In addition to direct loss of these species, indirect impacts to this PBF may also occur during construction from dust generation. Additionally, project activities will increase the risk of forest fires due to increased human activity, open burning, and the increasingly dry ground conditions, and excess wood and non-timber forest products (NTFPs) extraction. These effects will, however, be

very temporary and restricted to small, isolated sections of construction footprint where the species are present nearby.

431. In summary, the impact on vulnerable and irreplaceable tree species is limited in extent and magnitude. The permanent impact of loss is small in the context of the landscape. The remaining impacts are temporary and reversible. Overall, the impact is adverse but minor, partly permanent and partly temporary, and not significant.

432. **Mitigation for Trees and Plants:** The following mitigation measures represent the Project's formal commitments to avoid, minimize, and manage impacts on the notable flora. Detailed procedures, responsibilities, methods, and monitoring arrangements for each measure are set out in the BMP. The mitigation commitments include:

- All mitigation measures committed for forest habitats (above) will apply to all tree and plant species and are assumed to be implemented in full.
- All notable and vulnerable tree species will be identified and physically marked before construction starts and the final Project alignment will be modified to avoid direct loss.
- Every tree will be surveyed with its species, height, height at breast height and condition (health) entered onto the Tree Clearance Register.
- Every tree to be removed will be clearly marked by the DoFPS.
- All trees will be compensated for with a ratio of 2:1 and managed and monitored for at least five years.
- Vegetation clearance will be strictly limited to the approved Right-of-Way and pylon footprints, with no clearance outside pre-approved areas.
- Engagement with local communities will be maintained to manage access, grazing, and indirect pressures that may affect notable trees within and adjacent to the Project area.
- BPC will fund compensatory afforestation which will, where possible, prioritise planting *Picea brachytyla*, *Populus rotundifolia*, and *Taxus wallichiana*.
- The RoW will be encouraged to regenerate with native species and will be managed for wildlife in perpetuity.

433. The proposed mitigation will substantially reduce avoidable and unnecessary impacts on protected and vulnerable trees and plant species. These measures will reduce the construction footprint, limit disturbance, and ensure the planting of replacement, compensatory trees. Collectively, the measures are expected to address the residual impacts and therefore the Project will achieve NNL of protected and notable trees and plants.

### **Mammals**

434. Field surveys recorded six vulnerable or irreplaceable species in the Project area: Asiatic golden cat, Common leopard, Himalayan serow, Sambar, Wild dog and Asiatic black bear. These species will all be affected by the vegetation clearance but are all highly mobile and sensitive to human activities. They will therefore be very likely to move away from the construction works. As such, direct mortality is possible but very unlikely.

435. The bat assemblage in the forests was also precautionarily assumed to be important and while also a highly mobile species group, some bat species are more susceptible to mortality during

tree clearance and felling. Large fruit-eating bats are likely to be easily disturbed by noise and movement and will naturally disperse, but crevice dwelling bats, potentially roosting inside trees, could be killed or harmed if the tree is felled. It is acknowledged that the extent of forest to be cleared is small in the context of the surrounding forested landscape and any bats species present will likely be abundant across large ranges. While the potential loss of individual bats is therefore adverse at the local level, in the context of the species regionally, the vegetation clearance would unlikely affect the long-term conservation status of any species.

436. The loss of the forest's understory, even on a temporary basis, will directly destroy some species' places of shelter and potentially breeding, particularly for ground-based species, and some foraging sites and associated food sources. Increased traffic and heavy machinery may elevate roadkill risks, and the influx of construction workers could lead to hunting and poaching. Such risks are particularly relevant to the deer species and the small carnivores. There will also be on-going disturbance from noise and light generated during construction. The vegetation clearance activities will, however, be temporary and highly localized for a few weeks at any one location and vegetation along the RoW and access roads will regrow.

437. On this basis, the impacts to vulnerable and irreplaceable mammals during construction are considered to be adverse but minor, temporary and mostly reversible. As such, they are not considered significant.

438. **Mitigation for Mammals:** The following mitigation measures represent the Project's formal commitments to avoid, minimise, and manage impacts on mammals. Further details are provided in the BMP. The mitigation commitments include:

- All mitigation committed for forest habitats (above) is assumed to be implemented in full and will avoid and reduce the risk of mortality and disturbance of mammals
- Pre-vegetation checks for mammals and evidence of mammals will Vegetation clearance will be limited to the approved Right-of-Way and pylon footprints only. No clearance outside the pre-approved areas will be permitted.
- All habitat clearance will be phased to encourage fauna to move off site naturally and timing will be sensitive to nesting and breeding seasons.
- Vehicles and machinery will be restricted to approved access routes and work areas to prevent unnecessary disturbance or habitat damage.
- Poaching and hunting will be completely banned.
- All construction staff and subcontractors will be trained in the importance of wildlife care, reporting requirements and the complete ban on poaching and hunting.
- All temporarily disturbed areas will be rehabilitated following construction, with native or appropriate vegetation encouraged to re-establish.
- Preclearance checks of trees and other flora for bat roosts will be undertaken.
- In the event of wildlife encounters, injury, or mortality, immediately stop work in the affected area and inform PIU and the nearest Forest Office.

439. The proposed mitigation will substantially reduce avoidable and unnecessary impacts on protected and vulnerable mammals.

## **Avifauna (Birds)**

440. Impacts to birds will be limited to species dependent on the forest, i.e. smaller, passerine bird assemblages, which were not identified to be of conservation importance. Any impacts associated with vegetation clearance will be temporary and limited in extent, and will create spatial and species heterogeneity which may provide some, albeit limited benefits (e.g. increased species diversity and habitat structure). Impacts to the larger species, e.g. eagles and vultures will be temporary, reversible and negligible, assuming nests for such species are not present in or near the project area. Likely impacts to larger species will occur during the operational phase of the development.

441. On this basis, impacts from construction on bird species are considered to be very minor, temporary in nature and reversible. They are therefore not considered to be significant.

442. **Mitigation for Avifauna (Birds):** The following mitigation represents the Project's formal commitments to avoid, minimise, and manage impacts on bird species. Further details are provided in the BMP. The mitigation commitments include:

- All mitigation committed for forest habitats (above) is assumed to be implemented in full and will avoid and reduce the risk of mortality and disturbance of birds
- Preclearance checks of trees and other flora for nesting birds will be undertaken and works will be delayed if nests are active, particularly for vulnerable or irreplaceable species.
- Vegetation clearance will be limited to the approved Right-of-Way and pylon footprints only. No clearance outside the pre-approved areas will be permitted.
- All temporarily disturbed areas will be rehabilitated following construction, with native or appropriate vegetation encouraged to re-establish and to improve forest connectivity
- The implementation of the BMP and associated mitigation will be sufficient to control all expected impacts to bird species during construction and achieve NNL.

## **Invasive species**

443. Flora surveys recorded a single invasive plant species within the project area. *Ageratina adenophora* is a fast-growing species that often outcompetes native species, produces seeds extremely quickly, and therefore colonizes disturbed soils rapidly. *Ageratina adenophora* is particularly likely to spread during vegetation clearance and soil disturbance, as its light wind-dispersed seeds remain viable in the soil seed bank and germinate readily in exposed ground. The Pinewood nematode was also identified as being present on-site during consultation. It is transmitted by longhorn beetle species.

444. There is also a risk of introducing new invasive plant species if spoil or aggregates are brought into the Project area, or machinery contaminated with soil or plant matter from other infested areas arrive on site. The risk of spreading existing invasives is greatest during site preparation, vegetation clearance, spoil disposal, and along temporary access roads and storage areas where topsoil and organic debris are moved and exposed.

445. Although the introduction or spread of a few non-native species could initially appear insignificant, invasive species are a major cause of the global biodiversity crisis, often leading to significant ecological disruption and undermining the livelihoods of rural communities that depend on native ecosystems. Given that invasive species are already present, the ease with which they

spread, the vegetation clearance and ground works planned for the area and the proximity to rivers that can act as seed pathways, the magnitude of the adverse impacts if spread, would be significant and adverse. The risk of introducing new species is moderate but the likelihood of existing invasive species being spread is very high. While technically reversible, the ecological and potentially social impacts of spreading invasive species would be very large and the cost of remediation would be extraordinarily high. Invasive species pose a significant adverse impact at the local level.

446. **Mitigation for invasive species:** Mitigation is required to control the risks associated with introducing new invasive species and the high likelihood of spreading already present invasives. On this basis, the following measures will be incorporated into the Project BMP:

- The Project will complete a comprehensive survey of the entire construction footprint and record and map all invasive plant species before any vegetation removal.
- No works will take place within 15m of any watercourse to help prevent spread through seed ingress to water.
- The Project will develop species-specific GIP aligned guidelines for the safe clearance, treatment and disposal of invasives species known or likely to be present on site, including timings, frequency and methods.
- No vegetation, including any invasive species will be removed without prior written approval from the Project.
- The Contractor will remove, treat, avoid, transport and dispose of all invasive species in accordance with GIP (e.g. cleaning equipment) and all national legislation and guidance.
- A buffer area of at least 10 m will be established around all newly identified stands of invasive species or any treated stands that persist. The buffer will be physically marked within 24 hours of identification, and the plants will be removed or treated in accordance with the pre-approved species-specific methodologies immediately.
- All pines will be inspected before felling for the presence of pine wilt disease and trees will only be felled in accordance with methods approved by DoFPS or other regulatory body.
- All construction workers will be trained before they start, and annually, on the identification and risks associated with invasive species and the reporting and prevention procedures.
- The disposal of spoil, stockpiling of materials, and washing of equipment within 50 m of rivers will be strictly prohibited, and silt traps or sediment barriers will be installed at drainage outfalls to intercept floating invasive species seeds and spores.
- No non-native or invasive species will be used as part of the reforestation or afforestation commitments. DoFPS will approve all proposed species for planting.
- The Project will enforce corrective actions where non-compliance is identified, including non-conformance notices and Corrective Action Plans for immediate rectification work.

447. With the successful and sustained implementation of the mitigation the likelihood of large-scale invasive species establishment or spread will be reduced from moderate to low. Residual impacts are therefore expected to be not significant and no further actions required.

## **Cultural Heritage**

448. Feasibility surveys, confirmed that the TL route avoids physical cultural resources with no direct impact anticipated. However, risks to inadvertently impacts revered springs and streams, such as the Drupchhu and Menchu near AP 28 and 44, exist.

449. A possibility that underground assets or archaeological artifacts may be discovered at the site requires precautionary measures and procedures to be followed.

450. **Mitigation.** The following measures shall be undertaken to minimize impacts to tangible and intangible heritage.

- Restrict workers from touching or removing any item from the site
- Prevent pollution or impacts to the Drupchhu and Menchhu near towers AP 28 and 44.
- The contractor will brief all employees and workers on the presence of cultural sites and resources and provide details of avoiding damage or disturbance.
- Engage proactively with local communities and religious bodies to provide information on construction schedules and mitigation measures and to 'no-work' days when religious festivals are planned.
- Contractors will be mindful to avoid access issues leading to Dorjitse Monastery during the *Dorjitse Lamai Kuchoed* prayer festival as local traffic will increase substantially during the prayers.

451. Chance Finds. In case of discovery of a chance find, (archaeological, historical, cultural, religious objects, or graves) during the excavation, the following steps must be undertaken by the contractor and BPC:

- Upon detection of any chance find, the contractor must immediately stop all activity and immediately notify the supervisor onsite and the BPC. No construction is to be carried out by the Contractor until notified by BPC.
- BPC in turn will document the chance finds and immediately inform the Department of Culture, Dzongkhag Development, and Ministry of Home Affairs (MoHa)
- The Department of Culture and Dzongkhag Development (DoCDD) may also provide their assessment by photo documentation or conduct in-person site assessment to assess the chance find in detail and relay appropriate instruction to BPC.
- BPC must ensure no delays occur to the verification process or in notifying the contractor of the procedures to be followed based on the assessment by the DoCDD
- BPC must monitor to ensure that the instruction given by the DoCDD is carried out correctly.
- No works will resume until clearance is provided by the Department of Culture, MoHA and BPC permits construction works to resume.

## **Ecosystem services**

452. Vegetation loss associated with the Project will affect the local communities' access to firewood, timber and potentially food and medicinal plants, particularly in and around the three Community Forests through which the Project passes. Any losses may also affect the community forest groups ability to generate income through the sale of surplus timber <sup>24</sup>[1]. In addition to provisioning services, the forest, particularly those on steep terrain, provide essential soil stabilization and as evidenced by the water quality results, also provides water quality regulatory function by reducing surface runoff ensuring that the water quality is 'pristine'.

The clearance of 9 ha of community forest and additional surrounding forests will therefore result in a temporary reduction in such services until vegetation re-establishes. Temporary and permanent disturbance of forest soils may weaken regulating services, notably slope stabilization, erosion control, water regulation, and carbon storage, increasing localized erosion risks and reducing climate regulation benefits. Habitat modification will also diminish supporting services, including wildlife habitat and ecological connectivity, which underpin hunting restrictions, cultural values, and long-term forest productivity in Community Forest areas. The natural regeneration of the RoW (up to 7 m in height) and the Project's commitment to plant 100.4 ha of forest in the local area will, in time, compensate for the losses and indirect impacts. Therefore, given the narrow 27 m RoW, the linear configuration of the TL, and the largely temporary and reversible nature of vegetation clearance (with natural regeneration and compensatory planting committed), any reduction in these services will be highly localised and minor in extent. The forest is also an important source of water. However, the Project has been designed to avoid watercourses and no works within 15 m of the bank tops will be permitted. The implementation of GIP pollution control measures will ensure no impact on water quality. As such, impacts to water-related ecosystem services are considered negligible.

453. On this basis, the impact from loss of forest on associated ecosystem services during construction is considered to be adverse but temporary and of minor magnitude within the context of the retained forests surrounding the Project.

454. **Mitigation for Ecosystem Services:** The mitigation introduced previously for habitats, trees and plant, mammals and birds will, directly and indirectly address the predicted impacts on ecosystem services. The mitigation for other PBFs is therefore sufficient to address the loss and degradation of ecosystem services, if designed and implemented correctly. These mitigations for all other PBFs will collectively replicate, replace and, where necessary, compensate the provisioning and regulating services on which local communities depend. For example, forest restoration and offset planting will be located and designed to stabilize slopes, reduce erosion and restore long-term soil retention functions, while also ensuring that replacement of fuelwood and fodder are available in close proximity to affected households. As committed to in the BMP, all relevant mitigation must be designed in collaboration with both the Community Forest User Groups and the DoFPS.

455. Accordingly, the project's wider environmental and social mitigation will fully incorporate ecosystem-service considerations into design, phasing and long-term management. With this systematic and community-focused integration of ecosystem-service needs into all relevant mitigation and offset programmes, no residual impacts on ecosystem services are expected.

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<sup>24</sup> Garablung CFMP, Gyal- Lyon-Khar CFMP, Phomrong CFMP, Ngagnang CFMP.

### **Completion of construction work**

456. **Impact.** Completion of infrastructure work entails a number of critical steps that must be undertaken to ensure proper closure and handing over of worksites and repatriation of foreign workers.

457. **Mitigation:** To ensure proper completion of infrastructure works, the following measures are proposed:

- Upon completion of all work, dismantle all offices, storage sheds, worker camps
- Ensure the entire site is cleaned up, and remove construction materials and debris and dispose of these at an approved disposal site
- Restore disturbed sites with local/native floral species
- Repair any damaged roads or property
- Ensure that all foreign workers are repatriated upon completion of work as required by the Labor Regulation

### **F. Anticipated Impacts and Mitigation During Operation Phase**

458. This phase covers planning, design, and preparatory activities before the commencement of construction activities.

### **Worker health and safety risks**

459. **Impact.** Maintenance personnel may be exposed to occupational health and safety risks, including electrocution during operation and maintenance of live transmission infrastructure, as well as potential encounters with wild animals in remote and forested locations.

460. **Mitigation.** To minimize occupational health and safety risks to maintenance staff, BPC shall implement the following measures:

- Equip TL towers with anti-climbing devices (e.g., barbed wire or equivalent) to restrict unauthorized access and reduce accidental contact with live infrastructure.
- Install and maintain clearly visible warning signage in local language(s) at towers, access points, and high-risk locations.
- Ensure all new and existing maintenance staff receive mandatory induction and refresher training on:
  - Working safely in remote and forested areas;
  - Wildlife awareness and response procedures; and
  - Standard Operating Procedures (SOPs) for TL maintenance.
- Prohibit maintenance work during adverse weather conditions, including heavy rainfall, snowfall, strong winds, or storms.
- Provide and enforce the use of appropriate Personal Protective Equipment (PPE), including insulated gloves, helmets, safety harnesses, protective footwear, and wildlife deterrent equipment where applicable.

- Require maintenance activities to be conducted under a permit-to-work system with clear supervision and communication protocols.
- Establish emergency response procedures for electrical accidents and wildlife encounters, including access to first aid and emergency communication.

### **Maintenance of RoW**

461. **Impact.** If vegetation within the RoW is not regularly maintained, it may encroach on the TL, increasing the risk of electrical faults and electrocution.

462. **Mitigation.** As standard process, BPC operation and maintenance staff are required to carry out clearing of overgrown vegetation and trimming of tree branches along the RoW.

### **Noise**

463. **Impact.** Potential noise sources during operation include:

- Corona discharge from conductors under wet or high-humidity conditions
- Wind-induced vibration of conductors and fittings
- Substation equipment (transformers)

464. **Mitigation.** For overhead TLs, audible noise is typically low and intermittent, occurring mainly during rainfall, fog, or high humidity. In dry conditions, noise emissions are negligible. The project alignment traverses sparsely populated mountainous terrain, where background noise from wind, flowing water and natural sources generally exceeds TL noise.

465. At Garpang Substation, transformer noise is continuous but attenuates rapidly with distance. Equipment is designed and installed to meet applicable national and international standards for environmental noise.

466. Predicted noise levels at the nearest potential receptors are expected to comply with the WHO Environmental Noise Guidelines (2018), which recommend limits protective of human health and well-being. Given the absence of dense residential settlements within proximity to the alignment and the rapid attenuation of sound over distance and complex terrain, operational noise impacts on communities are assessed as minor to negligible.

467. Operational safety and risk management will be governed by Bhutan Power Corporation's Safety Manual (2021), which establishes procedures for hazard identification, periodic inspections and protection of the public. Preventive maintenance of electrical infrastructure reduces the likelihood of abnormal noise due to equipment faults, loose fittings, or excessive corona discharge.

### **Community Health and Safety Risks**

468. **Impact.** Communities living near TL towers and along the transmission corridor may face risks of electrocution, accidental contact with live conductors or towers, and fire hazards arising from electrical faults, vegetation encroachment, or unauthorized access.

469. **Mitigation.** BPC shall implement the following measures to minimize community health and safety risks during operation

- Restrict public access to TL towers through fencing, anti-climbing devices, and locked gates, where applicable.
- Install and maintain clearly visible warning signage in local language(s) at towers, access points, and high-risk locations.
- Conduct regular inspection and maintenance of TLs, towers, and Right of Way (RoW), including vegetation management, to prevent electrical faults and fire hazards.
- Implement a fire prevention and response protocol, including coordination with local authorities for rapid response in the event of electrical fires.
- Inform and sensitize nearby communities prior to operation on electrical safety risks, restricted activities within the RoW, emergency contacts, and the project's GRM.
- Promptly address any reported safety concerns or incidents through corrective actions.

### **Low Frequency Electro Magnetic Fields (EMF)**

470. **Impact** A quantitative assessment of extremely low-frequency electromagnetic field (EMF) exposure during operation of the 132 kV double-circuit TL has been conducted using conservative assumptions, including maximum current loading, minimum conductor clearance at mid-span (maximum sag) and standard phase configuration. Ground-level exposure was evaluated directly beneath the conductors and at the edge of the Right-of-Way (RoW), representing the nearest publicly accessible locations. Predicted EMF levels were compared with international public exposure limits established by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) for low-frequency fields (1 Hz–100 kHz).

471. Under worst-case conditions:

- **Directly beneath conductors:**  
Electric field = 5 kV/m; Magnetic field = 20  $\mu$ T
- **At RoW edge (~13–15 m from centerline):**  
Electric field = 1.0 kV/m; Magnetic field = 4  $\mu$ T
- **Beyond RoW (residential locations):**  
Electric field < 0.3 kV/m; Magnetic field < 1  $\mu$ T

472. **Mitigation** These values are below ICNIRP public exposure limits of 5 kV/m (electric field) and 200  $\mu$ T (magnetic field). The TL is in mountainous terrain at elevations of approximately 2,000–3,000 m above sea level, where conductor height above ground and limited accessibility further reduces actual exposure. Based on this assessment, EMF exposure at the RoW boundary and nearby communities is not expected to pose health risks.

### **Climate Change**

473. **Impact.** Project infrastructure may be exposed to risks from natural hazards, including landslides, floods, earthquakes, extreme rainfall, strong winds, and wildfires, which could result in damage to TL towers, access roads, and associated facilities, service disruption, and safety hazards.

474. **Mitigation.** To reduce risks associated with natural hazards and disasters, BPC shall:

- Conduct regular inspection and maintenance of towers, foundations, slopes, and drainage structures, particularly before and after the monsoon season.
- Establish and implement an Emergency Preparedness and Response Plan, including procedures for extreme weather events and natural disasters.
- Strengthen coordination with Dzongkhag, Gewog, Royal Bhutan Police, and other relevant authorities for emergency response and disaster management.
- Suspend maintenance activities during high-risk weather conditions and resume work only when conditions are safe.

### **Biodiversity Impacts**

475. The purpose of this section is to identify and evaluate the long-term biodiversity and ecosystem-service impacts associated with the operation of the Project. Once constructed, the TL will be largely autonomous with only periodic maintenance and vegetation management necessary. As such, the operational impacts to biodiversity could arise from:

- Collision of wildlife with pylons and transmission cables.
- Electrocution of wildlife from contact with cables/pylon conductors.
- Increased access to retained forest facilitated by new access roads.
- Increased disturbance during maintenance.

### **Protected Areas**

476. During operation of the Project, no impacts are expected on the PNP to the south and the Bumthang Wetlands to the north; there are no clear ecological or hydrological pathways linking the Project to these areas. No substantial or adverse impacts from maintenance activities are expected, therefore no significant operational impacts are likely. Impacts to birds that might use these areas are addressed below.

477. Since the north of the Project alignment is within a small section of the MUZ of the WCNP, there is the possibility that increased potential access for the local community, facilitated by the RoW of the TL and access roads. Improved access may result in increases in logging, hunting, poaching, gathering of firewood etc, which have the potential to degrade forests within the NP. However, given the location of the Project within the MUZ of the NP is devoid of trees and already subject to significant anthropogenic activity, it is very unlikely that the small RoW (370m) of the Project would exacerbate this situation. As such, any impact would be negligible and not significant. Therefore, there are no expected adverse impacts on Protected Areas during the operational phase of the Project.

### **Habitats**

478. The improved and maintained operational access roads will enable people to access areas of forest that previously they may not have been able to get to. Access could lead to an increase in

the extraction of timber, firewood and NTFP, and potentially hunting and poaching. Encroachment may also enable the unauthorized expansion of agricultural land, settlement, or other human activities. Both unsustainable timber extraction and land use change could also increase the likelihood of forest fires. The Project alignment is close to settlements and roads, however, so while the impacts are likely the magnitude is considered low to moderate.

479. Operational maintenance of the pylons and access roads and associated disturbances are anticipated to be annual and therefore infrequent. All associated effects will be short lived and only affect habitats in the immediate vicinity. Any impact will therefore be of very low magnitude. There will be no ongoing loss of land or habitat conversion after the construction phase, which includes all forest restoration.

480. The only residual, measurable habitat impacts, including upon Natural Habitat, relate to improved access during operation. A long-term Habitat Maintenance Plan shall therefore be developed and adopted by BPC for the operational phase. The Plan shall provide clear, practical guidance to maintenance teams on where vegetation clearance is required and how it is to be undertaken. Its objectives shall be to ensure infrastructure safety (including maintaining a minimum 7 m clearance to overhead lines), minimise disturbance to wildlife through appropriate timing of works, and retain vegetation at managed heights for as long as practicable to discourage vehicle access along project access roads (inclusive of continued consultation with the Gewog Administration and relevant authorities to restrict access, and the creation of barriers, bunds and signage). If successfully implemented in perpetuity and in acknowledgement of the BMP and BAP actions, including local community engagement and five-year monitoring, no adverse impacts are expected and NNL will be maintained.

### **Trees and Plants**

481. Operational impacts and associated effects on the vulnerable and irreplaceable tree species within the Project area are anticipated to be the same as those relating to Habitats, described above. No additional mitigation is required, and consequently no residual impacts on notable trees and plants are expected.

### **Mammals**

482. Operational impacts and associated effects primarily relate to the increased likelihood of illegal hunting and poaching enabled by improved access. The magnitude of the impact is considered low, given the remote nature of the Project, small population present in the surrounding landscape and the proximity to existing settlements and roads.

483. Mammals may also experience a low risk of roadkill where access roads remain in use, although traffic levels during operation will be very limited, infrequent and all vehicles will be travelling at low speeds. It is considered therefore very unlikely that any of the PBFs would be directly affected during operation and all impacts are likely to be negligible

484. Therefore, all predicted potential impacts will be temporary and localised and of low magnitude. No significant operational impacts on mammals are expected and no mitigation is required.

## **Avifauna (Birds)**

485. The project area is known to support large bird species that are at risk from collision with the overhead TLs. Species recorded include the Himalayan griffon and Mountain Hawk Eagle, and the Black-necked crane is present in the wider area given the proximity of the Project to the Bumthang Wetlands for which the protected area was designated. The risk of bird collision is a new risk, that was not present during construction and only relevant to the operational phase. Some faster large species have poor maneuverability, such as the Himalayan griffon and are particularly susceptible to collision with the TLs. Cranes are also particularly susceptible to collision as they too have poor maneuverability, often fly at low altitudes and their field of vision is also partly constrained by their head and neck posture making the thin, static wires difficult to see.

486. Global scientific evidence shows that overhead power lines pose a significant and well-documented collision risk to large birds, particularly slow-flying species. Studies worldwide report that power lines can account for up to 40–60% of recorded mortality in some crane, bustard, and stork populations. However, the extent of the collision risk posed by the Project and the existing power lines in the area is unknown at this stage. Surveys to date (as reported in the ESIA Appendices) have been limited in duration; further bird surveys are planned for the summer season to better determine the species presence, their abundance, the frequency of the movement and their behaviors (see mitigation below and the commitments set out in the BMP). Such knowledge is needed before any accurate collision risk can be estimated.

487. However, in accordance with the precautionary approach, any mortality to a Vulnerable, rare or slow reproductive species may cause population-level impacts and thus the magnitude of mortality would be high. Because such birds are highly mobile, a collision mortality might directly affect an established roost or nest site 50 km away or further, thus potential impacts are regional in extent. Collision risk will persist for the many-decade life of the TL, meaning impacts will be long-term in duration. As such, bird collision impacts from the TL, if unmitigated, could be highly significant.

488. It is also noted that larger bird species are also very susceptible to electrocution if their wings bridge the live components of the distribution lines. However, electrocution risks on the TL will be minimal due to the large engineering clearances needed for such construction (i.e. the live electrical components on the infrastructure are further apart than any bird's wind span can bridge). Therefore, bird electrocution should not be caused by the TL.

489. **Avifauna (Birds) Mitigation:** In line with ESS6 guidance, in the absence of definitive data with respect to the potential impact collisions with electrical infrastructure on birds, a precautionary approach is adopted. As such, to mitigate the theoretical impact from bird collisions, the following measures will be adopted:

- Improve the visibility of the TLs for birds<sup>25</sup>. Studies demonstrate that line marking leads to meaningful reductions in avian collision mortality. Reducing collision risk for eagles, vultures and other species to the extent practicable is essential to theoretically achieve NNL. Therefore, the Project commits to installing professional grade bird diverters every 10 m for the entire length of the Project. The Bird diverters must be purchased from Powerline Sentry (or a similar reputable company, as cheaper imitations that are available are ineffective and can cause increase risks to the safety of the infrastructure).(See Figure V-4) Markers shall

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<sup>25</sup> Beaulaurier, D. L. (1981) Mitigation of bird collisions with TLs. Bonneville Power Admin., U.S. Department of Energy, Portland, OR. 82 pp

be appropriately sized by wire diameter for retention. Markers shall be high contrast, with substantial light- and dark-colored areas, have reflective and phosphorescent components. Full details of these measures will be set out within the BMP.

**Figure V-4: An example of the bird diverters that will be installed every 10 m for the length of the Project (picture courtesy of Powerline Sentry)**



- Insulate all energized or electrically exposed parts of the pylon tower infrastructure, including its connection with the substation and solar farm. Insulation will reduce the risk of electrocuting birds. Insulators may include arcing horns or surge arrestors to safeguard against insulator damage during lightning strikes.
- Vantage Point bird survey will continue before construction, during construction and for at least two years after construction. These surveys will comprise at least one survey per month at pre-selected locations using the same monthly vantage point methodology reported in the ESIA Appendices. Data from these additional surveys will be used to refine the potential collision risk, e.g. increasing the frequency of the diverters to every 5 m in higher risk areas and reducing the frequency to every 20 m in lower risk areas. The surveys will inform where the greatest risks are.

490. **Residual Impact on Avifauna (Birds):** The proposed mitigation measures will substantially reduce avoidable and unnecessary impacts on large bird species. The use of bird diverters is known to reduce collision risk with electrical infrastructure<sup>26</sup> but cannot reduce it completely. Given the vulnerability of some of the species present, the loss of one breeding adult, even with a low likelihood, could still adversely affect the regional population and therefore result in a net loss. Despite the application of the mitigation hierarchy and the implementation of robust mitigation measures therefore, there is a residual risk to birds from collision with the Project infrastructure that cannot, at this stage, be fully compensated through on-site mitigation alone. As a result, achievement of>NNL cannot be demonstrated through mitigation measures only.

491. Consequently, a small residual adverse impact remains, comprising the residual risk of bird collision. Although the likelihood may be low and the impact potentially negligible, this residual loss

<sup>26</sup> <https://www.conservationevidence.com/actions/265> and references therein

requires additional conservation actions to achieve the NNL objectives required under ADB ESF ESS6. Additional conservation actions will therefore be developed and implemented through the BAP (see Appendix E). The BAP actions will be designed to offset the impact of any residual bird fatalities and will be informed by the final survey data, once complete. Actions may comprise, the increased surveying of particular species in collaboration with the Royal Society for the Protection of Nature, the provision of resources to the Bumthang Wetlands to help protect their Black-necked crane population or the retrospective insulation of existing un-insulated distribution lines in the area along. Uninsulated distribution lines pose a higher risk to large birds because their wide wingspans readily bridge conductors or conductors and grounded structures, causing electrocution during perching or take-off. This risk is often greater than collision risk, particularly in open landscapes where distribution poles are used for roosting. Retrospective insulation of distribution lines can therefore substantially reduce overall bird mortality, offsetting residual collision risk from nearby TLs by removing a more frequent and lethal source of mortality within the same landscape.

492. With successful implementation of the BAP, these additional actions will deliver measurable biodiversity gains that outweigh the small residual risk associated with the Project. Over time, they will compensate for the existing loss. On this basis, the residual impacts are expected to be fully addressed, and the Project will achieve NNL of biodiversity through the combined application of mitigation and targeted conservation actions.

### **Invasive species**

493. The risk of invasive species spread and propagation during operation is low but not absent. Routine maintenance of roads, the clearance of vegetation along the TL alignment and the management of forest reforestation sites could create areas of bare ground suitable for faster growing and early colonizing invasive plants, or disturb and encourage the spread of invasives that maybe present. The movement of maintenance vehicles is also a pathway to importing or moving invasive species, albeit a very minor risk.

494. These risks will remain limited in scale and extent and will be effectively contained through the measures set out in the BMP (Chapter D) and the Project specific, operationally relevant Habitat Maintenance Plan. With such a plan, the likelihood invasive species establishment or spread during operation is very low and no significant impacts are expected. With no measurable impacts during operation expected, no specific mitigation is required, and consequently no residual impacts are expected.

### **Ecosystem services**

495. During operation, impacts on ecosystem services will be limited and negligible. Long-term maintenance activities will be largely confined to periodic vegetation management along access roads and within the right-of-way to maintain safety clearances. The spatial extent of these areas is very small relative to the surrounding, extensive forest landscape. While the alignment may marginally increase local access, this is not expected to materially alter provisioning, regulating, or cultural ecosystem services. Overall, any positive or negative changes to ecosystem services during operation will be minor, localized, and insignificant at the landscape scale.

496. **Ecosystem Services Mitigation:** No additional ecosystem service-specific mitigation is required, as the proposed biodiversity and forest mitigation measures are sufficient to address potential losses or degradation of ecosystem services. Collectively, these measures will maintain, replace, and where necessary compensate for key provisioning and regulating services relied upon

by local communities. For example, forest restoration and offset planting will continue to support slope stabilization, erosion control, soil retention, and the local availability of fuelwood and fodder.

497. **Residual impact on Ecosystem Services:** These measures are being developed with explicit reference to community needs and the ecosystem functions most at risk, ensuring that the restored or replacement services remain accessible, practical and culturally appropriate into the operational phase of the Project. Under this integrated approach, the project's will have no residual impacts on ecosystem services are expected.

## **G. Anticipated Impacts and Mitigation During Decommissioning Phase**

### **Waste Generation**

498. **Impact.** Decommissioning activities will generate various types of waste from recyclable waste, which includes steel components (towers and fittings), aluminum conductors, steel cores, copper earthing materials, and various types of insulators (glass, porcelain, or composite); Non-hazardous Waste, such as concrete debris from tower foundations, excavated soil, packaging materials, and domestic waste; and potentially hazardous waste, such as lubricants, grease, oil-contaminated rags, and small amounts of contaminated soil, if present. Proper management of these dismantled materials is crucial, as inadequate segregation, storage, transport, or disposal poses significant risks such as soil contamination, adverse visual impacts and safety hazards for the community.

499. **Mitigation.** The contractor responsible for decommissioning activities must adhere to specific environmental waste management protocols, focusing on both minimization/recovery and proper handling/disposal. For waste minimization, the 3Rs principle (Reduce, Reuse, Recycle) must be applied to minimize overall waste generation and maximize the recovery of valuable recyclable materials like steel, aluminum, and copper. All waste from dismantling of facilities will be segregated into biodegradable and non-biodegradable. All recyclable items will be removed and sold to the licensed scrap dealers. Open burning, uncontrolled dumping, or burial of waste in forest areas, or near water bodies is strictly prohibited.

### **Completion of Decommissioning Works and Site Restoration**

500. **Impact.** There is a risk that worker camps, material storage areas, temporary access routes, and the right-of-way (RoW) may not be adequately restored following the removal of TL equipment and associated infrastructure. Inadequate restoration may result in soil erosion, visual scarring, restricted land usability, and delayed natural regeneration of vegetation.

501. **Mitigation.** Upon completion of decommissioning works, all labor camps, site offices, storage yards, and ancillary facilities will be fully dismantled and removed from the site. Disturbed areas will be restored using appropriate bio-engineering and native vegetation planting to promote natural regeneration and slope stabilization. Temporary access tracks will be rehabilitated unless otherwise agreed with landowners or relevant authorities. The restored areas will be protected from further disturbance to allow vegetation to establish.

## **Natural Hazards and Disasters**

502. **Impact.** Emergency situations such as fire, extreme weather events, or seismic activity may also pose safety risks, particularly in remote and steep terrain. A major risk is electric shock or electrocution if the TL remains partially energized or connected to the power grid during the phased dismantling. Other potential hazards include injuries from slips, trips, manual handling, falling objects, and traffic accidents. Furthermore, safety risks are heightened by emergency scenarios such as extreme weather, seismic events, or fire, especially given the remote and difficult terrain.

503. **Mitigation.** Similar to requirements set out in the earlier construction and operation sections, workers will be required to follow standard procedures during decommissioning, provided with PPE and appropriate safety briefings. Contractors shall use only qualified and certified personnel for decommissioning works.

## VI. ANALYSIS OF ALTERNATIVES

### A. Background and Objective

504. The Constitution of Bhutan requires the Government to secure ecologically balanced sustainable development, while promoting justifiable economic and social development, and ensure a safe and healthy environment. This has been the basis for Bhutan's development philosophy and the 'middle path' strategy. As such, the four pillars of GNH (good governance, sustainable socio-economic development, cultural preservation, and environmental conservation) form the foundation for Bhutan's balanced development strategies. Such considerations have been applied to for the 132 kV Wobthang-Garpang TL.

505. ADB's SPS (2009) requires "an analysis of project alternatives for all category A projects to determine the best method of achieving project objectives while minimizing environmental and social impacts providing the main opportunity to avoid and, if avoidance is not possible, minimize adverse environmental impacts and risks." This analysis is an important element of the environmental assessment process as it brings environmental and social considerations into early decision making. Assessing alternatives to achieve design optimization requires balancing economic, technical, environmental, and social factors, trading off the relative merits and disadvantages of each factor to arrive at the optimum outcome. For this reason, the consideration of alternatives was conducted in collaboration with the project design/engineering team from BPC to identify and analyze feasible alternatives.

### B. Comparison of the 'No Project' with 'With Project' Alternative

506. The criteria for this analysis include national policy goals and energy security and diversification, grid reliability, environmental, social and economic impacts.

507. **No- Project Scenario.** Under the "No-Project" scenario, the Government's ability to meet Bhutan's national renewable energy targets and sustainable development goals will be further diminished. The 120 MW Wobthang Solar Project, a flagship renewable energy initiative for Bhutan, would be *unable* to evacuate power to the national grid. While the "No-Project" option avoids localized environmental and social (discussed in Chapter V), it results in a significant loss of producing clean energy capacity and diversifying the energy mix of the country that is heavily reliant on hydro power and imported energy. Economically, the Government will miss out on the opportunity to minimize expenditure on imported electricity during the 'lean season'.

508. The local community in Tang Gewog would miss out upon opportunities for direct employment and the broader economic benefits associated with infrastructure development and enhanced energy security.

509. **With Project Scenario.** The government will gain an estimated 120 MW of clean energy capacity, potentially reducing reliance on expensive, volatile, carbon-intensive energy imports during. During construction the Project will support temporary direct employment opportunities in local communities in Tang and Choekhor Gewog's and potentially benefit from broader economic benefits associated with infrastructure development and, in the future, enhanced energy security. Community Forest Group members will be compensated for the loss of trees in community forest land, which is financially beneficial to some as some parts of the community forest are otherwise inaccessible.

510. Under this scenario, BPC will evacuate power from the 120 MW Wobthang Solar Project to the national grid. An assessment for site selection at Wobthang Solar Project has already been conducted<sup>27</sup> Environmental impacts are discussed in Chapter V, but in summary impacts to the WCNP, state forests, removal of vegetative cover will impact natural habitat and biodiversity. Without robust, well planned, clearly budgeted compensation management plans the residual impacts to natural habitat are considered adverse and high.

511. The "With Project" scenario is preferred as it aligns well with the strategic and economic ambitions of Bhutan. The project aims to strengthen the reliability of supplying clean power in the central-eastern region and reinforces east-west electricity supplies; enhances the socio-economic transformation of Bhutan; and fulfills BPC's mandate. At the local level, the project will provide an opportunity for income generation/employment for the local community. Although some physical impacts on air, water and soil may occur these are considered temporary. Private land acquisition is also minimal, involving only four households and impacting only 0.09ha. Impacts to natural habitat and biodiversity, including avian species, must be planned, funded, and agreed upon.

### C. TL Route Alternatives

512. The analysis utilized a structured Multi-Criteria Analysis (MCA) framework wherein four primary dimensions/criteria were weighted equally at 25% each. The basis for the selection of the four criteria reflects Bhutan's emphasis on balanced, holistic, and sustainable decision-making rather than prioritizing short-term economic gains over social and environmental integrity. This criterion has been previously used by BPC for the alternative assessment of the JICA funded Jomori Project (BPC, 2024<sup>28</sup>). The Evaluation Indicators are detailed in Table VI-1: Criteria and Indicators with weightage.

**Table VI-1: Criteria and Indicators with weightage**

Criteria	Evaluation Indicator	Weightage
Natural Environment (25 points)	1.1 Passing through Critical habitat, Protected Areas, International Bird Areas, Key Biodiversity Areas, Ramsar Sites, Protected wetlands	10
	1.2. Area of forest cut in natural habitat	5
	1.3. Forest area lost	5
	1.4. Impact on water sources	5
Social Environment (25 points)	2.1. Area of private land impacted	10
	1.3. Area of Community Forest impacted	10
	1.3. Cultural Sites impacted	5
Economic Efficiency (25 points)	Construction Cost for TL & Access Roads	25
Design Efficiency (25 points)	Length of TL	10
	Number of Towers	5
	Length of Access Road	5
	Ease of Construction (access roads, topography)	5

<sup>27</sup> <https://www.adb.org/projects/documents/bhu-58265-001-iee>

<sup>28</sup> BPC, 2024. Environmental and Social Impact Assessment Report. 132kV Jomori-Phuntshothang TL Project (2024).

## Basis of Selection of Criteria and Indicators

513. **Environment (25%).** When constructing power TLs, possible impacts on the natural environment include passage through protected areas, tree cutting, degrading the landscape, impacting wild animals and plants, and impacting water sources. Any impact on a protected area or community forest will result in a permanent loss of the area under PA and community forest for the future. Also, the forest serves as protective catchments for water sources. Excavation work and removal of protective forest cover have a direct and often severe impact on water sources.

514. **Social Environment (25%).** Within the project area, there are scattered settlements. Following the mitigation hierarchy, BPC prioritizes the avoidance of private land and impacts on cultural/religious heritage sites over impacts on government owned land. Because of the mountainous terrain, arable land is limited – covering less than 3% of the total land area in the country (NLCS, 2020). Agricultural production is the sole source of livelihood for rural people who have limited employment opportunities, especially in remote areas. Therefore, any loss or fragmentation of agricultural land directly affects household food security, income, and social well-being. The encroachment of high-voltage TLs on private land based on long-standing concerns was also recently debated in the National Assembly of Bhutan (Winter Session 2025). Recent parliamentary reports identified over 9,300 private plots nationwide as being restricted by transmission corridors, a situation that has led to significant loss of land value and restricted development for Bhutanese families. A critical point of contention in the 2025 National Assembly sessions was the 1,049 transmission towers currently standing on private land, many of which lack historical compensation and prevent any form of construction.

- **Private land.** Any impact on private land means that land must be either substituted from government land or compensated for. This is a multi-stage process that requires both time and human resources as it involves identification and registration of substitute land, cadastral verification, valuation, and inter-agency approvals. This process involves both time and staffing. Thus, it is desirable to avoid this as much as possible.
- **Community Forest.** Rural communities have legally recognized user rights over community forest resources for households and income needs.
- **Preservation of cultural heritage.** Bhutan's development philosophy of Gross National Happiness (GNH) places strong emphasis on preservation of cultural heritage as a pillar of sustainable development, recognizing spiritual well-being and cultural integrity as equal to economic growth. Considering this, the national environmental assessment process requires that projects must identify, assess, and manage impacts on cultural, religious, and heritage resources as part of the environmental clearance process. Therefore, the social criterion includes three indicators- private land, cultural sites and community forest.

515. **Economic efficiency (25%)** is evaluated based on the construction cost of the entire

516. project, which includes the construction of TLs, towers, access roads, and substation. It also captures regulatory compliance, and compensation-related expenditures, which directly affect project affordability, budget sustainability, and long-term financial performance

517. **Design Efficiency (25%)** evaluates the technical feasibility and long-term operational resilience of each alignment. In the context of the high-altitude terrain of the Tang Gewog and the Wobthang project site, this assessment is governed by several critical engineering restrictions and environmental stressors. The selection of the most feasible alignment is influenced by the following engineering constraints:

- **Elevation and Dielectric Strength:** The project area reaches elevations where atmospheric pressure and air density are significantly lower than at sea level. This reduction in air density decreases the insulating strength of the air, requiring increased phase-to-phase and phase-to-ground strike distances. Alternative 5 was optimized to ensure these increased clearance requirements are met without necessitating excessively tall or heavy tower structures that would be difficult to transport and erect in steep terrain.
- **Climatic Loading and Freezing Conditions:** The alignment is subject to extreme winter conditions, including heavy snowfall and atmospheric icing (rime and glaze ice).
- **Ice Loading:** Accumulated ice increases the mechanical load on conductors and towers, leading to potential structural failure or "galloping" (low-frequency, high-amplitude oscillations).
- **Power Outages:** To minimize the risk of outages due to ice-related flashovers or conductor clashing, the design prioritizes route sections with better sun exposure (to facilitate natural de-icing) and avoids narrow, wind-swept ridges where ice accretion is most severe.
- **Span Distances and Topographic Constraints:** Due to the rugged topography and the need to avoid "Kamzhing" (private dry land) and communal water sources, the design requires varying span lengths.
- **Infeasibility of Underground Cabling:** While undergrounding is often suggested for visual or social reasons, it was ruled out for this 132 kV line due to:
  - **Terrain & Geological Risk:** The steep, rocky and mountainous slopes with deep valleys and gorges make trenching technically unfeasible and would significantly increase the risk of triggered landslides and soil erosion.
  - **Thermal Management:** High-altitude soils in this region have poor thermal conductivity, making heat dissipation for buried cables inefficient.
  - **Cost:** The capital expenditure for undergrounding in this terrain is relatively higher than overhead lines, which would compromise the economic viability of the solar project.

#### D. Description of Project Alternatives

518. Five potential routes were assessed, with **Alternative 1** serving as the baseline and subsequent alternatives representing deviations to avoid specific obstacles or optimize the path.

Figure VI-1: Alternatives for the TL

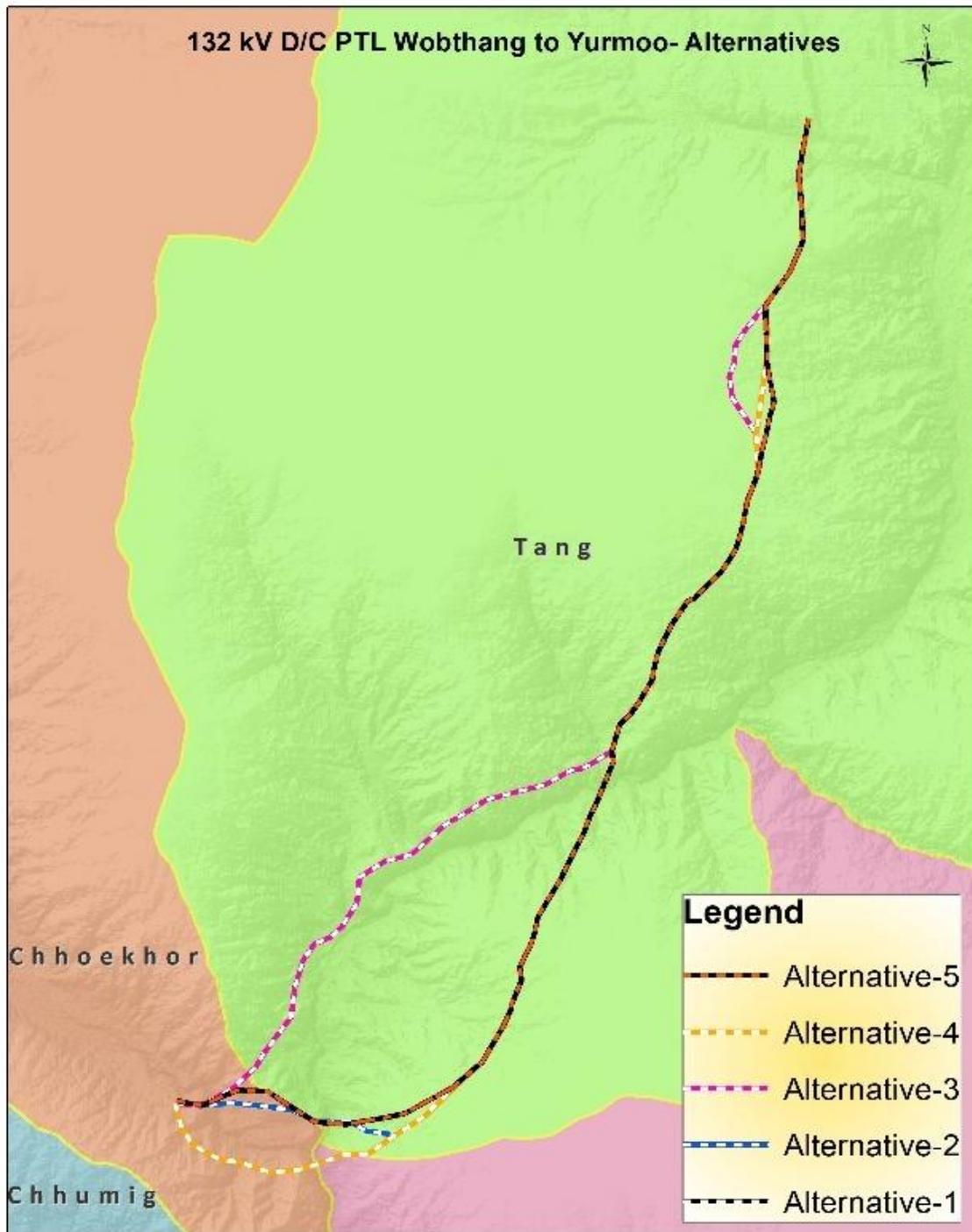
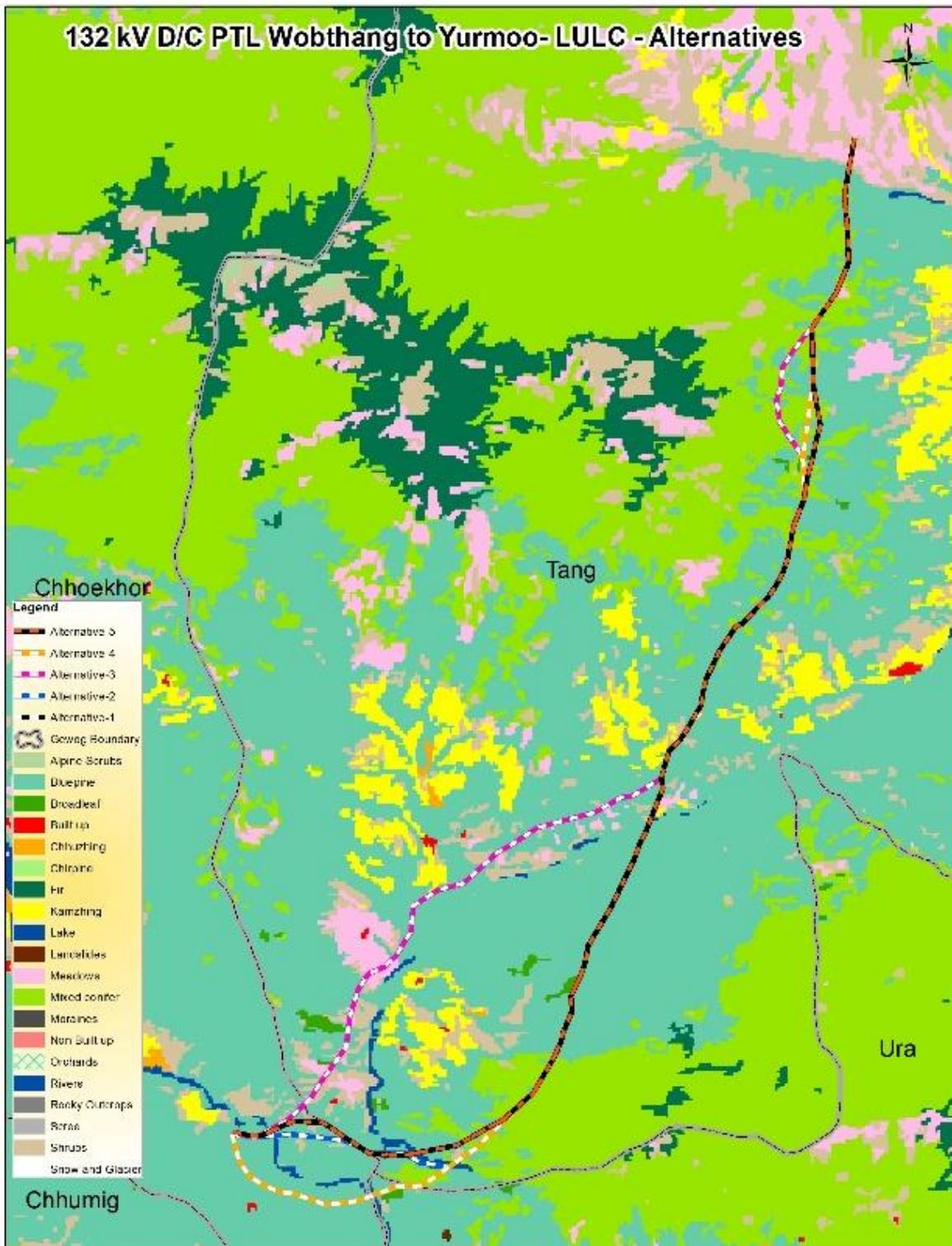


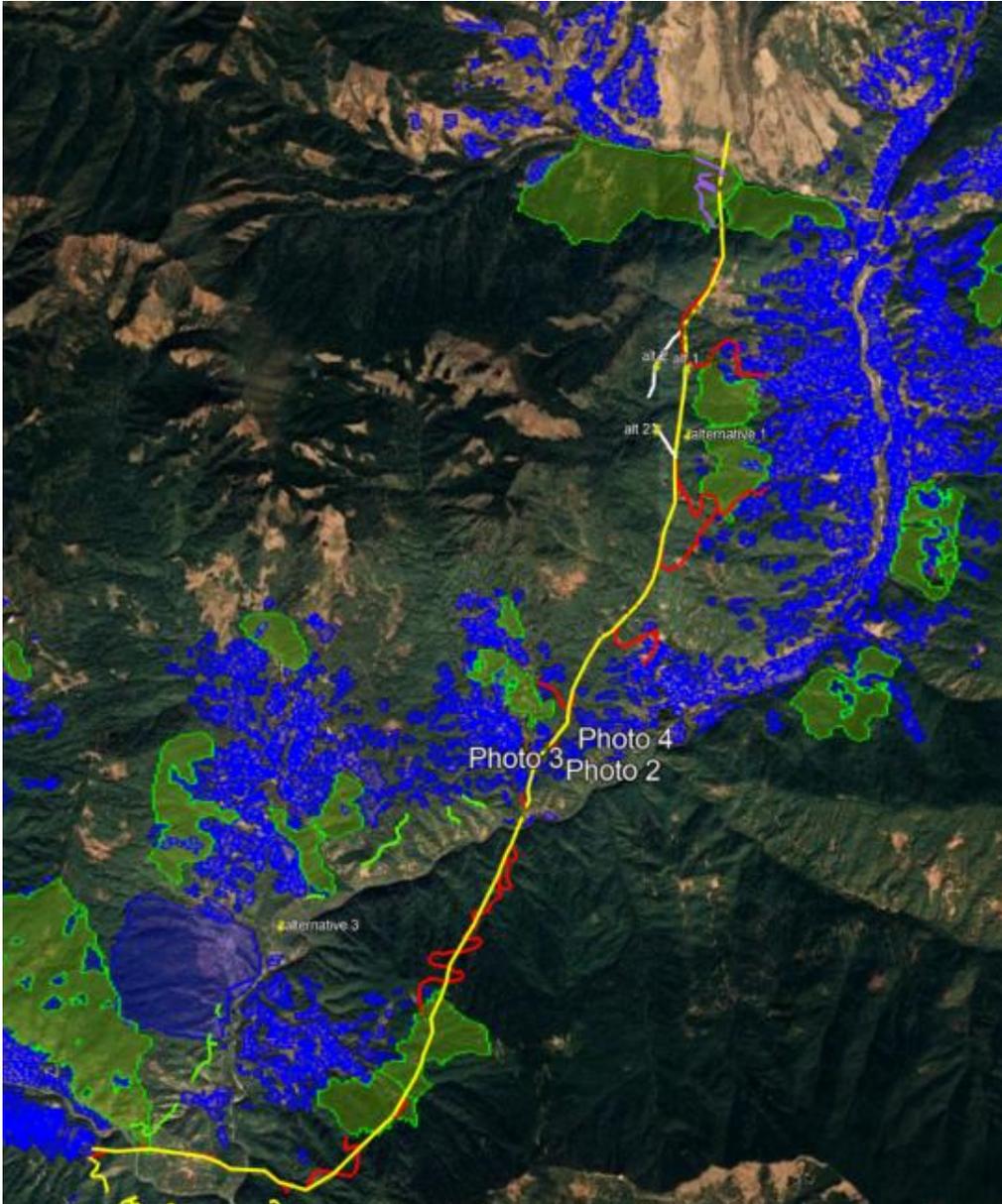
Figure VI-2: Land Use Map along each Alternative



519. All TLs begin at the Wobthang Solar Farm (Tower 1) in Tang Gewog and terminate at the Garpang substation.

520. **Alternative 1.** Spanning 17.375 km with 45 towers and 17 access roads, the project alignment requires the installation of one transmission tower (AP-1) and the construction of the initial 370 meters of the TL within the WCNP boundary. The Right-of-Way (RoW) required within the park amounts to approximately 2.11 hectares, representing less than 0.0004% of the total park area and less than 0.009% of the total Multiple Use Zone.

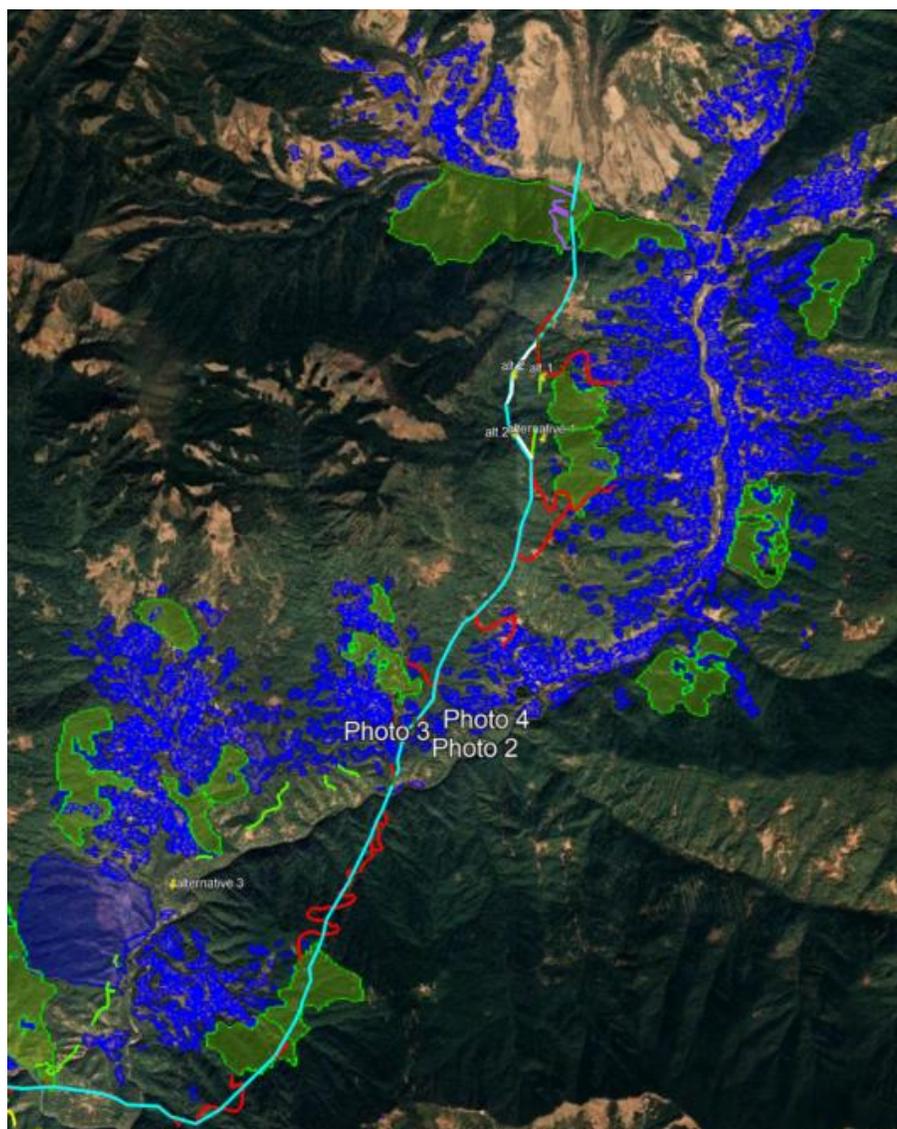
**Figure VI-3: Alternative 1 route**



521. **Forest clearance.** land use the alignment will impact 87ha of forest, including 1.86ha of broadleaf forest. The project will impact 13.6ha of land in 3 community forest (Garabbling, Phomrong1 and 2) and three water resources/tanks. In terms of social impacts, this alignment will impact 8 private land holdings totaling 0.5ha. No cultural sites will be impacted. The cost of construction is approximately Nu. 418 million.

522. **Alternative 2.** Spanning 17.5455 km with 57 towers and 17 access roads, this route follows Alignment 1 (Baseline alignment) but includes a specific deviation near the start; it diverges after Tower 4, adds three towers (5, 6, and 7) and reconnects to the baseline alignment at Tower 8. the impact on WCNP is the same as Alignment 1, with one transmission tower (AP-1) and the construction of the initial 370 meters of the TL within the WCNP boundary.

**Figure VI-4: Alternative 2 route**



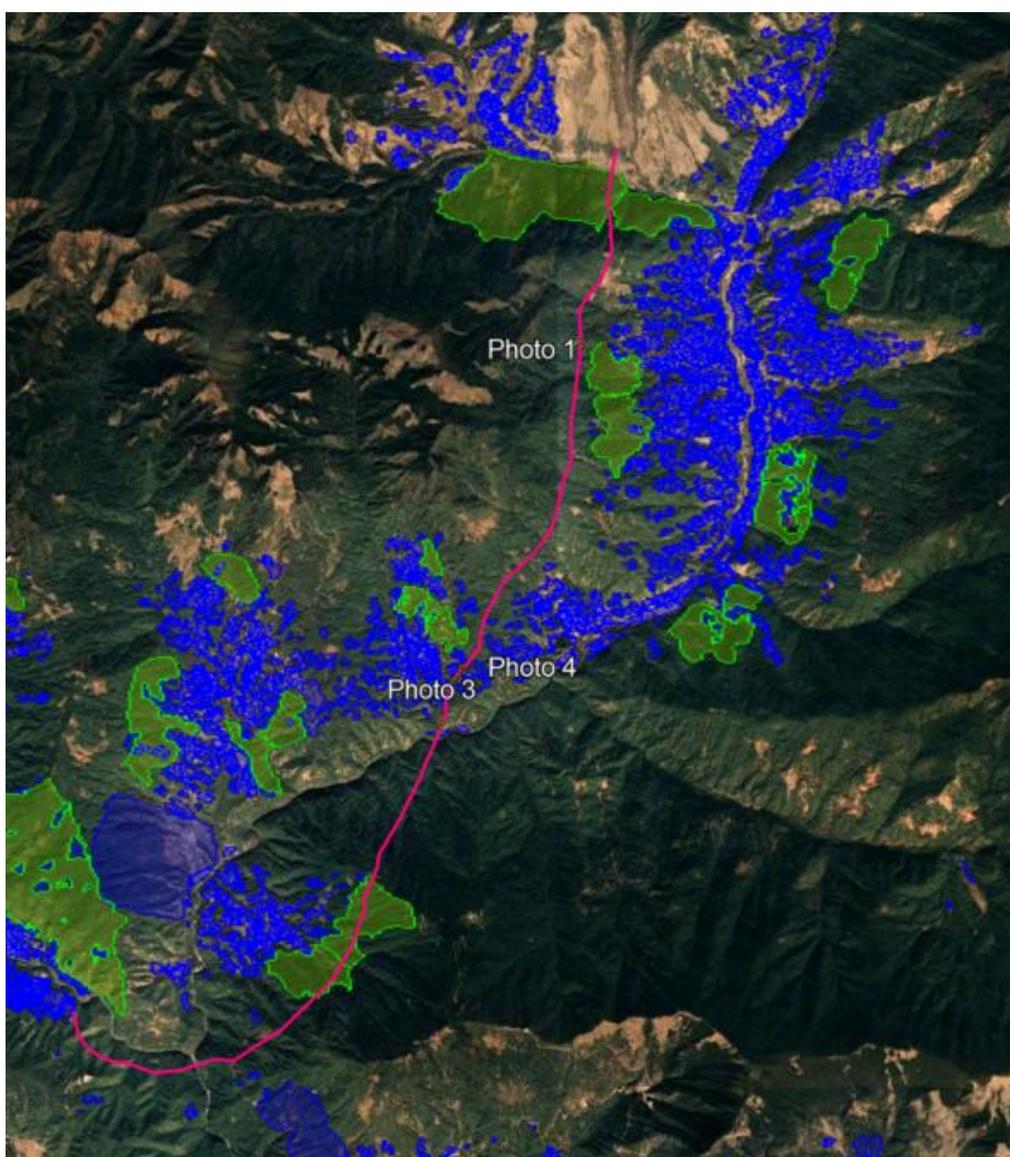
523. In terms of land use the alignment will impact 48ha of forest, including 1.86ha of broadleaf forest. The project will impact 13.6ha of land in 3 community forest (Garabbling, Phomrong1 and 2). Unlike Alignment 1, it will only impact one water resources/tanks. The alignment will impact the

same 8 private plots as Alternative 1, totaling 0.52 ha of land. Despite being similar in length (**17.545 km**) to Alternative 1, the design necessitates **57 towers** and incurs the second-highest construction cost.

524. **Alternative 3.** Designed for cost and distance optimization, this route follows the baseline until Tower 22 before taking a different alignment until Tower 38. It is the shortest route at **16.595 km** with the fewest towers (**50**) and the lowest construction cost (399 million Nu). In terms of land use, the alignment will impact 49ha of forest, including 1.3ha of broadleaf forest.

525. Impacts on Community Forest. The project will impact 4.9ha of land in 3 community forest (Garablung, Bepzur\_Phalinglep and Gyal-Lyon-Khar). Impacts on private land are estimated at almost 7.7ha belonging to 13 private plots.

**Figure VI-5: Alternative 3 route**

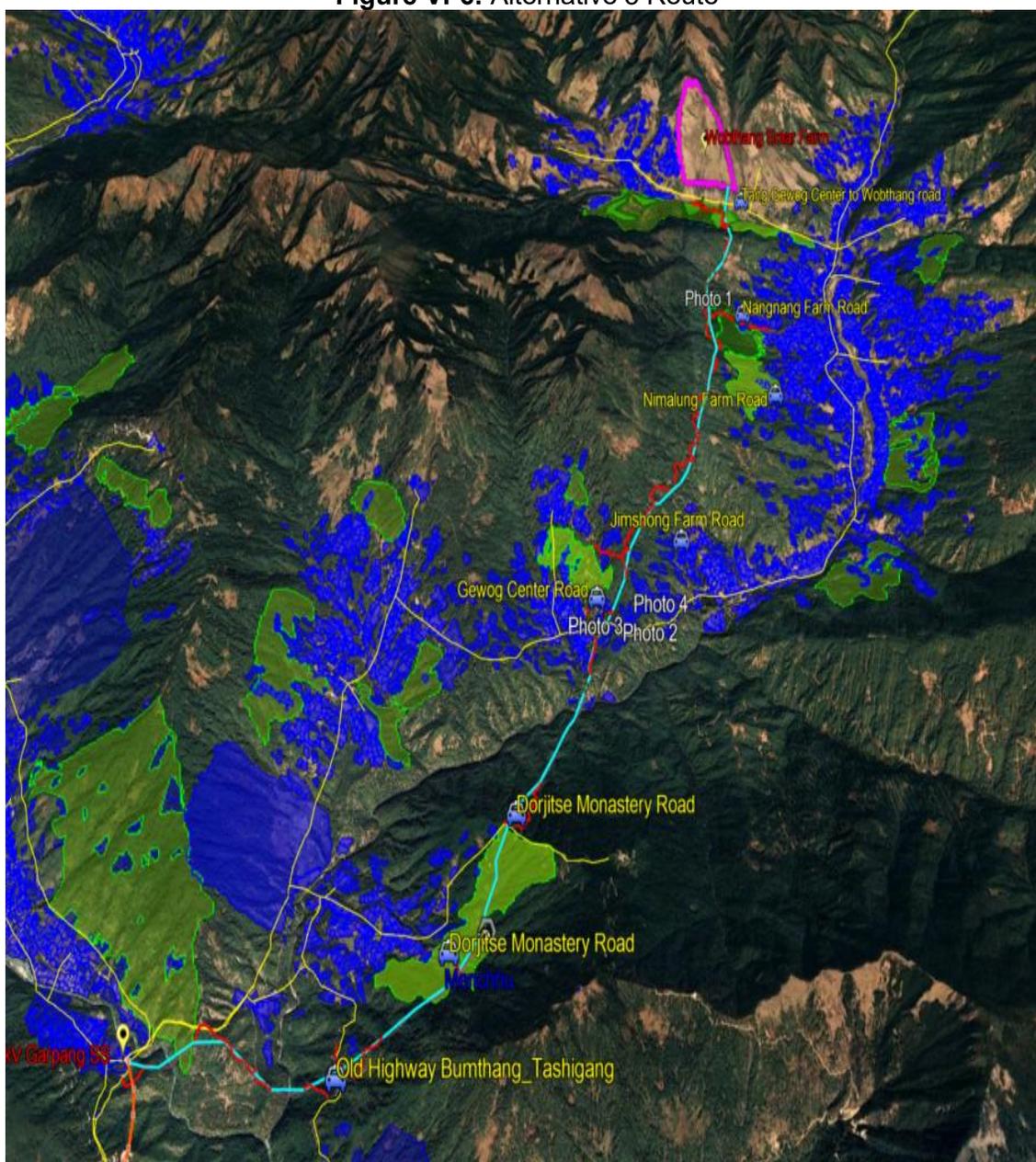


526. **Alternative 4.** This route follows Alignment 1 for much of the path until Tower 37, where it diverges the final segment up to Tower 46. It is the longest alternative at **17.869 km**

527. The alignment will impact 52.1 ha of forest, including 2.7ha of broadleaf forest. This includes 13.6ha of land in 3 community forest (Garablung, Phomrong1 and 2). In terms of impacts on private land, the alignment will impact almost 0.65ha belonging to 8 private plots

528. **Alternative 5.** This alignment follows the baseline until Tower 7 before diverging significantly to optimize the path through the Nangnang Community Forest. Spanning **17.33 km** with **57 towers**.

**Figure VI-6: Alternative 5 Route**



## Summary of Alternative Assessment

529. **Environmental Impacts.** All alignments will have the same impact on WCNP. The number of trees that will be cut is proportional to the length of the TL and number of access roads. Alternative 5 is the shortest in length and has the least number of access roads. Also, this alignment has avoided natural forest after AP 50, by crossing over the Tang river towards the highway, where the forest is degraded. With respect to community forest's, alternative 4 impacts only two community forest areas, while all other alternatives impact three community forests. No water sources will be impacted by Alternative 5. In contrast, all other alternatives impact one or more water source

530. **Social Impacts.** Under Alternative 5, impacts on private land are significantly lower (2 private plots under the Transmission RoW and 4 under Road construction) while all other alternatives will impact 5 or more under the Transmission RoW and 7 or more due to road construction. No cultural sites are impacted by any alternative option.

531. **Economics:** Alternative 3 is the cheapest option (approx. Nu.399 million), followed by Alternative 5 (approx. Nu. 417 million), Alternative 1 (Nu. 418 million), Alternative 3 (Nu. 422million). The most expensive alternative is Alternative 4.

532. **Design Feasibility.** Length of the TL. The shortest is option is five followed by option one, whilst option three 3 has the least number of towers

**Table VI-2: Summary of Alternatives Options Design Criteria**

#	Description	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
1	Total Line Length (meters)	17,375	17,545	16,595	17,869	17330
2	No. of Towers	55	57	50	56	57
3	Total Private Plots Affected	5	5	10	5	2
3.1	Tower Located on private land	0	0	5	0	0
3.2	TL Right of Way passing through private land	5	5	5	5	2
4	No. of Community Forests affected	3	3	3	2	3
5	No. of Water Resources affected	3	1	2	3	0
6	No. of Cultural Sites affected	0	0	0	0	0
7	Access Roads					
7.1	No. of access roads	17	17	17	14	11
7.2	Total Length of access roads (km)	21.3	20.6	18.2	17.5	19.4
7.3	No. of private plots affected	7	7	11	7	4
7.4	No. of community forests affected	3	3	3	2	3
8	Protected Areas					
8.1	No. of National Parks affected	1	1	1	1	1
8.2	No. of Biological Corridors affected	0	0	0	0	0
	Total Project Cost (Nu.)	418.3	422.3	399.5	430.1	417.2

## Results of the Alternatives Analysis

533. The analysis concluded that **Alternative 5** was the most suitable option. Alternative 5 represents the optimal approach indicating that it is technically efficient, economically sound and offers the highest level of protection to the communities and ecosystems of the Tang and Choekhor Gewog. The benefits of selecting Alternative 5 are as follows

534. **Minimizing Habitat Loss.** Despite all routes passing through a section of WCNP Option 5 minimizes impacts upon total area of forest clearing is minimized, thereby reducing the project's overall ecological footprint.

535. **Avoidance of water source.** While all other routes impacted between 1 and 3 water sources, Alternative 5 is the only alignment that completely avoids all recorded water resources (tanks and catchments), thus protecting local drinking water supplies.

536. **Impacts on Private land.** Alternative 5 ensures zero (0) tower locations fall on private plots and minimal impacts on private land along the TL and access roads. This specifically addresses long-standing concerns regarding the encroachment of high-voltage TLs on private land by avoiding encroachment on private land. The option eliminates disputes regarding physical displacement and maintains the full market value and buildability of local landholdings; a priority concern raised in the Parliament in 2025 <sup>29</sup>.

537. **Minimizing Indirect Social Impacts from Access Roads.** Alternative 5 also minimizes secondary social impacts, requiring only 4 private plots for access road development. This reduction minimizes the disruption to agricultural activities and prevents the fragmentation of "Kamzhing" (dry land) and "Chhuzhing" (wetland) plots, which were identified in parliament as the most vulnerable categories for rural farmers.

538. **Alignment with the 2026 Lease-Easement Model-** The Ministry of Energy and Natural Resources (MoENR) recently announced a transition to a 30-year annual lease-based easement model starting in 2026 to compensate for RoW restrictions <sup>30</sup>. By selecting the route with the least private land footprint, Alternative 5 reduces the project's long-term administrative and financial burden on BPC and the government. It minimizes the number of households forced into the complex and often financially overwhelming compensation schemes, thereby preserving the social fabric and land tenure security of the Tang Gewog.

539. **Costing.** While Alternative 3 was the least expensive, its social cost (affecting 11 private plots for the TL and roads) was deemed unacceptable. Alternative 5 provides the second-lowest project cost, while delivering better social and environmental outcomes

540. **Ease of construction.** The reduced length of both TL and access roads allowed the project timeline to be further reduced from the initially planned 18 months to 14 months, thereby resulting in savings on project expenditure (PMU, PIU, PIAC).

541. **Benefits of Design for this option.** There are a number of benefits of this design. These include.

- **Streamlined "Right-of-Way" and Social Risk Mitigation through Minimal Private Land Footprint:** By impacting only 2 private plots within the RoW which is the lowest of all alternatives—the project minimizes the administrative burden of securing "Right of

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<sup>29</sup> <https://nab.parliament.gov.bt/news/zzxq17i8ggweiu8ul1v7ed4y>

<sup>30</sup> <https://nab.parliament.gov.bt/news/zzxq17i8ggweiu8ul1v7ed4y>

Entry". The Zero-Tower Strategy by ensuring zero tower locations fall on private land eliminates the risk of physical displacement and protracted legal disputes, allowing foundation works to proceed without interruption.

- **Logistical and Access Optimization through reduced Take-off Points:** Alternative 5 requires only 14 access road take-off points, compared to 17 for the baseline, simplifying heavy machinery mobilization. The reduction in access road length to 19.4 km (from the initial 21.34 km baseline) significantly reduces the project's ground disturbance footprint. This optimized length provides direct access to tower groups, particularly through the Nangnang Community Forest corridor, enabling parallel construction workfronts.
- **Environmental and Technical Resilience through Hydrological Protection:** Alternative 5 is the only alignment to affect zero recorded water sources, removing the need for costly and time-consuming environmental protection measures required when working near communal water catchments.
- **Terrain-Responsive Pathing:** By following the Nangnang area topography, the design maintains manageable span distances while avoiding the geologically unstable slopes identified in Alternative 4.

## E. Conclusion

542. The design of Alternative 5 represents a strategic engineering decision that prioritizes the avoidance of private land and communal water resources while optimizing logistics through a shorter, more efficient 19.4 km access road network. This alignment provides the most realistic path to achieving the 14-month commissioning target.

## VII. INFORMATION DISCLOSURE, PUBLIC CONSULTATION AND PARTICIPATION

### A. Public Consultation and Participation

543. In accordance with *Article 16 of the Environmental Assessment Act (EA Act) 2000 and Chapter VI of the Regulations for the Environmental Clearance of Projects 2016*, and ADB's *Environmental Assessment Guidelines*, applicants are responsible for informing and consulting relevant stakeholders and organizations prior to submitting the environmental assessment documents to the competent authority. Additionally, the applicant must issue a written notice, including the project prospectus, to the relevant local authorities to facilitate public consultation.

544. In accordance with the ADB Safeguards Policy Statement (SPS), 2009, BPC is required to carry out meaningful consultations throughout the project cycle with affected persons, local communities, and other stakeholders. Consultations must be conducted in a transparent, inclusive, and non-coercive manner, using formats and languages that are understandable to participants. The consultation approach will be proportionate to the nature and magnitude of project impacts, and the views and concerns raised must be considered and incorporated into project design, mitigation measures, and decision-making processes. The consultation process and its outcomes must be adequately documented and disclosed as part of the environmental assessment. ADB environment and social representatives participated in public and government consultation activities during the project mission in December 2025.

### B. Consultation During Project Planning and ESIA Preparation

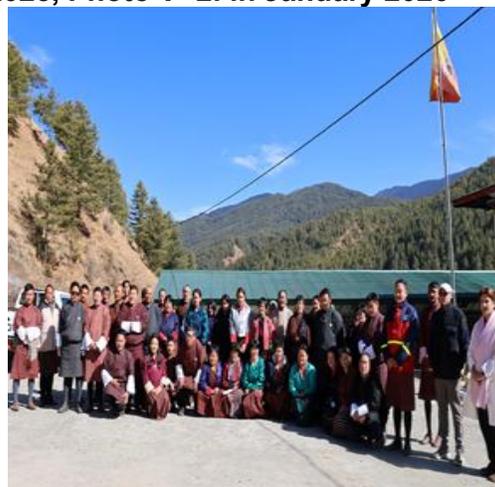
545. Gewog level public consultations with affected groups and local government functionaries commenced from April 2025 and continued up to January, 2026. The consultations were held in Tang and Choekhor Gewog. Public consultation meetings were conducted with the following key objectives and presentations were delivered in the national language, Dzongkha.

- To raise awareness about the proposed project.
- To consult with the Gewog administrations and gather their recommendations.
- To provide a platform for communities along the proposed TL route to express concerns and issues.
- Overview of applicable rules and regulations on Land substitution and compensation
- To collect feedback from affected individuals regarding anticipated challenges and possible solutions.

546. During the consultation, participants were made aware of the Grievance Redress Mechanism (GRM) was also shared during the consultation. The BPC team explained that during the construction phase, consultations will be continued to inform on the project progress and pamphlets in Dzongkha will be distributed to stakeholders, providing details of the GRM process, the contact information of the CPO Grievance Focal Points, and an outline of the project objectives.

547. A second-round community consultation was held towards the end of 2025 (November-December) and again in early 2026 (9 January, 2026), with the community, to provide present the updated project design, discuss the project impacts and mitigation measures, and to seek the views and input of the community to further refine the ESIA and EMP.

**Photo V- 1: Consultation at Tang Gewog in June 2025, Photo V- 2: in January 2026**



**Photo V- 3 & and Photo V- 4: Meetings with Garablung community forest Members  
Nangnang community forest Members**



**Photo V- 5: Meeting with Phomrong community forest Members and Photo V- 6: Nangnang  
community forest Members**



**Photo V- 7: Meeting with Range Officer and Photo V- 8: Bumthang Forest Division**



**Photo V- 9 and Photo V- 10: Meeting with Project Affected Persons**



548. The record of discussion (ROD) of consultation and list of participants are attached in Appendices 5-1 to 5-10.

**Table VII-1: Detail of Consultations**

No.	Date	Meeting	Location	#Participants (M, F)	Participants
1	18th April,2025	Garabbling Community Forest Consultation	Tandingang, Tang Gewog	24 (19M,4F)	Garabbling Community Forest members
2	18th April,2025	Phomrong Community Forest Consultation	Bepzur, Tang Gewog	6 (3M, 3F)	Phomrong Community Forest members
3	9th June 2025	Public Consultation	Tang Gewog Meeting Hall	10 (7M, 3F)	District Administration, Gewog Administration, Tang Community
4	10th June 2025	Public Consultation	Choekhor Gewog Meeting Hall	9 (7M,2F)	District Administration, Gewog Administration, Choekhor Community
5	22nd November, 2025	Stakeholder Consultation Garabbling CFMG	Tandingang Chiwog, Tang Gewog	29 (24M, 5F)	BPC, Forest Range officer- Tang Beat office, Garabbling Community Forest members
6	22nd November 2025	Stakeholder Consultation with Nangnang Community Forest Management Group (CFMG)	Kizom Chiwog, Tang Gewog	20 (11M,9F)	Forest Range officer- Tang Beat office, Nanagnang Community Forest member
7	25th November 2025	Follow-Up Meeting with Garabbling CFMG	Tangdigang Chiwog, Tang Gewog	25 (17M,7F)	Forest Range officer- Tang Beat office, Garabbling Community Forest member and Tang Gewog Administration (Tshogpa)
8	29th November 2025	Follow up with Nangnang CFMG	Kizom Chiwog, Tang Gewog	9 (5M, 4F)	Forest Range officer- Tang Beat office, Nanagnang Community Forest member
9	1st December 2025	Stakeholder Consultation with Phomrong CFMG	Bepzur Chiwog, Tang Gewog	29 (9M,20F)	BPC and Nanagnang Community Forest member
10	9 January, 2026	Community consultation meeting with Tang Community	Tang Gewog Office	54 (27M 27F)	ADB, Bumthang Dzongkhag Administration officer, Gewog Administration of Tang and Community representatives of Tang

549. During the consultations, stakeholders were informed about the location of the Wobthang TL, land requirements, potential positive and negative environmental, health, and safety (EHS) what impacts, as well as the grievance redress procedures. The public consultation feedback revealed that residents of the affected Gewogs were not previously informed about the proposed project.

However, upon receiving detailed information during the meetings, they expressed a positive attitude and general approval. The local communities demonstrated strong support for the project. They expressed appreciation for transparency and assured corporations during project implementation.

550. Points discussed during the Consultation. During the consultation, several concerns were raised by the participants. They emphasized that the project should not result in unnecessary clearing activities and private land must not fall within RoW. They also highlighted the restrictions placed on land within the RoW, particularly on constructing houses. Additional concerns included the risk of contractors encroaching on private land during the construction phase, as well as the potential disturbance of water sources and incidents of pipe bursts caused by construction activities. Detail on public consultation is presented in Table VII-2: Summary of key concerns and feedback on the project.

**Table VII-2: Summary of key concerns and feedback on the project**

Meeting	Concern / Recommendation	Response from BPC	Mitigation Measures and inclusion in the EMP
Garabling CFMG Meeting, 18th April 2025	Confirmation sought on the no. of towers within the community forest.	Only one transmission tower falls in the community forest	The Contractor will ensure that if the tower locations are changed, the respective community will be informed, prior to construction (para 520)
	Query on the extent of forest clearing	Approximately 1.62ha of clearing will be required (approx. 600 m length and 27 m RoW)	Measures to minimize impact are included in the BAP and BMP
	CFMG members indicated that while they are not against the project, they request additional land as compensation for the area lost	Provision of additional land is not possible. Compensation will be provided in the form of rates prescribed for standing basis. Additionally, felled trees may be handed over to the community if required.	This is beyond BPC's mandate. BPC will inform DoFPS TWG regarding this request.
	Concern that trees in the past were not handed over to the community after clearing.	Such instances occurred when clearing was done in a State Reserved Forest (SRF) and not within the community forest, which is why the community was not entitled to the felled trees.	A tree handover register and photographic records shall be maintained for felled trees within Community Forest to ensure transparency and traceability.
	Suggestion that CFMG members be allowed to conduct tree felling and clearing themselves. This would ensure minimal disturbance to areas beyond the Right of Way (RoW) and avoid over-clearing land	If the CFMG is willing to carry out the clearing, this can be permitted subject to agreement with the contractor. The wage rate and responsibilities should be mutually agreed upon between the contractor and the CFMG members.	-Where agreed, CFMG members may be engaged for controlled tree felling under contractor supervision, with agreed wage rates and safety procedures. These workers will be trained in correct felling and removal methods to minimize collateral forest damage.
	Request for accountability in case of accidental damage to trees beyond the buffer, penalties will be applied as per CFMG rules. If CFMG members are involved in the clearing, they will bear the responsibility for any such damage	Noted and agreed	Cutting of trees outside the RoW will be strictly prohibited and monitored. To do this, the RoW boundary will be marked with colored tape so that trees are not cut accidentally. Any damage outside the approved RoW shall be recorded, compensated, and penalized in accordance with Forest and Nature Conservation Rules and Regulations and CFMG guidelines.
Garabling CFMG Tandingan Chiwog, Tang Gewog, 22 November, 2025	CFMG members suggested an alternative route via the side with the bridge connection, as the proposed alignment was steep and included multiple turning points,	BPC suggested route is significantly longer than the proposed alignment and passes through a larger forested area. This could affect Forest Clearance approval if the forest coverage exceeds 40%, which needs to be taken into consideration. Additionally, the access road should be aligned as close as possible to the tower points and	Access road alignment will be finalized through joint field verification with CFMG and DoFPS to minimize forest footprint. Alternative logistics (ropeways, head-loading) shall be considered where feasible.(para 325)

Meeting	Concern / Recommendation	Response from BPC	Mitigation Measures and inclusion in the EMP
	which could hinder transportation of materials and more forest coverage.	follow the shortest feasible distance to minimize impact. The team informed that alternative options were also explored such as using a ropeway for material transportation, in case the proposed route was found to be not feasible.	The BPC team and the members of Garabling community forest agreed to conduct a joint site survey for the proposed access road route identified during the consultation (Surveys completed in January 2026).
	There have been changes in the community forest area. The updated community forest now covers a smaller area, and the suggested route primarily falls within the SRFL, with only a small portion of the access route passing through the community forest area.	The team will validate the data of the updated community forest area and make the necessary changes.	Updated Community Forest boundaries shall be used for ESIA process and impact assessment and mitigation
Phomrong Community Forest Members, at Bepzur, Tang Gewog Office, 18th April, 2025	Query on the extent of forest clearing	Approximately 5.4 ha of clearing will be required (approx. 2 km length and 27 m row)	
	Concern that the TL may cross a sacred or spiritual area, commonly known as "Pho Lha." Based on the confirmation, the CFMG members agreed that the clearance shall be granted by the four heads of the CFMG if the line does not cross the Pho Lha	BPC confirmed that a BPC representative was sent along with the community forest ranger to evaluate the alignment and it was confirmed that the line does not pass through the sacred area.	In general mitigation measures to reduce potential impacts on culturally sensitive and sacred sites are included in the EMP. Construction activities shall maintain buffer distances as agreed with the community and follow chance-find procedures.
	CFMG requested that members be allowed to undertake the felling work and that BPC facilitate discussions with the contractor.	The request has been acknowledged. BPC will communicate with the contractor to ensure negotiations are held, ensuring mutual benefit for both parties.	Engagement of local CFMG members for felling shall be formalized through written agreement with contractor, including safety, wages, and SOP for tree felling
Community Consultation at Tang and Choekhor Gewog, 9th-10th June, 2025	Contractor's encroachment on private land during construction phase	The contractor would be briefed during the process and if any issues occur in future, the GRM process as distributed would be followed.	Contractors shall demarcate construction boundaries and prohibit encroachment on private land. GRM signage shall be installed at work sites and circulated through the Gewog. Any encroachment incidents shall be rectified immediately.
	Concerns regarding the restriction imposed on lands under RoW, where construction of houses is prohibited.	LRO of Bumthang Dzongkhag- Clarify that RoW lands are generally ineligible for compensation or substitution; realignment options can be provided if there are SRFs adjacent to the affected plot and exception may be made	RoW restrictions shall be communicated clearly to affected landowners during pre-construction consultations.

Meeting	Concern / Recommendation	Response from BPC	Mitigation Measures and inclusion in the EMP
		in case where the land owners have no alternative land for housing. Additionally, compensation will be provided for any crop or structural damage caused by project activities provided such incidents are reported to the relevant Gewog Administration.	Compensation for crop or structure damage shall follow RP procedures. Alignment optimization shall continue during detailed design to minimize private land impacts where technically feasible.
	There should not be impacts especially concerning clearing	Noted	Vegetation clearing shall follow approved alignment only; no additional clearing shall be allowed. Daily supervision and random audits will be conducted.
Nangnang Community Forest Management Group (CFMG), Kizom Chiwog, Tang Gewog, 22nd November, 2025	The CFMG Members raised concerns that the proposed access road may encroach upon or adversely affect private land. They emphasized the need to ensure that land ownership and related issues are properly considered and addressed during project planning.	The team clarified that no private land will be affected by the proposed access road. The alignment has been carefully planned to avoid any private land, ensuring that it follows the existing lodging road alignment as much as possible and traverses mostly through State Forest land. Therefore, there will be no land acquisition or impact on private landowners. However, in future if it impacts the private land, a particular owner will be consulted.	Final access road alignment shall avoid private land. Any unavoidable impacts shall trigger consultation, compensation, and written consent prior to works.
	The CFMG members also inquired about the current condition of the existing road. They requested clarification on how the road will be maintained, including who will be responsible for upkeep and whether any improvements are planned as part of the project.	The team clarified that road maintenance is outside the scope of BPC and is the responsibility of the contractor. Once the work is awarded, the community may enter into a formal agreement with the contractor regarding road maintenance and to address any issues that may arise.	Contractor shall maintain access roads during construction and reinstate damaged sections upon completion as part of site restoration obligations.
Nangnang CFMG, 29th November 2025	Community was given updates on the TL Project, connecting the 120MWp Wobthang Solar Farm to the 33/11 kV substation at Garpang, covering Choekhor and Tang Gewogs in Bumthang. There were no queries or recommendations		
Consultation with Phomrong CFMG, Kizom Chiwog, Tang Gewog, 1st December, 2025	Enquiry on how compensation will be made	Commercial royalties for felled trees will be paid in accordance with the Royalty Produce 2006 Manual. If the community requires the felled timber, it may be handed over to them accordingly as per the rules. However, as per the NOC clause, no extension of the community forest area will be provided for the land taken for the project.	Tree compensation and timber handling will be determined by DoFPS as per prevailing Regulations and procedures. Extension of community forest area may be tabled during the TWG meeting and formally communicated to CFG.

Meeting	Concern / Recommendation	Response from BPC	Mitigation Measures and inclusion in the EMP
	<p>The farm road leading to Dorjitse Monastery was fully funded by the local community, who regard it as their private road. According to their road regulations, all users are required to pay Nu. 1,500 per trip. However, they noted that if the contractor agrees to maintain the road up to the project area, the trip charges will be waived.</p> <p>They proposed two conditions:            -Payment of Nu. 1,500 per trip; or            -Maintenance of the farm road up to the project site if the road is significantly damaged during construction.</p>	<p>The team clarified that road maintenance is outside the scope of BPC and is the responsibility of the contractor. Once the work is awarded, BPC will inform and instruct the village road regulations to the Contractor. The community may enter into a formal agreement with the contractor regarding road maintenance and to address any issues that may arise.</p>	<p>During the pre-bid meeting, BPC will inform the Contractor regarding the conditions prevailing the use of Dorjitse road.</p> <p>The Contractor will consult and make necessary agreements with the Community regarding the use of the road. Accordingly, the Contractor will abide by any agreement with the community forest. (para 327).</p> <p>BPC and the contractor will document the pre-project condition of the access roads. Road condition monitoring and reinstatement shall be included in the traffic management plan of the CEMP.</p> <p>Communities must be fully informed about the existing GRM procedure and the available channels for submitting grievances, including grievances related to obstructed travel routes or road damage. (see paras 402-405)</p>
<p>Community consultation, Tang Gewog, 9th January, 2026</p>	<p>BPC inquired whether there are any seasonal, timing-related or restricted areas that would limit public access- It was informed that the Jok Community has specific timebound restrictions on access to certain areas. However, the proposed TL is located away from the Jok Community area.</p>		<p>NA</p>
	<p>An inquiry was made regarding the TL route, including a suggestion to consider aligning the TL closer to the highway.</p>	<p>BPC emphasized that the alignment of the TL has been planned and designed to avoid any adverse impacts on local communities as a first priority and all possible measures have been undertaken to minimize impacts on private land and community.</p>	<p>BPC shall maintain the required buffer from Highway as required (for future expansion and minimize risk of damage to highway) at take off points (EMP #20),</p>
	<p>Inquiry regarding the rental of space required for the project office and labor camps.</p>	<p>BPC informed that, if sufficient rental space is available for the project, the project office and contractor might rent the space.</p>	<p>BPC shall explore renting over construction of new offices (para 421)</p>
	<p>An inquiry was made regarding whether the felled trees would be taken back by BPC or returned to the community. They suggested that returning the felled trees to the community would be beneficial.</p>	<p>BPC informed that it does not have the authority to return the felled trees within the RoW to the community. The management of the felled trees will be the responsibility of NRDCL.</p>	<p>BPC EGSS shall discuss the potential sharing of felled trees In the RoW. Ultimately the decision will be made by the NRDCL and depends on various factors including royalties and quota</p>

Meeting	Concern / Recommendation	Response from BPC	Mitigation Measures and inclusion in the EMP
	Inquiry about Project time period	BPC informed that the project is scheduled to commence this year and according to the tentative plan, the project duration is expected to be one year and eight months.	BPC to inform the Gewog to inform the community regarding the change in the project/construction timeline from 18 to 14 months via their local office.
	The community expressed concerns that the influx of labor could increase the risk of disease transmission and place additional pressure on local health services. They suggested that BPC assist in the development or enhancement of the local health center to better address these potential impacts.	BPC clarified that the development or enhancement of the health center falls outside the scope of BPC. However, BPC mandates that prior to the commencement of project activities, the contractor is responsible for conducting comprehensive health screenings for all laborers to ensure the health and safety of both the workforce and the local community.	The Contractor shall ensure to implement measures to reduce health and safety risks through on-site medical facilities and first aid capacity as well as implementation of the community health and safety management plan and the CEPRP (para 431)
	The community suggested BPC to organize a follow-up meeting with the project office and contractor to address project-related queries. They highlighted that certain areas are culturally restricted, and such consultations would help ensure mutual understanding and respect for local practices.	Most contractors, prior to the signing of the contract, used to consult with the Gewog regarding the project. Additionally, during the pre-bid stage, BPC engages with the contractors to inform them about the consultations with the community.	Measures to map and document culturally restricted areas are included in the EMP (para 329, 382)
	An inquiry was made regarding the load-carrying capacity of the bridges located along the project alignment.	Prior to the commencement of the project, all bridges will be assessed for their load-carrying capacity.	BPC to undertake bridge carrying capacity assessment and include provisions for bridge improvement if required into the construction cost-in consultation with DoST and Gewog (para 402)

### **C. Future Consultation**

551. The Project must ensure communities remain well informed about project activities, progress, are aware of construction activities, electrical safety, and workers code of practice. To achieve meaningful consultation and information disclosure as per ADB requirements (see SPS 2009), BPC will continue to consult with relevant stakeholders, affected persons, and key stakeholders and continue to disclose updated and relevant project information throughout the project implementation period.

552. During pre-construction phase a minimum of the below topics will be discussed during public consultations:

- Share key project details such as final detailed design, project timeline, works schedule, lay down areas, camps, traffic management, blasting, access, power outages
- Community health and safety and construction EHS
- GRM access
- Impacts on local health facility
- Implementation of resettlement plan - compensation for affected households and community forest
- Implementation of EMP, BAP, BMP measures.

553. During construction a minimum of the below topics will be discussed at public consultations:

- Update construction progress/schedules
- Listen to community concerns, reduce conflict, identify issues and find acceptable solutions.
- As needed discuss design changes or unanticipated projects changes
- Access and success to the GRM
- Incidents and accidents, as needed
- Corrective actions

554. BPC will also consult and engage with other stakeholders/Interested Parties (DoFPS, RSPN, Dzongkhag, National Land Commission, Local health facility) to input and information for implementing project activities, such as a Technical Working Group, assess impacts on local health facility and address unanticipated incidents and take corrective action.

555. During Project Operation, BPC will undertake consultations for

- Implementation of O&M measures
- Seek key stakeholders' input and information for monitoring purposes.
- Continue the active support of local communities and local government.
- Address unanticipated incidents and take corrective action.
- Preparation of project completion report

556. The contractor will undertake further consultations to inform key stakeholders of project final planning and design outputs and disseminate necessary information ahead of the start of civil works. Specifically the contractor will consult the local community to:

- Inform about local job opportunities/needs of the project and recruitment processes.
- Implement mitigation measures under CEMP and sub-plans such as traffic management plan, community health and safety plan, blasting plan etc.
- Prepare contracts and agreements for land lease, tree felling and usage of Dorjitse road etc.

557. The project will also activate the Grievance Redress Mechanism (Chapter VIII) ahead of works commencement and ensure information regarding the GRM is disseminated to both the local community and key stakeholders in the project Aol.

#### **D. Information Disclosure**

558. Once cleared by the DECC and ADB, the ESIA (including the EMP) will be disclosed before project appraisal on BPC website, together with summaries translated into Dzongkha language, within two weeks after ADB's clearance of the document. The document will also be posted on the ADB website at least **120 days before ADB board consideration**.

559. Documents will also be made available at the local BPC and Tang and Chhoekhor Gewog office, as well as the construction site offices wherever these are established by the contractors. Updated documents will be disclosed as necessary.

560. BPC will be responsible for notifying and informing the public on construction work prior to implementation, publishing the emergency response plan, disclosing the measures to manage accidents and emergencies, including environmental and public health emergencies related to spills of hazardous wastes like oil, fuels, etc., and similar events.

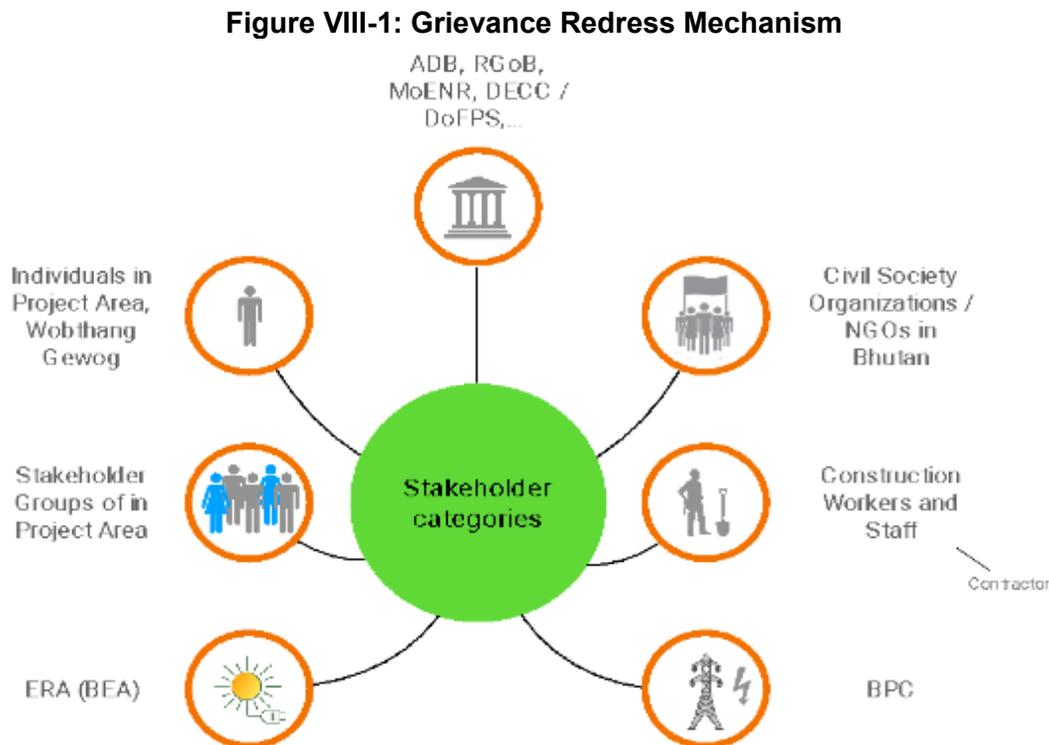
561. BPC will prepare quarterly Environmental Monitoring Reports (EMRs) and submit this to ADB for review and disclosure within 30 days after the end of each monitoring period (e.g., by end-March, end-June, end-September and end-December), starting from project effectiveness and continuing until ADB issues the Project Completion Report (PCR)—typically 1–2 years after financial close—or a later date if specified. Summaries of EMRs will be disclosed on BPC website and at Gewog local offices (summary in Dzongkha), within two weeks of ADB's clearance. Within three months of completing all civil works, BPC will also prepare a report on the project's environmental compliance performance, which will serve as input to the overall PCR. All reports (in English) will be disclosed on ADB website.

## VIII. GRIEVANCE REDRESS MECHANISM

### A. Grievance Redress Mechanism

562. BPC will establish a project-specific Grievance Redress Mechanism (GRM), as soon as the Project (sector loan) becomes effective, to receive and manage any grievances (complaints as well as suggestions) that may arise from the project and facilitate prompt resolution of aggrieved persons' issues, concerns, problems, or claims.

563. Aggrieved persons may include members of the local community or construction workers. The project wide GRM will address both environmental and social safeguards, consultation and information disclosure related issues, and other related eligible grievances/complaints raised by aggrieved persons, in a timely and culturally appropriate manner. The GRM will involve all stakeholders as will be applicable to grievance cases, as depicted in Figure VIII-1: Grievance Redress Mechanism.



**Source:** BPC with support of ADB TA Consultant

564. The GRM will ensure that:

- Basic rights and interests of aggrieved persons are protected by the environmental and social safeguard performance of BPC and their contractors on the project;
- Issues, concerns, problems, or claims arising about consultations with people and communities, and information disclosure on project and safeguards, and environmental and social performance of BPC and their contractors during the conduct of pre-construction and construction activities, and BPC during O&M activities are promptly and effectively addressed; and

- Relevant suggestions and recommendations made by the local community and other stakeholders are considered in the construction and operation of the TL project.

565. Recourse to the project's GRM does not impede access to the country's judicial or administrative remedies at any stages of the grievance resolution process. Aggrieved persons are free to approach the court of law at any time and independently of the project's grievance redress process. Aggrieved persons may (subject to eligibility criteria) also access ADB's Accountability Mechanism whereby people adversely aggrieved by ADB-financed projects can express their grievances, seek solutions, and report alleged violations of ADB's operational policies and procedures, including ADB SPS.

566. The GRM will be set up upon loan effectiveness and be operationalized before the commencement of any civil works, including enabling works. BPC and their Contractor (during pre-construction and construction) will appoint GRM focal persons. BPC will appoint a full-time project-wide focal, and the Contractor will appoint one full-time focal. All staff of BPC, its representatives, and the Contractor, as well as local and national government and other entities directly involved in the GRM process, will receive orientation from the environmental and social safeguards experts recruited to assist the Project Management Unit (PMU) before the start of works to fully grasp their roles and responsibilities within the GRM as well as approaches to constructively resolve project-related grievances/complaints. BPC will provide a similar training as part of the handover to the operational team that will run the solar PV project.

567. Communities within the impacted area will be made aware of this GRM as well as how to access it, including addresses and contact numbers, through (i) community awareness-raising during community or one-on-one meetings; (ii) pamphlets distributed to the general public in the direct vicinity of the project site, in Dzongkha (official language) but maximizing use of graphics to convey messages given low literacy rates (50% of the population of the interviewed households reported being illiterate) in affected communities, and (iii) notices on the radio and/or local newspaper, as well as notice boards on site, at BPC and Gewog local offices, and on BPC websites, etc will be ensured by BPC. Any concerned person or group of people can file a complaint through the project's GRM, at any time and no cost.

568. BPC and contractor's focal will actively engage with the aggrieved local communities and construction workers throughout pre-construction and construction, with BPC's focal doing the same at the onset of operation, providing an opportunity for community members or workers to approach them with any grievance/complaint. Affected peoples may also lodge grievances/complaints online through BPC's website, email, by phone or SMS at numbers to be provided, by submitting a note in a suggestion box kept on-site, by sending a letter, or in person at a project-site office or the Gewog local office for conveyance to the project.

569. All staff and workers of BPC, its representatives, Contractor, and Subcontractors, will also be made aware of the GRM and must know who to direct any complainant to if approached regarding a grievance. The local Gewog staff, local forest department office, and local protected area management office will also be made aware of the GRM and will be able to provide appropriate contacts and redirect people to the focal through the Gewog administration office.

570. The GRM will follow a three-tier structure; summarizes the process while lists key members and timelines.

571. An exhaustive grievance log record must always be kept on-site by the contractor's focal during construction and BPC during construction and O&M. Any grievance/complaint received,

whether minor or major, whoever it was first addressed to, must be reported to the site-based focal and documented, including the name of the person making the complaint; date and time the complaint was received; relation of the complainant to the project; nature of the complaint; details of all meetings held, including participants, date, issues discussed and decisions taken; details of all actions taken towards resolution of the grievance; the log of all formal communication sent to the complainant informing of the evolution of the process, etc. Appendix 21 provides a template for a grievance/complaint register. BPC GRM focal will set up a project-wide grievance handling database replicating the site logs at the project level.

572. Once a resolution has been proposed to the aggrieved person, they will be asked to sign a form acknowledging receipt of that proposal and providing their approval or refusal or comment, as applicable; this form will be added to the grievance/complaint register and once all actions are taken the associated entry will be closed but not deleted. Sample GRM forms are attached in Appendix 21.

573. The GRM will include provisions to deal with claims on Sexual harassment, exploitation, abuse which will be survivor centric and confidential.

574. The entry points for filing grievances for affected people can be at any of the agencies as could be accessible for them, such as directly filing to BPC, at site level to contractor or to local governments coordinated by the BPC. The grievance is then to be recorded, resolved and consolidated at the project implementation unit under the BPC and BPC.

## **B. Grievance Tiers**

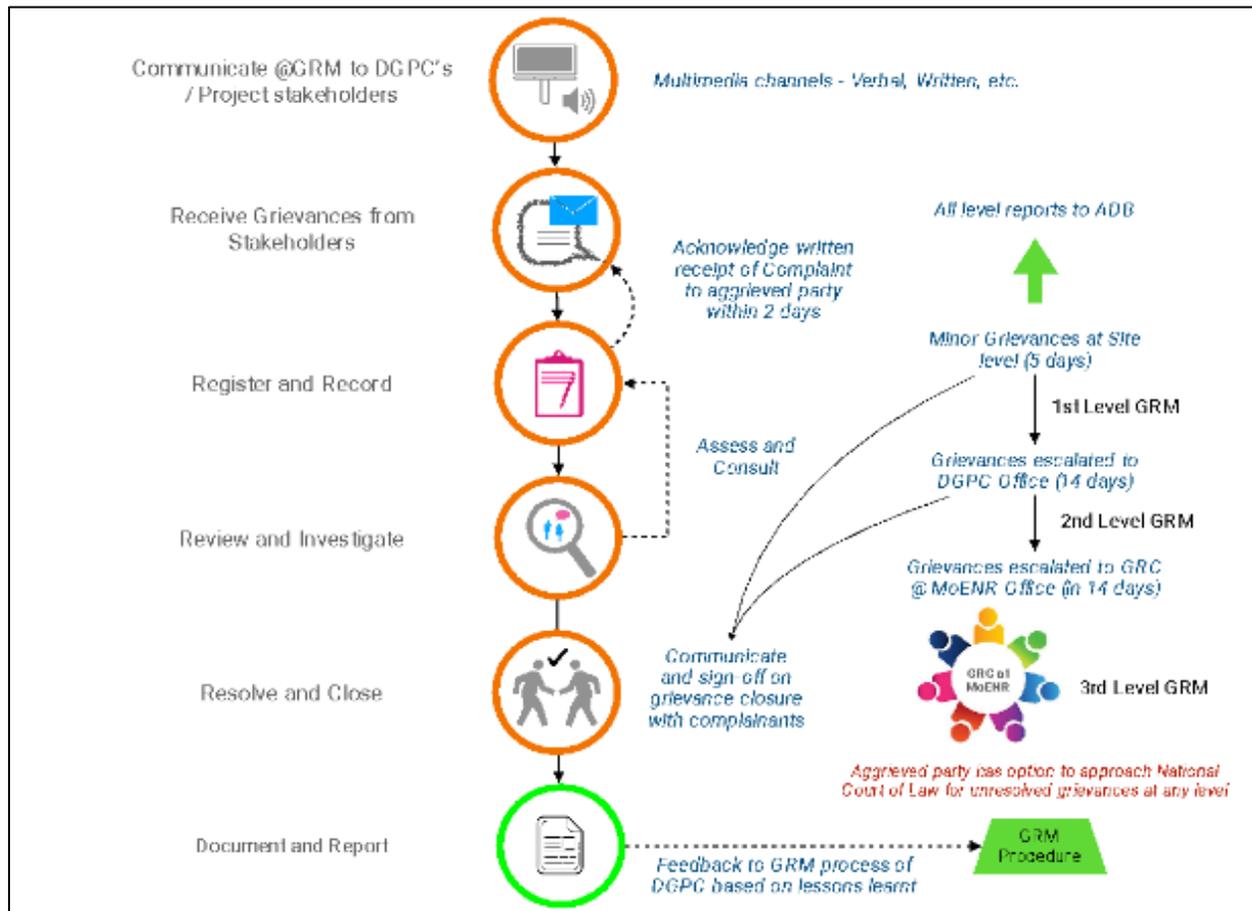
575. **Site -Level Grievance Handling Protocol.** The contractor, at site level, once operational will define a site-level grievance handling protocol, as initial input to the GRM. During construction, for any urgent matter, emergency and H&S issues, the contractor's site-level focal will take note of the grievance/complaint, record it in the GRM register maintained at site, and get immediately in contact with their own Environmental & Health Supervisor (EHS) (staff of the Contractor) with BPC's Community Liaison Officer (CLO) posted to site for immediate action. Short-term issues (e.g., dust, noise, spills, leaks, etc.) may be corrected immediately (within 2 to 3 days) while more complex issues involving personal conflict may take longer under the direction of the contractor's focal, in collaboration with respective construction workers. In case of impending damage to structures (offsite), flora or fauna, or physical cultural resources, the contractor or CLO shall get in immediate contact with BPC's Environment and Social Safeguards Officer<sup>31</sup> who will formally be appointed on project commencement who shall have the power to halt works until corrective action is taken

576. At every entry point and the form in which the grievance/complaint is received and its nature, even though it has yet to enter the formal GRM, it should be accepted by the site-level focal and registered in the grievance register with the actions taken to resolve the complaint.

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<sup>31</sup> BPC has assigned one of its staff as Environmental & Social Focal Person during project preparation. The incumbent may continue in the PMU during project implementation.

**Figure VIII-2: GRM Process for BPC TL**



**Source:** BPC with support of ADB TA Consultant

577. **First Level of GRM.** During construction, the contractor's GRM focal is responsible for this first formal level. Responsibility will be handed over to BPC site engineer during operation. Aggrieved persons may first approach the contractor's GRM focal and/or project manager and the community liaison officer (CLO) also appointed by BPC in case of complaints related to construction. The grievance/complaint must be recorded in the site register and the contractor/site engineer must provide a written form acknowledgement of complaint receipts to the complaint within 2 working days. Complaints can be made verbally or in written form. Actions to resolve the complaints made by the aggrieved person should be confirmed within 5 working days and recorded in the grievance register. In case, the complaint is not resolved at this level or mutual agreement is not achieved with affected person, the contractor/site engineer will forward the complaint to the second level.

578. Aggrieved persons are entitled to lodge complaints regarding any aspect of the loss of assets, entitlements, or rates of payment as well as any other project-related environmental or social, consultations and information disclosure issues. Complaints, their nature, and resolution should be regularly reported (updates every two weeks) to BPC PMU Level GRM Focal, mentioned in the quarterly progress reports and the Semi-Annually Environment and Social Monitoring reports (SAE&SMR).

579. **Second Level of GRM.** At this level, the contractor's GRM focal and/or project manager will coordinate with BPC Project Manager which should be in place before project implementation. GRM coordination will be handed over to the TL project site engineer appointed by BPC during operation. The aggrieved person who filed the complaint (or representative/s from the aggrieved household/s) will be called to present his or her case and deliberation on the case will be done through proper hearing or mediation, with an official from the local government office playing the role of mediator. It will be the responsibility of the BPC site in charge to resolve the issue within 14 working days from the date the complaint is received. Minutes of the meetings will be kept, and the resolution provided will be recorded in the grievance register for purposes of project monitoring.

580. If the complaint is unresolved at this level, the BPC site in charge will inform the aggrieved person accordingly and assist them in elevating the complaint to the Grievance Redressal Committee (GRC).

581. **Third Level of GRM.** The PMU / BPC Project Manager within 14 working days will bring the complaint to the Grievance Redress Committee (GRC) through the Grievance Redressal Officer of BPC at the BPC level. The Grievance Redress Committee will comprise of: (i) CEO, BPC (Chairperson); (ii) Director, BPC (Member Secretary); (iii) Project Director, PMU; (iv) Grievance Redressal Officer (v) Legal officer, BPC; (vi) Environment and Social Safeguards Officer of BPC; (vii) Project Manager of the site concerned and (viii) at least 1 Representative from local NGOs and (ix), the complainant AP and his/her representative. It will be the responsibility of the grievance redressal committee to resolve the issue within 15 working days from the date the complaint is received. In the event, the grievance is still not resolved; the matter may be elevated by the aggrieved person to an appropriate court of law. The court will have the final authority to approve or reject the case. Aggrieved persons may seek recourse through the legal system at any stage of the GRM process.

582. **Other avenues for Grievance resolution.** The GRM notwithstanding, an aggrieved person shall have access to the country's legal system at any stage. This can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM. If the established GRM is not able to resolve the issue, the aggrieved persons/communities can also use the ADB Accountability Mechanism by directly contacting (in writing) the Complaint Receiving Officer at ADB headquarters having first approached resolution by the project team (after making prior good faith efforts to resolve the problems with the operations departments). The complaint can be submitted in English or any of official or national languages of ADB's Developing Member Countries (DMCs).

583. **Information Dissemination.** Information about the project level GRM contact information, project staff, BPC, and Bhutan Resident Mission and eligibility for ADB Accountability Mechanism will be included in the information pamphlets to be distributed to the project area people and public as part of the project consultation and disclosure activities during the preparation of draft and updated Resettlement Plan as applicable.

**Table VIII-1: Key members and timeline**

GRM Level	Composition	Maximum timeline
First Level of GRM (Site-level)	<p>Responsibility: Contractor's project manager supported by contractor's GRM focal (BPC site engineer during operation)</p> <p>Other parties involved, as applicable: Aggrieved person and/or up to two representatives of aggrieved person (gender-inclusive)</p> <p>Contractor's representative BPC's Project Manager when on-site</p> <p>Total meeting members: 4-6</p>	<p>Two (2) working days: acknowledging complaints receipt</p> <p>Five (5) working days: a meeting between contractor's project manager and complainant and action plan agreed upon (or escalation to level 2)</p> <p>Maximum 15 working days: action taken, and grievance resolved, however any environment safeguard grievances that are an emergency or pose a H&amp;S risk to workers or community members must be resolved immediately by the contractor</p> <p>Information and reporting to BPC GRM focal on a two-weekly basis by the contractor</p>
Second Level GRM	<p>Responsibility: BPC's project manager is supported by BPC GRM focal (BPC project manager on operation)</p>	<p>Three (3) working days: confirmation of receipt to the complainant</p>
(Project-level)	<p>Other parties involved, as applicable: Aggrieved person and/or up to two representatives of aggrieved person (gender-inclusive)</p> <p>Representative of the contractor BPC environment and social safeguards officer</p> <p>Local rural office and community organization representative</p> <p>Total meeting members: 4-8</p>	<p>14 working days: a meeting between the project manager and complainant and action plan agreed upon (or escalation to level 3)</p> <p>Maximum 15 working days: action taken, and grievance resolved</p> <p>Information and reporting to BPC board and management by BPC GRM focal.</p>
Third Level of GRM (Committee level)	<p>Responsibility: BPC project manager as facilitator of GRC, handing over to BPC project manager upon operation</p> <p>Other parties involved, as applicable: Aggrieved person and/or up to two representatives of aggrieved person (gender-inclusive)</p> <p>BPC GRM focal Representative of the contractor Government representatives as applicable depending on environmental or social issues being resolved (e.g., land revenue, survey, forest office, agriculture office, municipality representative, etc.)</p> <p>NGOs/CSOs representatives depending on environmental or social issues being resolved. Total meeting members: &lt;10</p>	<p>2 working days: confirmation of receipt to the complainant</p> <p>15 working days: grievance redress committee meeting and the action plan agreed upon</p> <p>Maximum 44 working days: action taken, and grievance resolved</p> <p>Information and reporting to BPC board and management by BPC GRM focal. a</p>

### **C. Monitoring and Reporting**

584. All entries to the grievance register, whether resolved at the initial informal level on-site or at any of the three levels of the formal GRM, along with updates on ongoing or completed actions taken to address the grievance/complaint, will be included in monthly reports by the Contractor to BPC and the monthly progress report and the SAE&SMRs from BPC to ADB.

585. PIAC will monitor the overall grievance resolution process along with BPC and will recommend any improvements to increase the efficiency, timeliness, and fairness of the process.

586. **Budget.** BPC and the contractor, and BPC during operation, will need to provide resources (staff and budget) for the GRM that will sufficiently cover the costs of its operations including initial awareness-raising/communication, capacity development training, support services, field inspections, meetings, documentation, supplies, etc. The budget is provisioned in the Resettlement Plan or Social Due Diligence Report, as applicable, and will be used for implementing the GRM.

### **D. GRM For Operational Phase**

587. GRM operationalization will be handed over to BPC following construction. BPC upon taking up the responsibility of the operation of TL shall ensure the following:

- GRM as per the above requirements and adjusted for the operation phase should continue to be operationalized,
- There must be a specific GRM focal person for environmental and social grievances reporting appointed by BPC. This is particularly important during the initial phase of the project operation where the actual impacts of the project will be known on the ground.
- Proper recording of grievances and their solutions should be kept with the site office and submitted to national agencies as and when sought.

588. For the operation of the TL, the operational monitoring will be supplemented by Department of Environment & Climate Change (DECC) and Electricity Regulatory Authority (ERA), including the licensing and Environmental Clearance Terms of Reference. It shall be the responsibility of BPC/operating agency to adhere to these requirements.

### **E. Platform for potential complaints before Project Effectiveness**

589. BPC will ensure to (i) establish a project based GRM (proposed in the draft resettlement plan and adjust as needed during implementation) by the loan effectiveness date, and (ii) until then assign focal persons from its current staff with BPC contact information published to affected people and public (as given in Section of this draft Resettlement Plan for Grievances), to address grievances and queries before loan effectiveness and during the project implementation.

BPC will ensure to (i) establish a project based GRM (proposed in the draft resettlement plan and adjust as needed during implementation) by the loan effectiveness date, and (ii) until then assign focal persons from its current staff with BPC contact information published to affected people and public (as given in Section of this draft Resettlement Plan for Grievances), to address grievances and queries before loan effectiveness and during the project implementation.

#### **Contact information at BPC**

Address: Yarden Lam, Environment, GIS & Survey Section, Construction Division

Tarden Lam, Thimphu, Bhutan  
Office Hours and days: Monday to Friday ( 09:00 AM to 5:00 PM)  
Phone number: 17652616  
Email: [ugyendorji2013@bpc.bt](mailto:ugyendorji2013@bpc.bt)

#### **F. ADB Accountability Mechanism**

590. ADB's Accountability Mechanism has two functions: Problem Solving and Compliance Review. Complaints are eligible by ADB Accountability Mechanism after making prior good faith efforts to resolve the complaint at the project operation level. Complaint can be received by the Receiving Officer at the ADB Headquarters in Manila, with contact details in ADB website.

591. An aggrieved persons and/or their representatives can directly contact ADB's Resident Mission in Thimphu and/or the project operation unit of the ADB's Energy Sector Group, South Asia in project website of ADB, for any grievances or queries they may have at any time. The party informs on their complaints in writing form the Resident Mission or sector group to initiates a good faith effort to resolve the grievance. The aggrieved party can use local language, English or any national language to send their complaints at address below.

Contact: Bhutan Resident Mission  
Address: 2nd Floor, Royal Textile Academy Building Norzin Lam, Chhubachhu, Thimphu - 11001  
Office Hours and dates: Monday to Friday ( 09:00 AM to 5:00 PM)  
Phone number: [+975 2 339150](tel:+9752339150); [339151](tel:339151)  
Email:

## IX. ENVIRONMENTAL MANAGEMENT PLAN

### A. Introduction

592. ADBs SPS (2009) mandates that the borrower or client prepares an Environmental Management Plan (EMP) that addresses potential Project risks and impacts risks identified by the environmental assessment. This EMP sets out mitigation measures to avoid, minimize, mitigate, or compensate/offset for the adverse environmental impacts and risks on the physical, biological, and socioeconomic environment. Implementation of this EMP by BPC and their contractor during pre-construction, construction, operation and decommissioning will ensure project implementation will comply with ADB SPS (2009) requirements, applicable EHS requirements of the Royal Government of Bhutan, including international agreements it is a signatory too, and good international practice measures as set out in relevant IFC EHS guidelines.

593. The purpose of this EMP is to guide and provide direction to BPC management and contractors on the management of environmental impacts from pre-construction to commissioning phases. To achieve this, the EMP summarizes the potential adverse impacts and risks from the planned activities with respect to the following stages: (i) detailed design and pre-construction preparatory work, (ii) site establishment and construction, (iii) O&M and (iv) and decommissioning. The EMP and the EMoP reflect Bhutanese national requirements and international good practice, including standards and guidelines to be adhered to during project implementation. To ensure the EMP and the EMoP are implemented, BPC and the PMU will be supported by a Project Implementation Assistance Consultant (PIAC) who will undertake a program of environmental supervision and monitoring during project implementation. Unanticipated impacts, or requirements for corrective action due to non-compliance identified during project implementation will be reported by BPC to ADB and appropriate action taken.

594. The EMP contains several components crucial to effective environmental management within the project, these include:

- Mitigation and management plans to be applied and/or implemented during detailed design and pre-construction preparatory work, construction period, O&M, and decommissioning.
- EHS codes of practice elaborate to guide upon mitigation measures to be implemented during all Project phases.
- Monitoring requirements including quantitative sampling
- Implementation arrangements, including organizational roles and responsibilities for mitigation, supervision, monitoring and reporting on EMP implementation, capacity development and training requirements for BPC, their contractor on various aspects of EMP implementation and an indicative cost estimate/budget.

595. The EMP must be considered as a dynamic, living document and should be updated as appropriate during project implementation.

596. The final version of the EMP will be cleared by ADB and disclosed on its website. The EMP will form part of all bidding and contract documents, and the contractor will be responsible for implementing all relevant measures from pre-construction to construction, under the supervision of BPC. The contractor must always follow the definite version of the EMP as disclosed on ADB website.

## B. Environmental and Biodiversity Management Plan and Action Plans

597. In accordance with ESS6, biodiversity risks and impacts must be managed through application of the mitigation hierarchy, using a precautionary and adaptive management approach, with the objective of achieving at least NNL of biodiversity and, where required, Net Gain.

598. During the assessment process it was agreed that biodiversity related risks and impacts would be presented separately in a **standalone** BMP section (Chapter D). The preference to separate biodiversity considerations from the EMP intends to provide a more in-depth breakdown, providing additional guidance to avoid or manage anticipated risks and impacts during the pre-construction, construction, and operation. This approach ensures that all ESS6 monitoring and evaluation requirements are fully embedded within a single, coherent BMP/BMEP framework, consistent with good international practice and ADB guidance.

599. The BMP is presented in Table IX-3: Biodiversity Management and Monitoring Plan, immediately following the E&S Management Plan. The BMP details all construction-related biodiversity mitigation measures, including actions to avoid, minimize, and restore impacts on habitats, species, and ecological functions. The BMP also incorporates the requirements of a Biodiversity Monitoring and Evaluation Plan (BMEP), as defined under ESS6. In accordance with ESS6, biodiversity risks and impacts must be managed through application of the mitigation hierarchy, using a precautionary and adaptive management approach, with the objective of achieving at least NNL of biodiversity and, where required, Net Gain.

600. Accordingly, the BMP table includes:

- Biodiversity-specific mitigation and management measures
- Biodiversity performance indicators and monitoring parameters
- Monitoring frequency, methods, and responsibilities
- Reporting requirements and
- Provisions for adaptive management where monitoring indicates that outcomes are not being achieved.

601. The reciprocal Environmental Monitoring Plan (Table X-1: Environmental Monitoring Plan (EMoP)) is presented later in this chapter. It defines the parameters, methods, frequency, responsibilities, and reporting requirements for monitoring compliance with the E&S mitigation measures set out in the EMP (excluding biodiversity).

602. The BAP is presented in the final section of this chapter. The BAP sets out additional and proactive biodiversity conservation actions that go beyond impact mitigation, in line with ESS6 requirements for projects with risks to natural habitats, protected areas, and PBFs. It commits the project to the requisite long-term management actions needed to achieve NNL of the most sensitive biodiversity receptors ensuring that residual risks are addressed and that biodiversity outcomes are demonstrable, measurable, and sustainable, in accordance with ESS6. Ultimately, the BAP ensures that the project achieves no adverse impacts on biodiversity and therefore NNL of all PBFs.

603. The objectives of the BAP are to:

- strengthen biodiversity outcomes beyond construction-phase mitigation;
- provide confidence that NNL of biodiversity is achieved; and
- support longer-term conservation outcomes aligned with national and landscape-level priorities.

604. The BAP focuses in particular on:

- Wangchuck Centennial National Park (WCNP);
- Natural forest habitat affected by or associated with the Project; and
- Local and migratory bird assemblage, including collision and electrocution risk management.

605. The BAP includes a short action plan for each of the three key receptors above. Each action comprises a succinct plan detailing what must be done, when, by whom and how to ensure that the conservation status of the target PBF is improved. The actions are designed to engage and receive commitments from multiple users, principally:

- BPC as the Implementing Agency must understand each action in sufficient detail to provide institutional leadership and ensure their successful implementation
- BAP implementing partners (e.g. Divisions of the DoFPS) who must understand and follow the actions to ensure all activities are successfully completed on the ground
- External stakeholders, such as RSPN, who may wish to audit or support implementation actions
- ADB who must ensure that the actions are proportionate, achievable and correctly resourced, and therefore that there is a high likelihood of success.

### **C. Implementation Schedule**

606. BPC will be the implementing agency and overall responsible for the TL, associated components, safeguards planning and implementation.

607. The TL is planned to be implemented in a period of **14 months**, once the loan is considered effective. The construction activities will be sequenced so that the TL is completed and fully commissioned in tandem with the solar facility, enabling immediate evacuation of generated power upon plant commissioning and avoiding any delay in grid integration.

608. During the pre-construction period, the requisite national environmental clearances will be obtained before any contracts are awarded. Strictly no contracts will be awarded before the EMP has been incorporated into the contract documentation. Further, no site establishment or construction activity is to take place before BPC/PMU has received and approved the requisite contractor's CEMP including all sub-plans and provides a no-objection.

**Table IX-1: Environmental Management Plan**

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
<b>Pre-construction phase</b>					
General risks	Reduce risks	<ol style="list-style-type: none"> <li>1. Integrate all ESIA-EMP requirements (including the EMP) into the bidding documents and civil works contracts;</li> <li>2. Compliance with national laws and regulations and SPS 2009 requirements</li> <li>3. Appoint a qualified and experienced E&amp;S Officer (fulltime) upon loan effectiveness for the project</li> <li>4. BPC to appoint dedicated safeguard specialists</li> <li>5. Complete site-specific geological and geotechnical investigations for tower and foundation locations.</li> <li>6. Ensure the Bill of Quantities (BOQ) follow the prevailing Bhutan Schedule of Rates (BSR) 2025 which includes a Guideline for OHS, and Guideline for Temporary Living Accommodation</li> <li>7. Ensure obtainment of Environmental Clearance for TL and Roads, Clearance from Department of Surface Transport, Forest Clearance prior to the commencement of the construction activities</li> <li>8. Within three months of receiving the Environment Clearance, prepare a detailed implementation plan and submit to DECC for no-objection</li> <li>9. Review and approve the CEMP together with PIAC</li> <li>10. Finalize the training program with PIAC</li> <li>11. When unanticipated environmental impacts become apparent, inform ADB and update the IEE for clearance and disclosure by ADB</li> </ol>	PMU/PIAC	PMU	<ul style="list-style-type: none"> <li>- EMP included in bid documents; EMP cost items included in BoQs</li> <li>- Environmental Clearance for TL and Roads, Clearance from Department of Surface Transport, Forest Clearance obtained prior to works and shared with contractors</li> <li>- Detailed Implementation plan</li> <li>- No breaches of national regulations and/or international good practice guidelines. No breaches of EMP, contractor, subcontractors or other third parties with prompt corrective action taken if required. Status of EMP compliance documented in EMRs</li> <li>- Prepare and submit semi-annual EMRs for ADB review and approval as per required timelines and schedule</li> <li>- Report any accidents, fatalities to ADB within 48 hours as well as any unanticipated incidents along with corrective actions taken within one week</li> </ul>
Contract award and mobilization	Contractor awareness	<ol style="list-style-type: none"> <li>12. Organize and conduct pre-bid meetings with potential contractors. Topics will cover compliance requirements (ADB and national requirements), budgeting for EMP provisions, need for a dedicated personnel and experts (ESS expert, EHS expert and an ecologist) on the team, preparation of CEMP, self-monitoring and reporting requirements</li> <li>13. Once the Contractor is selected conduct awareness training on responsibilities and actions set forth in EMP,</li> </ol>	PMU / PIAC	PMU	<ul style="list-style-type: none"> <li>- Pre-bid meeting participant list</li> <li>- Briefing documentation and participant list</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		BMP and BAP implementation, to comply with ADB and RGoB requirements (Labour and Employment Act of Bhutan 2007 and Rules and Regulations on Occupational Health and Safety and Welfare, 2022, the Regulation on Occupational Health and Safety for the Construction Industry 2022)			
	Contractor staffing, planning budgeting and implementation of safeguards	<p>14. Appoint qualified and experienced safeguard staff as detailed under Chapter 8</p> <p>15. Ensure all subcontractors and third parties, irrespective of being formally or informally employed by them, also comply with the final EMP and any updates to it, as well as their own CEMP and that this responsibility is cascaded</p> <p>16. Subcontractors to be required to appoint an EHS representative for each construction site. EHS representative must have the necessary training, experience and certification</p> <p>17. No illegal forced or child labor to be employed in construction with the minimum age for employment on the construction site to be 18 given hazardous nature of works involved – no persons under 18 to be employed</p> <p>18. Contractors must not discriminate and must proactively encourage the employment of suitably skilled women on the project</p> <p>19. Contractor to prepare a detailed training plan upon contract award elaborating how training and awareness raising activities required by EMP will be conducted. Training should not be limited awareness level but is dependent on the roles and responsibilities. H&amp;S sensitive positions e.g. rigger, scaffolder, excavation competent person etc. should have the necessary experience and certifications</p> <p>20. Contractors must proactively encourage local employment for unskilled roles whilst ensuring suitably qualified and experienced workers for skilled role</p> <p>21. Plan, coordinate and conduct specialized training and</p>	PMU / PIAC	PMU	<ul style="list-style-type: none"> <li>- Appointment letter for safeguard staff to the project</li> <li>- Approved CEMP with Subplans (HSMP, Pollution prevention plan, blasting plan, site restoration plan, air quality, noise and vibration management plan, solid and hazardous waste plan, traffic management plan, emergency preparedness and response plan, labour management plan, worker accommodation plan, and stakeholder engagement plan.</li> <li>- Approved training plan</li> <li>- Number of approved subcontractors</li> <li>- Minutes of coordination meetings, participant list</li> <li>- Inclusion of budget for worker accommodation, OHS, trainings</li> <li>- Training reports</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		<p>induction for staff and workers in collaboration with the local forest office, police, health personnel and gewog.</p> <p>22. Prior to the start of and then throughout construction contractor to conduct training for construction management and provide all workers and visitors onsite, irrespective of them being formally or informally employed by contractor, subcontractor or third-party with an EHS induction before being allowed on-site including dos and don'ts in relation to construction site, temporary workers camps, local communities, forests, protected area</p> <p>23. Provide all workers with: (i) EHS induction training, (ii) Daily Toolbox Talks, (iii) monthly HIV/AIDS awareness trainings, (iv) monthly first aid &amp; ERP trainings, (v) quarterly training on SEAH, code of conduct and culturally acceptable practices, biodiversity conservation awareness, prohibition on firewood and NTFPs collection by workers, prohibition on fishing, hunting, or poaching by workers; chance find procedures; H&amp;S including use of PPE etc.</p> <p>24. Document retain records of all training activities.</p>			
Detailed design and updates to ESIA	Minimize land use change	<p>25. Contractors to ensure that detailed designs reflect the requirements of the ESIA/EMP and international engineering best practice/good EHS practice including site-specific measures where these are required</p> <p>26. Finalize access road alignments, stream crossing and the number and location of culvert</p> <p>27. conduct a detailed structural assessment of load carrying capacity of existing bridges and if required provision for upgrade of the bridges to accommodate project vehicles in consultation with Department of Surface Transport and the Gewog</p> <p>28. Identify suitable muck disposal sites for road construction</p> <p>29. Follow the Guidelines for Environment Friendly Road Construction (EFRC)" issued by the Department of Roads (2019)</p>	PMU / PIAC	PMU	<ul style="list-style-type: none"> <li>- Land Use certificate</li> <li>- No objection provided for the locations of contractor facilities</li> <li>- Number of diverters and insulation incorporated into design</li> <li>- ESIA updated as required to reflect detailed design and any unanticipated impacts and reviewed and cleared by ADB prior to the start of related works</li> <li>- Finalized detailed for access road alignment</li> <li>- Confirm and assess suitability of muck/soil disposal sites and include in updated ESIA.</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		<p>30. Identify gradient management needed at certain points to ensure safe and efficient transportation.</p> <p>31. Ensure provision of proper engineering solutions to enhance road usability and safety.</p> <p>32. At Take Off points from highway, gewog and farm roads, maintain adequate buffer for future road widening and safety as per Road Act 2013 and the conditions of the Department of Surface Transport.</p> <p>33. Follow BMP to minimize impacts beyond the RoW for both TL and access roads.</p> <p>34. Through design, ensure the vegetation clearance and slope cutting is kept to the required minimum as per DOFPS requirements</p> <p>35. Include measures in design to mitigate impact on birds, see BMP</p> <p>36. Align roads as much as possible so that these are co-located within the RoW to reduce project footprint and where possible, minimize number of permanent roads</p> <p>37. Locate site contractor facilities (site offices, storage sheds, worker camps), away from communities and sensitive receptors and on already disturbed, degraded or non-productive land.</p>			<ul style="list-style-type: none"> <li>- Include meeting minutes of community consultations in updated ESIA</li> </ul>
Construction EHS management planning		<p>38. Contractor to develop Contractors site-specific Environmental Management Plans (CSEMPs) and H&amp;S Plans including all subplans as required by the EMP to be approved by BPC in line with IFC EHS guidelines including the Construction and Demolition section and ILO Code of Practice. These will be living documents, to be updated as required and re-approved by PGCB as construction proceeds, if construction methods or site conditions change</p> <p>39. Facilities generating noise and dust or those that may generate sediment laden runoff or wastewater (e.g., concrete batching plant, asphalt plant, refueling areas, labor camps, maintenance yards, storage areas) must be sited at least 500m from residential property and outside</p>	Contractor	PMU/PIAC	<ul style="list-style-type: none"> <li>- CSEMPs/H&amp;S Plans and all subplans cleared and approved before work are reflective of Project EMP requirements to minimize impacts and risks on EHS during subsequent stages of the project.</li> <li>- Copies and any updates to these plans are to be attached to EMR</li> <li>- Abide by requirements set forth in Workers' accommodation: Processes and Standards: A guidance note by IFC and the EBRD (2009)</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		<p>biodiversity sites, protected areas, physical cultural resource.</p> <p>40. HSMP will contain Safe Systems of Work (e.g. PTW) / Safe Work Practices especially for high consequence activities e.g. lifting and rigging, TL stringing etc. b) risk assessment and control (high level and site/activity specific)</p> <p>41. Laydown and storage areas that are not potential pollution sources may be located a minimum of 50m distant. No land requiring extensive landfill or levelling will be used, there will be no clearance of trees/vegetation on land to be used by the contractor. Photographic record of land condition to be undertaken before any works to establish temporary facilities.</p> <p>42. Contractor to seek to locate all temporary construction facilities required including laydown and storage areas in suitable areas, non-sensitive areas as agreed to by BPC. Any use of public or private land required for temporary construction facilities will be negotiated with private landowner and submit land ownership papers and copy of agreement for temporary land use with a photographic record of pre-project condition.</p> <p>43. Sites that are waterlogged or supporting natural habitat must not be used. Drainage must be installed at all temporary facility locations to avoid waterlogging – the drainage must not exacerbate waterlogging on the adjacent land.</p> <p>44. Design of sanitation and welfare facilities at construction sites and labor camps/overnight accommodation to conform to IFC EHS general guidelines, ILO's guidance on worker accommodation and national regulation</p> <p>45. If contractors use existing or install their own borewell for construction water supply permissions will be obtained from authorities together with agreement of local communities before abstraction</p>			

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		<p>46. Contractors will use locally sourced materials as far as practical to reduce transportation, but all raw materials will be sourced only from existing licensed source</p> <p>47. Contractors to provide adequate facilities for the collection, separation, and storage of construction waste</p>			
Change in land use	The land use within the RoW and access roads will be permanently changed from forest/grazing land	<p>48. Align the roads as much as possible so that these are co-located within the RoW to reduce project footprint</p> <p>49. Ensure the vegetation clearance and slope cutting is kept to the required minimum</p> <p>50. Aside from the TL and road, site contractor facilities such as site offices, storage sheds, worker camps on already disturbed, degraded or non-productive land.</p> <p>51. Wherever possible, minimize the number of permanent roads</p> <p>52. Restore cleared and disturbed areas to original or equivalent pre-project land use</p>	Contractor / PIAC	PMU	<ul style="list-style-type: none"> <li>- Detail road design</li> <li>site inspection records of contractor facilities</li> <li>- restoration report</li> </ul>
Project design	Land acquisition	<p>53. Provide compensation to the affected people following the resettlement plan before construction commences</p>	PMU	PMU	<ul style="list-style-type: none"> <li>- Compensation completion report</li> <li>- Signed receipts</li> </ul>
Community Forest	Compensation of loss of community forest resources	<p>54. Compensate the Community Forests for loss of timber and non-wood forest products (NWFP)</p> <p>55. Provide cut trees to the respective Community Forests, if required by the CFMGs.</p> <p>56. Engage CFMG members to carry out tree felling and clearing activities, where feasible, to ensure minimum disturbance beyond the approved Right of Way (RoW); and avoid over-clearing of vegetation.</p>	PMU	PMU	<ul style="list-style-type: none"> <li>- Compensation payment receipts</li> <li>- Engagement of community forest members in tree removal</li> <li>- Receipt of trees felled by community forest</li> </ul>
Community Forest	Reduce loss of NWFP	<p>57. Map key NWFP collection areas within the Community Forest; and agreed upon with the community.</p> <p>58. Strictly prohibit workers from collecting fuelwood, timber, or non-wood forest products from Community Forests</p>	PMU/PIU	PMU	<ul style="list-style-type: none"> <li>- Through community consultation develop detailed maps of NWFP areas</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		59. Avoid removal of undergrowth, unless alternative NWFP collection areas are identified 60. Include degraded areas with the community forest for Compensatory Afforestation			
Community Forest	Compensation for removal of trees on community forest	61. Pay compensation for removal of trees on community forest	PMU/PIU	PMU/Gewog	- Degraded areas in community forest included under compensatory afforestation plan
Cultural Heritage	Determination of cultural heritage sites and practices	62. Carry out consultation and mapping to establish if there are any potentially important tangible and intangible cultural heritage that may be in use by the local community. 63. BPC will update the community on the revised project timeline and project commencement date via Gewog, 64. Minimize impacts on cultural heritage, Consultation and information dissemination	PIU/PIAC	PMU	- Attach map to EMR - Update ESIA as necessary
Employment	Provide local employment	65. Contractor will disseminate information on job opportunities or mitigation measures under subplans, prepare contracts with local communities, and keep them informed in case of any changes in project design. 66. Contractors will also discuss and agree upon tree felling sub-contracts with the community	Contractor	PIU	- Consultation record - Community contracts
Establishment of a functioning Grievance Redress Mechanism (GRM)		67. Contractor's EHS team too operationalize the informal site level GRM per ESIA to resolve and address grievances entering the formal GRM 68. Maintain record of all grievances registered, status, time taken for redressal and outcomes, etc. 69. Nominate a GRM Focal Point for each construction site who will keep affected persons and local communities informed of the status of work and be readily available onsite to receive, document and deal with grievances at site level 70. GRM to be disseminated through community meetings, one-on-one consultations, posters, leaflets, brochures,	Contractor	PIU	- Notification on establishment of the GRM and nomination of GRM focal person - Photographic evidence of GRM posters, signboards - Copies of GRM dissemination materials - Community feedback and consultation records

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		<p>SMS, or sign boards in prominent areas. Contractor to provide notice boards at all substations, construction site offices and active work sites including highly visible details of the GRM including the name, designation, contact numbers</p> <p>71. GRM will be available to all workers to receive and handle complaints about unfair treatment or unsafe living or working conditions, ensuring no coercion nor reprisal. Construction workers will be given access to register any grievances with the contractors or direct access to the GRM Focal person</p> <p>72. Contractor to carry out awareness raising among workers on the GRM at the start of employment onsite, including details on how to submit a grievance, process, and timeframes including disseminating GRM contact details on noticeboards and placing suggestion boxes at construction site offices and at employer provided staff accommodation</p>			
<p>Meaningful consultations, information disclosure and community awareness</p>		<p>73. Prepare a detailed stakeholder engagement plan for meaningful consultation with the local community</p> <p>74. Contractor to consult with and seek agreement of landowners and local communities within 500m on proposed locations for any temporary labor camps, site offices, storage areas, areas for waste management</p> <p>75. Contractor to consult with and seek agreement of local communities to temporarily use any community resources (e.g., water supplies) during construction to ensure additional demand will not place unnecessary stress on community resources</p> <p>76. Contractor to communicate at least one month prior to the commencement of works advance notice to local communities through community meetings, one-on-one consultations, posters, leaflets, brochures, SMS, or sign boards in prominent areas about the agreed schedule of and details of the planned construction works including its anticipated impacts, such as traffic disruption (road closures, diversions, including notices/signs on either end</p>	<p>PIAC/PIU</p>	<p>PMU</p>	<ul style="list-style-type: none"> <li>- Stakeholder engagement plan prepared, and ESIA (minimum of a summary of key risk, impacts and management measures) locally disclosed and accessible to affected person in a suitable language</li> <li>- Details of all consultations and awareness raising included in the EMR</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		and marking of the diversion routes) to help manage any disruption and disturbance to and potential conflicts with local communities			
<b>Construction Phase</b>					
Worker recruitment	Employment opportunities and labour management	<p>77. Ensure that bidding and contract documents include specific provisions requiring contractors to comply with all applicable labour laws and core labour standards</p> <p>78. Hire local workers to the extent possible, to benefit the local communities through employment generation and also reduce the risk from the influx of workers.</p> <p>79. Prepare a Contractor's Labor Management Plan (LMP) as a component of the CEMP.</p> <p>80. Comply with national rules for local and foreign worker recruitment, including the Handbook on Recruitment and Employment of Foreign Workers in Bhutan.</p> <p>81. Provide all workers with clear, written employment contracts with clear employment terms, detailing working hours, wages, overtime, leave, and benefits and compliance with codes of practice and standard procedures</p> <p>82. Comply with labour regulations restrictions on employment of persons below 18, forced or coerced labor, discrimination,</p> <p>83. Brief workers on gender discrimination and sexual harassment and establish as functional worker grievance redress mechanism (GRM) for workers to raise concerns regarding working conditions, terms of employment,</p> <p>84. Ensure that EMP requirements are cascaded down to all sub-contractors, regardless of whether they are formally or informally employed</p>	Contractor / PIU	PMU	- Record of local employment
Environment safeguards training and		85. Contractors to ensure workers with a specific role have, before been allocated the task, attended specialized health and safety training related that role e.g., health	PIAC/PMU	PMU	<ul style="list-style-type: none"> <li>- Training records (date, participants and topics)</li> <li>- Risk assessment report</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
awareness raising activities		<p>and safety stewards, first aiders, fire safety officers, as well as ensuring workers have received task-specific training for working at height, demolition, working with electricity, etc.</p> <p>86. Only allow suitably trained and qualified workers to work on electrical equipment and at height, these workers must have training record of attending suitable training course on electrical safety and working at height and be provided with and wear the appropriate PPE for their role.</p> <p>87. Untrained workers must not be permitted to work with either live electricity or at height. During construction site and activity specific risk assessments to be undertaken prior to the commencement of related work to identify the hazards present and applicable measures to be followed.</p> <p>88. Contractor to undertake regular, compulsory awareness raising activities for all workers related to the EMP, including short monthly EHS refresher sessions, daily toolbox talks and posting of information at construction site offices, labor camps, and all work sites etc.</p> <p>89. Contractors to conduct regular emergency preparedness and response drills involving all workers irrespective of them being formally or informally employed by contractor, subcontractor or third -party to prepare them in case of an environmental or health and safety incident including fire, spillage, natural disaster, disease outbreak, etc.</p> <p>90. Emergency preparedness and response training for construction management will include modules on first aid and fire safety including training on how to use first aid and firefighting equipment provided onsite.</p> <p>91. All construction workers to be made aware of the chance-find procedure and types of finds to be reported.</p> <p>92. Driver training to include advice on behaviour to reduce the potential for disturbance</p>			<ul style="list-style-type: none"> <li>- Emergency Drill reports</li> <li>- Certificates of specialized positions (electricians and first aiders) and worker competency record</li> <li>- Site inspection reports</li> <li>- Chance find procedure briefings conducted.</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
Construction workers	Occupational Health and Safety	<p>93. Comply with the Regulation on Occupational Health and Safety for the Construction Industry, 2022,</p> <p>94. Prepare, as part of the CEMP a Health and Safety Management Plan (HSMP) and a Construction Emergency Preparedness and Response Plan prior to commencement of works.</p> <p>95. Ensure all staff comply with approved health and safety policies, procedures, safety programs, and work rules at all times.</p> <p>96. Provide appropriate training and supervision to all personnel,</p> <p>97. Allow only trained and certified personnel for technical work such as stringing of conductors,</p> <p>98. Clearly identify, mark, and barricade hazardous areas and trenches/excavated areas, including warning signs indicating hazards</p>	Contractor	PIU	<ul style="list-style-type: none"> <li>- Approved Health and Safety Management Plan (HSMP) and Construction Emergency Preparedness and Response Plan (CEPRP)</li> <li>- Records of worker induction and refresher trainings,</li> <li>- Site inspection reports</li> <li>- Vehicle inspection logs</li> <li>- PPE inventory and issuance records,</li> <li>- Qualified first aider(s) and trained fire marshal(s) on site</li> <li>- Displays/signage/barricades</li> <li>- Occupational injury and illness register, including reporting and compensation records</li> </ul>
Natural Hazards and Disasters	Minimize risk of damage to Project facilities due to natural hazard and disasters	<p>99. Integrate disaster-resilient design standards (seismic design, slope stability criteria, drainage capacity) for all tower locations along with slope protection structures based on site specific assessments.</p> <p>100. Ensure safe setbacks from rivers, streams, and steep slopes.</p> <p>101. Strengthen coordination between Dzongkhag, gewog, Royal Bhutan Police (for firefighting) and BPC for emergency preparedness in case the need arises.</p>	PIU/PIAC	PMU	<ul style="list-style-type: none"> <li>- Assessment reports</li> <li>- Design standards</li> <li>- Coordination meetings</li> </ul>
Site Preparation & Worker Camps	Sanitary conditions, overcrowding, disease risk, and environmental degradation from camps.	<p>102. Ensure that bidding and contract documents include specific provisions requiring contractors to comply with all applicable labour laws regarding provision of weather proof (rain, wind and cold), climate suited worker accommodation with safe drinking water, lighting and sanitation facilities, safe from wildlife and away from steep slopes (landslide risk) and at least 30m from river banks and as per IFI or GIP guidelines</p>	Contractor/PIAC/PIU	PMU	<ul style="list-style-type: none"> <li>- Provisions in bidding documents</li> <li>- Assessment reports</li> <li>- Number of rented houses/apartments</li> <li>- Worker Accommodation Plan</li> <li>- Accommodation inspection report</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		<p>103. Where feasible, explore the option of renting existing homes/ buildings for offices and accommodation to minimize the project footprint and associated environmental disturbance.</p> <p>104. Contractors will prepare a Worker Accommodation Plan especially because teams will need to move from one location to another.</p> <p>105. Worker and labor accommodation must be weather proof and able to withstand cold conditions, snow or heavy rainfall.</p> <p>106. Locate camps on existing clearings or disturbed areas and within the RoW</p> <p>107. Use prefabricated, containerized, or modular units that can be assembled and dismantled with minimal foundation</p> <p>108. Design camps to be fully relocatable as work progresses.</p> <p>109. Equip camps with fire extinguishers and ensure that there is adequate water storage tanks.</p> <p>110. Use above-ground, temporary water and power connections that can be removed without trenching</p> <p>111. Provide portable toilets or containerized septic units with sealed holding tanks or compact soak systems, or construct pits with liners to prevent seepage into forest soils.</p> <p>112. If camps are not movable then these must be design based on ILO<sup>[1]</sup> or EBRD/IFC, and national standards (Temporary Living Accommodation Standards in the Bhutan Schedule of Rates 2024/25) to ensure adequate habitable spaces, sanitation facilities, waste management, fire protection and control and other welfare requirements.</p> <p>113. Require camps to be fully dismantled and relocated once work at a particular site is completed.</p>			<ul style="list-style-type: none"> <li>- Camp location and facilities (type of sanitation facilities, water storage facilities,</li> <li>- Fire extinguishers</li> <li>- Inspection report</li> <li>- Abide by requirements set forth in Workers' accommodation: Processes and Standards: A guidance note by IFC and the EBRD (2009</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		114. Conduct a joint inspection with the Forest Range Office prior to demobilization sign-off.			
Worker recruitment and management	Risk of discrimination against workers, employment of underage workers, harassment, and inadequate access to grievance redress mechanisms.	115. Comply with national rules for local and foreign worker recruitment, including the Handbook on Recruitment and Employment of Foreign Workers in Bhutan. 116. Prohibit employment of persons below 18 years of age. 117. Ensure gender-sensitive employment, including equal pay for equal work. 118. Brief workers on gender discrimination and sexual harassment. 119. Prepare and implement a Labour Management Plan (LMP) prior to mobilization. 120. Define employment terms, including working hours, wages, overtime, leave, and benefits. 121. Ensure non-discrimination and equitable treatment of all workers. 122. Include measures to prevent harassment, exploitation, and GBV. 123. Establish a worker grievance redress mechanism.	Contractor/PIU	PMU	<ul style="list-style-type: none"> <li>- Approved Labour Management Plan (LMP)</li> <li>- Worker recruitment records and Worker contracts</li> <li>- Records of worker induction and training</li> <li>- Functional Worker Grievance Redress Mechanism and worker grievance logs</li> <li>- Site inspection reports on labor conditions and worker welfare</li> </ul>
Occupational Health and Safety (OHS)	Risks from steep terrain, machinery rollover, ropeways operation, excavation, electrical hazards, and natural hazards	124. Prepare and implement, as part of the CEMP, a Health and Safety Management Plan (HSMP) and a Construction Emergency Preparedness and Response Plan prior to commencement of works. The HSMP must take into consideration the Regulation on Occupational Health and Safety for the Construction Industry 2022. 125. Prohibit child labor; no person under the age of 18 shall be employed or engaged in project activities, including at solar power plant sites. 126. Ensure all staff comply with approved health and safety policies, procedures, safety programs, and work rules at all times. 127. Provide appropriate training and supervision to all personnel, particularly those working on or near HV and	Contractor / PIU	PMU/ DOL	<ul style="list-style-type: none"> <li>- Approved Health and Safety Management Plan (HSMP) and Construction Emergency Preparedness and Response Plan (CEPRP)</li> <li>- Records of worker induction and refresher trainings,</li> <li>- Site inspection reports</li> <li>- Vehicle inspection logs</li> <li>- PPE inventory and issuance records,</li> <li>- Qualified first aider(s) and trained fire marshal(s) on site</li> <li>- Displays/signage/barricades</li> </ul>

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		<p>LV electrical equipment, including ancillary workers such as panel cleaners.</p> <p>128. Allow only trained and authorized personnel to install, operate, maintain, or repair electrical equipment.</p> <p>129. Clearly identify, mark, and barricade hazardous areas and equipment, including warning signs indicating electrical hazards and wiring sequences.</p> <p>130. Install safety signboards and symbols at all high-risk locations to alert workers and third parties.</p> <p>131. Maintain construction areas in good condition to ensure safe movement of vehicles and workers</p> <p>132. Ensure vehicles operate are fitted with functional horns, reverse alarms, lights, and mirrors.</p> <p>133. Provide all workers (direct, subcontracted, formal, or informal) with appropriate PPE, along with training on correct use, care, and maintenance, in accordance with IFC EHS Guidelines.</p> <p>134. Enforce PPE use through a disciplinary system, including removal from site for repeated non-compliance.</p> <p>135. Provide N95 dust masks or equivalent to workers exposed to vehicle exhaust, dust, and earthworks.</p> <p>136. Install fire extinguishers and firefighting equipment at all work sites and ensure these are checked and refilled as required.</p> <p>137. Ensure a qualified first aider and trained fire marshal are present on-site during construction activities. Emergency contact number and details for medical, fire, etc. are to be displayed in all construction site</p> <p>138. Construction workers to be given medical checkup per statutory requirements before being allowed on site; medical records are to be maintained by the contractor's labor officer</p>			<p>- Occupational injury and illness register, including reporting and compensation records</p>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		<p>139. Ensure all workers are aware of the and key contact numbers for staff as well as emergency numbers (ambulance, hospital)</p> <p>140. Keep a well-stocked first aid kits are at all work locations.</p> <p>141. Provide transport arrangements to the nearest healthcare facility, including ambulance services for serious emergencies.</p> <p>142. Ensure all occupational injuries and illnesses are documented, reported, and compensated in accordance with Bhutanese regulations.</p> <p>143. Maintain a log of all incidents, near-misses, and accidents, and include these records in monthly monitoring reports.</p> <p>144. Ensure good housekeeping at construction site, storage areas, staff accommodation, etc. -- to be kept neat and tidy, e.g., no materials, equipment, trash laying around, cleanup worksites so that they are free of debris on daily basis</p>			
Water requirements	Demand for water for domestic and construction purposes	<p>145. Obtain clearance for water abstraction from Gewog.</p> <p>146. Ensure water source is not blocked and repair any pipe leakages immediately.</p> <p>147. Ensure adequate water supply for domestic and construction use is arranged.</p>	Contractor	PIU/PMU	<ul style="list-style-type: none"> <li>- Water abstraction clearance</li> <li>- Grievance logs regarding water</li> </ul>
Transportation, use of construction plant, demolition and earthworks including works for temporary facilities	Safety risks on steep slopes and narrow access roads, traffic disruption	<p>148. Construction equipment and vehicles to meet national emission standards including for air and noise. A provision for a daily log sheet to document dust suppression activities,</p> <p>149. The use of horns in areas where sensitive receptors are located (houses, schools, clinics, mosques, etc.) will be prohibited.</p> <p>150. Regularly check and maintain construction equipment and vehicles to keep them in good working order</p>	Contractor	PMU	<ul style="list-style-type: none"> <li>- Alternatives/Ropeway installation</li> <li>- Consultation records</li> <li>- Alerts on traffic disruption</li> <li>- Traffic Management Plan</li> </ul>

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		<p>151. In areas where the terrain is too difficult and inaccessible for standard machinery mobilization, contractors will explore ropeway options to transport items like sand and aggregates.</p> <p>152. The contractor must consult local representatives during mobilization to identify if there are any water channels/pipelines that may be damaged and</p> <p>153. Traffic Management plan to manage traffic flow and</p> <p>154. Alert communities during traffic/road disruption</p>			
Site clearance and earthworks including works for temporary facilities		<p>155. Ensure clear demarcation of the working area and avoid encroachment outside the agreed impact area. Implement careful construction practices to avoid damage to trees.</p> <p>156. Vehicle movements to be restricted to demarcated working areas to reduce unnecessary impacts to adjacent land.</p> <p>157. Demarcation of trees to be avoided and retained as per the Tree Plantation Plan. Only marked trees are to be felled after joint verification with PMU and approval of tree list.</p> <p>158. In case tree cutting is required, PMU to secure the necessary permit from the DOFPS and schedule tree cutting/trimming outside the bird breeding season with all trees <b>checked by an ecologist</b> for nesting birds and other fauna prior to being cut. Similarly, any burrows will be checked for fauna by an ecologist before any earthworks commence.</p> <p>159. Record all trees removed during construction, (including location, species, size, and economic value) in accordance with the relevant plans and requirements.</p> <p>160. Use of herbicides or burning to clear vegetation is strictly prohibited.</p> <p>161. Minimize removal of existing vegetation and topsoil. Excavated spoil to be reused as a landscaping material.</p>	Contractor	PMU	<ul style="list-style-type: none"> <li>- Tree removal permit and record of trees removed</li> <li>- Tree plantation plan</li> <li>- Report on soil quantities reused and disposed</li> <li>- Site inspection report</li> </ul>

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		<p>162. Topsoil disturbed will be separately stored and used to restore exposed surfaces which will be promptly revegetated with native species including areas used for temporary construction facilities</p> <p>163. Topsoil storage areas will be protected from vehicle movements to avoid soil compaction.</p> <p>164. Carry out works during the dry season to minimize soil erosion and sedimentation and in wet conditions minimize the use of heavy machinery.</p> <p>165. Consideration of the temporary use of removable steel plates to protect soil and its vegetation cover especially in locations that are subject to being waterlogged.</p> <p>166. Strict prohibition of cutting of fuelwood or timber for cooking and heating by the construction workers. Contractor to provide alternative fuel source (e.g., kerosene/LPG) which will be stored safely. Trainings will be provided to workers on identification of threatened species, dos and do</p> <p>167. Stockpiles of spoils and other dust generating materials to be kept to a minimum. Cover stockpiles with tarpaulin. Locate stockpiles as far away as possible from residential property to avoid inconvenience from fugitive dust and from waterbodies to minimize pollution.</p> <p>168. Ensure soil is enclosed by a solid fence or equivalent to avoid windblown dust and sediment laden runoff entering waterbodies.</p> <p>169. Minimize double handling and drop loads.</p> <p>170. Remove materials that have the potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used onsite cover, seed or fence stockpiles to prevent wind whipping</p> <p>171. Trucks transporting any loose materials or loose spoil from construction sites to local approved disposal sites will be covered with tarpaulin to reduce dust.</p> <p>172. Position any stationary emission sources (e.g. diesel generators, compressors, etc.) as far as practical from</p>			

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		<p>sensitive receptors (houses, schools, clinics, mosques, etc.)</p> <p>173. Only use cutting, grinding, or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays. Impose speed limits on construction vehicles to minimize exhaust and dust emissions along areas where sensitive receptors are located (houses, schools, clinics, mosques, etc.) – 10km/hr on site and 30km/hr on unpaved roads otherwise per the national limits.</p> <p>174. Clean dust from access roads daily and then once after all construction work is completed. Strictly prohibit the burning of waste generated by project-related activities.</p> <p>175. Ensure workers working near or having long exposure to vehicle exhausts and earthworks are provided with clean N95 dust masks to avoid inhalation or particulate matter and other pollutant</p>			
Biodiversity risks and impacts	See Biodiversity Management Plan and Biodiversity Action Plan				
Soil & Water Resources	Soil erosion, sediment runoff into streams (Tang Chhu, Chamkhar Chhu), and water contamination.	<p>176. Develop and implement Sediment management Plan.</p> <p>177. Maintain a 30m buffer from all rivers and 15m from streams respectively.</p> <p>178. Schedule earthworks during the dry season to minimize erosion by surface water runoff.</p> <p>179. Install silt fences (semi-permeable geotextile) along permanent streams or water bodies to prevent runoff.</p> <p>180. Restrict discharge of sediment laden surface water runoff directly into surface water.</p> <p>181. No wastewater will be discharged direct to surface waterbodies or groundwater without adequate treatment. Use of pit latrines is prohibited as is open defecation and urination.</p> <p>182. Provision of adequate onsite sanitation facilities including connection to existing sewerage system linked to a wastewater treatment plant, septic tanks with soak-</p>	Contractor	PMU / DECC	<ul style="list-style-type: none"> <li>- Sediment Management Plan</li> <li>- Water quality test results (turbidity, TSS)</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		<p>aways or alternative temporary sanitary facilities that do not allow untreated disposal of sewage to adjacent water bodies e.g., portable toilets where the wastewater generated is enclosed in a container and will later be taken offsite for wastewater</p> <p>183. Provide spill prevention kits (sorberent pads, loose sorberent material, etc.) at storage areas and other at-risk locations within clearly labelled containers to immediately confine any spills or leaks that occur.</p> <p>184. Provision of designated hard standing areas for equipment servicing, refueling and wash down at least 50 m from surface water and groundwater wells, with drainage directed through oil and grease interceptors before being discharged into a settling pond prior to discharge offsite.</p>			
Noise and disturbance	Disturbance due to blasting	<p>185. Follow silent/controlled blasting techniques that minimize vibrations, dislodging fragmentation of rock fragmentation.</p> <p>186. Comply with the Explosives Rules, 1989 in terms of permits, procurement, transportation, storage, security personnel, safety precautions, maintenance of records and blasting procedures. This includes ensuring that a competent person/blaster with a shotfirer's certificate and experience in preparing and carrying out blasting work is utilized.</p> <p>187. Ensure the safety of all blasters through proper provisioning of the requisite PPE.</p> <p>188. Ensure the safety of other workers during blasting operation through use of warning signs and audible signals before the commencement of blasting.</p>	Contractor	PMU/PIU	<ul style="list-style-type: none"> <li>- Blasting plan</li> <li>- Record of blasting materials and usage</li> <li>- Storage of blasting materials</li> <li>- Certification of blaster</li> <li>- Safety measures undertaken during blasting</li> </ul>
	Influx of workers, vegetation clearance, use of machinery, vehicles and material transporting trucks	<p>189. Prior information on work scheduling will be provided to the local representative to be shared with the community</p> <p>190. The Contractor Representative (Liaison Person) will be available on-site, and their contact details will be</p>	Contractor	PMU/PIU	<ul style="list-style-type: none"> <li>- Notification on work schedules</li> <li>- GRM records related to traffic, noise, or access disruption</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
	and access road construction	<p>provided to the local representative. This will allow residents to lodge any grievances to the contractor.</p> <p>191. All construction equipment must be kept in good working condition.</p> <p>192. All vehicles and equipment shall be turned off when not in use.</p>			<ul style="list-style-type: none"> <li>- Equipment maintenance logs and idling-control checks</li> <li>- Site inspection reports on traffic and access management</li> </ul>
Community Health and Safety	Risk from Blasting activities	<p>193. Report any loss or theft of explosives immediately to the permit issuing authority and to the nearest police station.</p> <p>194. Immediately remove all remaining explosives from the site upon completion of blasting.</p> <p>195. Prepare Emergency Preparedness and Response Plan and follow emergency procedures to evacuate injured persons immediately to a health facility in case of accidents.</p> <p>196. Inform the community when the blasting work is going to commence so that all are aware about this and place an alarm prior to blasting work</p>	Contractor	PMU/PIU	<ul style="list-style-type: none"> <li>- Blasting permits and blasting record/log</li> <li>- Shotfirer/blaster certification and PPE records</li> <li>- Community notification record</li> <li>- Incident or complaint records related to blasting activities</li> <li>- Blasting Management Plan</li> </ul>
Community Health and Safety	Social conflict, spread of disease, traffic risks to pedestrians/children.	<p>197. Screen all foreign workers for communicable diseases (HIV/AIDS, TB, malaria, dengue) at entry.</p> <p>198. Conduct orientation for workers on local culture and sexual harassment/abuse.</p> <p>199. Prepare and require workers to follow Code of Conduct</p> <p>200. Conduct consultations with communities regarding construction schedules and worker influx. Warn community/children of traffic risks</p> <p>201. Place clear warning signs on access roads and at worksites to alert the public to construction and potential hazards.</p> <p>202. Install physical barricades at active construction sites to keep out the public, animals, and vehicles.</p>	Contractor	PMU/PIU / Gewog Administration	<ul style="list-style-type: none"> <li>- Training attendance sheets</li> <li>- GRM dissemination and grievance logs</li> <li>- Consultation minutes</li> <li>- Approved Code of Conduct</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		<p>203. Enforce safe driving, including adhering to project-specific speed limits, especially in settlements and on village roads</p> <p>204. Establish a GRM and share GRM procedures and contact details via accessible channels (e.g., notice boards, meetings, social chat channels) for rapid and effective community response</p>			
Air Quality & Dust	Dust from excavation/transport; Exhaust emissions (NOx, CO) from machinery.	<p>205. Establish and enforce vehicle speed limits appropriate to road conditions (e.g., maximum of 20 km/h on unsurfaced roads) to minimize dust generation.</p> <p>206. Cover trucks transporting loose or fine materials (e.g., sand, soil, aggregates) and spoil with tarpaulin to prevent dust emissions and spillage during transport.</p> <p>207. Carry out dust suppression through regular sprinkling of water at excavation sites, haul roads, and other dust-prone areas, particularly during dry and windy conditions.</p> <p>208. Keep stockpiles of soil, aggregates, and waste materials covered to prevent wind-blown dispersal and erosion during rainfall, and locate them away from adjacent properties where practicable.</p> <p>209. Ensure routine maintenance of all construction machinery and transport vehicles in accordance with manufacturers' specifications. Maintenance records shall be kept in a logbook and made available for inspection at least once every two months.</p>	Contractor	PMU/PIU	<ul style="list-style-type: none"> <li>- Vehicle maintenance log</li> <li>- Visual inspection of dust suppression</li> </ul>
Air Quality & Dust	Deterioration of air quality due to operation of excavators and material and worker transporting vehicles	<p>210. All construction equipment, vehicles, and stationary sources (including diesel generator sets) must be regularly serviced and maintained in good working condition in accordance with manufacturer specifications, must pass applicable emission tests, and must have maintenance recorded in logbooks.</p> <p>211. Avoid unnecessary idling of vehicles and machinery.</p> <p>212. Diesel generators used as power sources must comply with Bhutanese emission standards and good</p>	Contractor	PMU/PIU	<ul style="list-style-type: none"> <li>- Vehicle service log</li> <li>- Air quality monitoring reports</li> <li>- Site inspection report</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		<p>international industry practice, including appropriate stack-height design</p> <p>213. Instruct staff and workers to avoid burning of waste .</p> <p>214. Construction activities shall comply with national ambient air-quality standards 2020 and WHO guidelines for TSPM, PM<sub>10</sub>, and PM<sub>2.5</sub> at nearby receptors; additional mitigation measures shall be implemented if exceedances are detected.</p>			
Traffic risks	Increase in traffic along narrow routes will increase traffic and heighten risk of accidents for school children and risk of damaging roads.	<p>215. Prepare and implement a Traffic Management Sub-Plan, avoiding peak traffic and school hours.</p> <p>216. Document pre-project road conditions and restore any construction-related damage at contractor's cost.</p> <p>217. Provide advance notice to communities on increased traffic and road-safety risks to children.</p> <p>218. Enforce speed limits, regular vehicle maintenance, and use of back-up warning sirens.</p> <p>219. Inform communities of the GRM for traffic, road damage, or access-related grievances.</p>	Contractor	PMU/PIU	<ul style="list-style-type: none"> <li>- Approved Traffic Management Sub-Plan</li> <li>- Report on pre-construction road condition</li> <li>- Prior notification to community</li> <li>- Number of road/property damage incidents recorded</li> </ul>
Waste Management	Pollution from construction debris, sewage, and hazardous waste (oil/grease).	<p>220. Comply with the Waste Prevention and Management Act of Bhutan, 2009 and Regulation, 2012 (amended 2016), Applicable EHS Codes of Practice, IFC EHS General Guidelines – Waste Management and Hazardous Materials Management and the Basel Convention for any transboundary movement of hazardous waste</p> <p>221. Prepare a Solid and Hazardous Waste Management Sub-Plan as part of the Construction Environmental Management Plan (CEMP) prior to commencement of works. The Sub-Plan must consider the existing capacity of Dzongkhag waste disposal facilities. The plan must cover waste minimization, segregation, collection, storage, transport, reuse, recycling, and final disposal for excavated and construction waste, scrap metals and packaging waste, domestic and biodegradable waste and hazardous waste (used oil, grease, contaminated soil, chemical containers). The plan shall apply to all construction sites,</p>	Contractor	PMU/PIU / DECC	<ul style="list-style-type: none"> <li>- Waste Management Sub-Plan</li> <li>- Site inspection report</li> <li>- Waste disposal documentation</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		<p>tower locations, access roads, pulling stations, and temporary workers' camps.</p> <p>222. Establish a segregated waste collection system prior to construction especially at the worker camps so that waste is not mixed with hazardous waste.</p> <p>223. Brief workers on waste segregation and fines for indiscriminate disposal of waste. Apart from organic waste which can be dumped into pits and covered with soil all other waste must be taken out of the project site to either recycling agents, scrap dealers or to the waste disposal site.</p> <p>224. All waste shall be stored in designated and secure area using appropriate containers (bins, drums, or cement bags) in a secure area to prevent these being opened by wildlife or blown off due to strong winds.</p> <p>225. Hazardous waste must be stored in a secure, roofed area with an impermeable floor, such as plastic. Bunds will be installed to hold 110% of the largest container of liquid hazardous wastes, integrity checks of bunds, drains, and impermeable floors</p> <p>226. For off-site storage and disposal, the contractor must consult the District Environment Officer and make disposal plans accordingly.</p> <p>227. Spill response kits (absorbent pads, sand, containers) shall be maintained at all fuel and hazardous material storage locations. In the event of spills, immediate cleanup must be undertaken and contaminated materials must be treated as hazardous waste</p> <p>228. Contractor must instruct staff and workers to avoid burning of waste</p>			
Physical Cultural Resources	Damage to religious sites or chance finds during excavation.	<p>229. BPC will brief contractors on avoiding/minimizing impacts on physical and cultural heritage (including religious sites, sacred landscapes, and associated practices) during the pre-bid meeting.</p> <p>230. The Contractor must:</p>	Contractor	PMU/PIU / DoCDD	<ul style="list-style-type: none"> <li>- Chance Find Procedure</li> <li>- Incident reports</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		<ul style="list-style-type: none"> <li>• Integrate cultural heritage protection into the CEMP, specifically avoiding disturbance during the Dorjitse Tsechu (October) and minimizing impact on sacred water sources (Menchhu, Drupchhu).</li> <li>• Brief workers on sacred sites/local beliefs, stressing prevention of damage, pollution, noise, and disturbance to areas considered abodes of deities/spirits.</li> <li>• Avoid establishing camps/storage within 50m of cultural structures.</li> <li>• Install barricades/access controls near cultural structures to prevent unauthorized entry/disturbance.</li> <li>• Strictly prohibit workers from touching, removing, damaging cultural items, or polluting water bodies (Drupchhu, Menchhu) near tower locations.</li> <li>• Engage with local communities/religious authorities to share schedules, agree on mitigation, and identify required "no-work" days during religious events.</li> <li>• Ensure personnel/transporters avoid blocking access roads to Dorjitse Monastery, especially during the <i>Dorjitse Lamai Kuchoed</i> prayer festival due to increased traffic.</li> </ul> <p>231. In case of discovery of a chance find, (archaeological, historical, cultural, religious objects, or graves) during the excavation, the following steps must be undertaken by the contractor and BPC;</p> <p>232. Upon detection of any chance find, the contractor must immediately stop all activity within 30m of the find and immediately notify the supervisor onsite and the BPC. No construction is to be carried out by the Contractor until notified by BPC.</p> <p>233. The BPC in turn will document the chance finds and inform the Department of Department of Culture and Dzongkhag Development, Ministry of Home Affairs of the discovery immediately to avoid delay in the construction work.</p> <p>234. The Department of Culture and Dzongkhag Development (DoCDD) may provide their assessment from the photo</p>			

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		<p>documentation or conduct in-person site assessment to assess the chance find in detail and relay appropriate instruction to BPC/</p> <p>235.BPC must ensure that there are no delays in the verification process or in notifying the contractor of the procedures to be followed based on the assessment by the DoCDD</p> <p>236.BPC must monitor to ensure that the instruction given by the DoCDD is carried out correctly.</p> <p>237.No works will resume until clearance is provided by the Department of Culture, MoHA and BPC permits works to resume.</p>			
Site reinstatement including of temporary facilities	Risk that construction sites not restored or cleaned up and workers still remain onsite	<p>238.Upon completion of all work, dismantle all offices, storage sheds, worker camps</p> <p>239.Ensure the entire site is cleaned up, and remove construction materials and debris and dispose these at an approved disposal site</p> <p>240.Restore disturbed sites with local/native floral species</p> <p>241.Repair any damaged roads or property</p> <p>242.Ensure that all foreign workers are repatriated upon completion of work as required by the Labor Regulation.</p> <p>243.Provide a photographic record will have been made of the pre-construction condition of land used for temporary facilities before construction to inform the reinstatement works. After completion of the construction work any temporary structures will be completely removed and the temporary land will be restored to its earlier condition with all waste being removed</p> <p>244.All spoil and construction waste and scrap material must be removed on the completion of works and temporarily disturbed sites restored back to their earlier condition. Roads and footpaths utilized to be cleaned and restored back to their previous condition satisfactorily to the community which is using them</p>	Contractor	PMU/PIU	<ul style="list-style-type: none"> <li>- Work completion and closure report</li> <li>- Restoration and handover certificate</li> <li>- Site inspection report</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
<b>Operation Phase</b>					
TL operation	Ongoing vegetation clearance within RoW	245.Undertake selective trimming only; avoid unnecessary tree felling; comply with forestry clearance conditions	PMU/PIU	PMU	- Maintenance reports
Worker Health and Safety	Electrocution risk, risk of wildlife encounter	<p>246.Fit transmission towers with anti-climbing devices (e.g., barbed wire) to prevent unauthorized access.</p> <p>247.Install and maintain clear warning signage, including voltage information, at hazardous locations.</p> <p>248.Ensure plant access control and security measures are in place to keep people away from danger areas.</p> <p>249.Include electrical safety requirements in the project's Safe Systems of Work (SSoW) and ensure staff comply with all safety policies, procedures, and work rules.</p> <p>250.Ensure all staff involved in electrical works are trained, competent, and adequately supervised, and that other personnel working nearby are informed of potential hazards.</p> <p>251.Require all electrical works to be conducted under a Lockout–Tagout (LOTO) system, with circuits tested to confirm a zero-energy state before work begins.</p> <p>252.Provide mandatory induction and refresher training for workers on:</p> <p>253.Working in remote and forested locations;</p> <p>254.Operation and maintenance procedures; and</p> <p>255.Emergency response and wildlife awareness.</p> <p>256.Prohibit maintenance work during unsafe weather conditions, including heavy rain, snow, or windstorms.</p> <p>257.Provide and enforce use of appropriate Personal Protective Equipment (PPE) for all repair and maintenance activities.</p>	PMU/PIU	PMU	<ul style="list-style-type: none"> <li>- Visual inspection of towers</li> <li>- Safety audit reports</li> <li>- Maintenance logs</li> <li>- Worker briefing reports</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		<p>258. Clearly mark hazardous areas and equipment, with signage visible to workers, visitors, and third parties.</p> <p>259. Maintain first-aid kits at all worksites and ensure transport arrangements to the nearest healthcare facility are available at all times.</p> <p>260. Display emergency contact numbers prominently at work locations.</p> <p>261. Require prompt reporting of all accidents, injuries, spills, environmental incidents, and near-miss events to the site-in-charge for investigation and corrective action.</p>			
Community health and safety	Community safety risks from live conductors	<p>262. Restrict public access to TL towers through fencing, anti-climbing devices, and locked gates, where applicable.</p> <p>263. Contractor is responsible for ensuring H&amp;S of everyone on construction site including visitors and sub-contractor workers regardless they have been formally or informally employed</p> <p>264. Install and maintain clearly visible warning signage in local language(s) at towers, access points, and high-risk locations.</p> <p>265. Conduct regular inspection and maintenance of TLs, towers, and Right of Way (RoW), including vegetation management, to prevent electrical faults and fire hazards.</p> <p>266. Implement a fire prevention and response protocol, including coordination with local authorities for rapid response in the event of electrical fires.</p> <p>267. Inform and sensitize nearby communities prior to operation on electrical safety risks, restricted activities within the RoW, emergency contacts, and the project's Grievance Redress Mechanism (GRM).</p> <p>268. Promptly address any reported safety concerns or incidents through corrective actions.</p>	PMU/PIU	PMU	<ul style="list-style-type: none"> <li>- Warning signs installed and maintained (</li> <li>- Site inspection records</li> <li>- Awareness programs participant list/attendance sheet</li> <li>- Safety related incidents</li> <li>- Record of corrective actions</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
Access roads	Risk of illegal tree felling and poaching	<p>269. Inform and sensitize local communities on the purpose and necessity of closing temporary access roads after construction.</p> <p>270. Physically close and rehabilitate temporary roads that are no longer required for operation and maintenance.</p> <p>271. Coordinate with the Gewog Administration and relevant authorities to restrict access and prevent use of closed roads by unauthorized persons.</p> <p>272. Install barriers (gate/soils or rock piles) and signage at closed access points to deter illegal entry.</p> <p>273. Support periodic monitoring and joint patrols, where feasible, with local authorities and CFMGs</p>	PIU	PMU	<ul style="list-style-type: none"> <li>- Road closure notification</li> <li>- Briefing/meeting attendance list</li> <li>- Inspection and monitoring reports</li> <li>- Number of temporary access roads physically closed and rehabilitated</li> <li>- Reports of illegal activities</li> <li>- Meeting records</li> </ul>
Tower and TL	Risk of damage due to natural hazards and disasters	<p>274. Conduct regular inspection and maintenance of towers, foundations, slopes, and drainage structures, particularly before and after the monsoon season.</p> <p>275. Establish and implement an Emergency Preparedness and Response Plan, including procedures for extreme weather events and natural disasters.</p> <p>276. Strengthen coordination with Dzongkhag, Gewog, Royal Bhutan Police, and other relevant authorities for emergency response and disaster management.</p> <p>277. Suspend maintenance activities during high-risk weather conditions and resume work only when conditions are safe.</p>	PIU	PMU	<ul style="list-style-type: none"> <li>- Routine inspection and maintenance reports</li> <li>- Approved Emergency Preparedness and Response Plan (EPRP)</li> <li>- Records of coordination meetings with Dzongkhag/Gewog/RBP</li> </ul>
<b>Decommissioning Phase</b>					
Decommissioning works	Worker health and safety risk	<p>278. Workers will be required to follow standard procedures during decommissioning, provided with PPE and appropriate safety briefings</p> <p>279. Contractors shall use only qualified and certified personnel for decommissioning works.</p>	Contractor	BPC	<ul style="list-style-type: none"> <li>- Records of worker induction and refresher trainings,</li> <li>- PPE inventory and issuance records,</li> <li>- Worker qualification</li> <li>- Occupational injury and illness register, including reporting and compensation records</li> </ul>

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
	Waste Generation	<p>280. Follow the 3Rs principle (Reduce, Reuse, Recycle) shall be applied to minimize overall waste generation and maximize recovery of recyclable materials such as steel, aluminum, and copper.</p> <p>281. Segregate all wastes generated from dismantling activities into biodegradable and non-biodegradable waste streams.</p> <p>282. Collect all recyclable materials, store these safely in temporary storage areas, and transport to licensed scrap dealers or recycling companies</p> <p>283. Restrict workers from carrying out open burning, uncontrolled dumping, or burial of waste, particularly within forest areas or near water bodies</p>	Contractor	BPC	<ul style="list-style-type: none"> <li>- Inspection and monitoring reports</li> <li>- Waste disposal report</li> </ul>
	Completion of Decommissioning Works and Site Restoration	<p>284. Upon completion of decommissioning works, all labor camps, site offices, storage yards, and ancillary facilities will be fully dismantled and removed from the site.</p> <p>285. Disturbed areas will be restored using appropriate bio - engineering and native vegetation planting to promote natural regeneration and slope stabilization.</p> <p>286. Temporary access tracks will be rehabilitated unless otherwise agreed with landowners or relevant authorities.</p> <p>287. The restored areas will be protected from further disturbance to allow vegetation to establish.</p>	Contractor	BPC	<ul style="list-style-type: none"> <li>- Site inspection report</li> <li>- Area restored and regeneration success</li> </ul>

## D. Biodiversity Management Plan

609. This BMP details all the mitigation requirements necessary to avoid and minimize impacts on biodiversity and restore it to its natural conservation value post-construction. The BMP should be read in conjunction with the Environmental Management Plan (EMP), which outlines all non-biodiversity-related mitigation measures. The measures included in this BMP should therefore be implemented alongside and in addition to those required as part of the EMP.

610. The BMP should also be read in conjunction with the BAP. The BAP goes beyond the avoidance and mitigation of this BMP and details the additional conservation actions and offsets for biodiversity, particularly WCNP, Natural Forest Habitat and large birds vulnerable to possible collision with the new TL.

611. The BMP has been prepared following the assessment of potential impacts and relevant and associated mitigation measures as defined in the Environmental and Social Impact Assessment (ESIA) and the ecological data presented in the Critical Habitat Assessment (CHA). The BMP collates all the biodiversity mitigation actions into a single document and introduces how they must be implemented during pre-construction, construction and operation, including who is responsible for each action and how their success will be monitored.

### BMP Aims and Objectives

612. The aim of this BMP is to detail the full range of project management, conservation activities and monitoring requirements, including mitigation measures designed to avoid and reduce identified adverse impacts to biodiversity because of the Project and restore habitats, where relevant. It will address:

- **Actions needed** - describes the biodiversity mitigation actions needed to avoid and reduce anticipated impacts on biodiversity and restore habitats, where relevant.
- **Roles and responsibilities** - detail who is responsible for carrying out each management action, and who is accountable if the action is not completed.
- **Timeframe for implementation** - confirms when actions must be carried out, including pre-construction, construction and operation.
- **Monitoring and Verification** – confirms how each action will be verified and who will independently assess and confirm its completion.

### Roles, Responsibilities and Reporting

613. Defining clear roles and responsibilities is essential if the mitigation actions are to be successfully implemented. Clarity will help each individual, team or organization involved understand their specific duties, encourage effective coordination and communication and manage risks. Project roles and responsibilities are summarized above, and the person(s) or organization responsible for implementing the action and the person(s) or organization accountable for the action (i.e. ultimately responsible and therefore with a duty of care to independently assess and check the work is complete), are made clear in the following mitigation table.

614. Each action within the BMP is designed to address a clearly defined risk or impact to biodiversity and is therefore essential to achieving compliance and effective conservation outcomes. To ensure that actions are implemented correctly and remain effective, a structured two-stage checking process will be applied. First, the person(s) or organization responsible for delivering

each action will undertake a self-check to confirm that the activity has been completed in full and in accordance with the plan. Second, the accountable person(s) or organization will independently verify the action and document their findings.

615. Where performance is satisfactory, confirmation will be provided to those responsible and reported to the Project Management Unit (PMU). Where deficiencies or risks to biodiversity are identified, these will be escalated immediately to the PMU and, where necessary, to BPC for corrective action.

616. To support this process, the PMU will engage National Biodiversity Specialists and International Specialists to ensure adequate technical capacity, objective oversight, and sufficient independence for robust monitoring and mutual verification throughout project implementation, see Table IX-2: Biodiversity Management Plan Roles and Responsibilities.

**Table IX-2: Biodiversity Management Plan Roles and Responsibilities**

Ref	Person(s) / Organization	Overview
1	Bhutan Power Company (BPC)	Project proponent and ultimately accountable for the Project and all safeguard compliance
2	Project Management Unit (PMU)	Part of BPC with delegated authority for the management and implementation of the Project
3	Project Implementation Unit (PIU)	Part of the PMU based on Site, responsible for day-to-day management of the project
4	Project Implementation Assistance Consultants (PIAC)	External consultants providing technical guidance and overseeing compliance
5	National Biodiversity Specialist (NBS)	Independent expert within the PIAC supporting the implementation of the BMP and BAP
6	International Biodiversity Specialist (IBS)	Independent expert within the PIAC providing technical, compliance focused guidance
7	EPC Contractors and Sub-contractors	Responsible for the final design and construction of the Project
8	Department for Forestry and Protected Sites (DoFPS)	Responsible for forest clearance planning, tree removal and all reforestation activities
9	The Asian Development Bank	Project financiers

617. It can sometimes be difficult to implement biodiversity mitigation plans alongside many other competing compliance requirements, and external factors (e.g. poor weather or other environmental conditions) can also slow or adversely affect implementation. As such this BMP and the Contractor's reciprocal BMP will be managed using Adaptive Management practices.

618. Adaptive management is a structured and iterative approach to managing biodiversity risks and impacts. It recognizes that not all impacts can be fully predicted at the design stage and that management measures may need to be adjusted in response to monitoring results, new information, or unforeseen outcomes. Under the BMP, adaptive management requires that mitigation measures are regularly monitored, their effectiveness assessed, and results reviewed by the responsible and accountable parties. Where monitoring indicates that measures are not achieving the intended outcomes, or where new risks to biodiversity are identified, management actions will be promptly modified or strengthened. This process ensures continuous improvement, timely corrective action, and the sustained protection of biodiversity throughout the project lifecycle. Details are provided at the end of this BMP.

## Biodiversity Management Plan

619. Most of the impacts on biodiversity occur during construction, either directly (e.g., habitat loss) or indirectly (e.g., noise and light disturbances). Consequently, a large proportion of the effort needed for the implementation of this BMP is relevant to construction activities.

620. A list of specific avoidance and mitigation actions, and instructions on how they should be implemented and monitored is presented in Table IX-3. The details include:

- **Mitigation aim:** The aim of each mitigation measure in avoiding, minimizing or restoring impacts on Biodiversity and maintaining the conservation value
- **Action required:** Details on the specific actions required to achieve the mitigation aim
- **Project phase:** Confirmation of when during the project lifespan the activity will be undertaken
- **Responsible:** Confirmation of who, individual or organization is responsible for carrying out the required action
- **Accountable:** Confirmation of who, individual or organization is accountable, particularly if the action is not carried out to a satisfactory level
- **Verification:** Confirmation of how the action will be reviewed to ensure it has been completed to a satisfactory level
- **Key Performance Indicator:** Confirmation of what the indicator of success is for each mitigation action
- **Timing and frequency:** Confirmation of when the action will be undertaken during the project and when monitoring will be completed, and how often
- **Responsibility:** Confirmation of who is responsible for carrying out the monitoring

621. Adaptive Management requirements are presented after Table IX-3.

**Table IX-3: Biodiversity Management and Monitoring Plan**

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring				
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible	
<b>A: General Pre-Construction Actions</b>										
A1	Ensure compliance during construction	<p>The Project Management Unit (PMU) will recruit an independent, competent National Biodiversity Specialist (NBS) in full time role as part of the Project Implementation Unit (PIAC), the site-based employees of the PMU. The NBS will manage the implementation of the BMP and BAP.</p> <p>PMU to recruit an independent, competent International Biodiversity Specialist (IBS) as part of the Project Implementation Assistance Consultant (PIAC) team. The IBS will advise on the implementation of BMP and BAP. They will work closely with the Biodiversity Manager employed by the Contractor.</p> <p>The preferred candidates must be approved by both the PMU and ADB competent authorized person(s).</p>	At least three months before construction	PMU	BPC	An open, public and transparent recruitment process. Receipt of at least three applications for both roles, formal offer employment, inclusive of detailed scopes of work, and three-month management review of performance	Written and signed contracts. Completion of three months employment	One-off	BPC	
A2	Biodiversity training and awareness raising	The NBS will deliver biodiversity awareness training to all construction workers pre-construction. Construction workers will be taken to include all primary and secondary contractors (e.g. sub-contractors). The training will be compulsory and must be renewed annually. The training		NBS	IBS	Collection and review of signatory list showing attendance of workers at the awareness training	More than 90% workforce attendance at biodiversity training	Before construction, renewed annually	PMU	

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring				
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible	
		must be written by the IBS and NBS and in accordance with the project risks and opportunities. Preparation and publication of information and warning signs at site offices, worker camps, and at all work sites in forest habitat.								
A3	Verification of contractors' BMP document	Review, improve and approve the Contractors' BMP (and wider EMP), which will describe in detail how the Contractor will implement every BMP action including the precise locations and timing of all mitigation / monitoring, the persons responsible for each action, and when and how each activity will be completed, checked, and verified.	Before any construction starts on site	IBS	IBS	Publication of approved Contractor's BMP	Written approval of report by PMU and ADB competent and authorized person(s)	Once	PMU	
<b>B: Protected Areas (Wangchuck Centennial National Park and Bumthang Wetlands)</b>										
B1	Protection of Wangchuck Centennial National Park (WCNP)	Consult with the Department of Forests and Park Services (DoFPS) and the local communities to ensure construction works are undertaken in full compliance with all permits, and acknowledgement and regard for the WCNP conservation objectives and community requirements. Commit to follow the rules and regulations of the WCNP during all construction activities. Commit to avoid and minimize tree and vegetation clearance within WCNP, plan access routes to avoid	Pre-construction	PIU (NBS)	PIAC	Preparation of a work subplan for work within the WCNP to demonstrate how work will be carried out in accordance with permits, regulations and agreements with park staff and local communities.	Approval of the work subplan by WCNP staff	Throughout all works in and near WCNP	PMU	

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		vegetation and prioritize open land, plan the pylon location so that natural habitat loss is minimized. Fence/physically mark the vegetation surrounding the construction area to protect surrounding vegetation. All vegetation work to be supervised by the NBS.							
B2	Compensate for the permanent and temporary loss of vegetation from the WCNP	All trees and vegetation to be lost will be surveyed, quantified and replaced to provide an area at least equivalent to that which is removed (see Natural Habitat and Forest actions in C1-5 below for more detail)	During construction	PIU (NBS)	PIAC	Preparation of compliant baseline report. Development and implementation of a replanting strategy.	Approval of baseline report and formal acceptance of the replanting by DoFPS.	Once on approval of baseline report and on approval of replanting	DoFPS
		<i>Finalize the BAP Consult with the DoFPS and the Park Management Office, and the local communities, review all of the Park's conservation objectives and commit to financing or implementing additional conservation objectives – details are included in the BAP.</i>	<i>Pre-construction</i>	<i>PIAC (IBS)</i>	<i>PMU</i>	<i>Preparation and agreement of additional conservation actions - BAP</i>	<i>Published BAP approved by ADB competent and authorized person(s)</i>	<i>Within 6 months of construction start date</i>	<i>BPC</i>
B3	Avoid impacts to birds associated with the Bumthang Wetlands	<i>Finalize the BAP Continue Bird Vantage Point surveys to confirm the species present, their abundance and behavior near the Project area, particularly the population of Himalyan Griffon, Mountain Hawk</i>	<i>Pre-construction</i>	<i>PIAC (IBS)</i>	<i>PMU</i>	<i>Complete survey methods in accordance with best practice, completion of a compliant set of</i>	<i>Approval of the final survey report by IBS.</i>	<i>Monthly, throughout construction</i>	<i>BPC</i>

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring				
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible	
		<i>Eagle, Black-necked Crane for at least three years – details are included in the BAP.</i>				<i>surveys over the required period.</i>				
<b>C: Natural Habitat and Forests</b>										
C1	Avoid habitat loss	<p>Plan all vegetation clearance and write pre-vegetation clearance plans for all pylon locations, access roads and other infrastructure detailing exactly what will be removed, how, when and what will be retained and how.</p> <p>Design and mark the location of all pylons and access routes prior to any works commencing. Select the exact location of the pylons, the access roads and the location of all other construction activities that avoid vegetation (e.g. preferentially select the path with fewest trees). Identify natural breaks in vegetation to be used as preferred access routes.</p> <p>No construction vehicles will be permitted outside these access routes.</p> <p>Survey and record the exact number of trees and shrubs, and their species, within the construction footprint that must be removed to facilitate construction. Valuable trees must be highlighted. Record the species of each tree, its width and height, and condition (health) in the Project's Tree</p>	<p>Pre-construction and during construction</p> <p>Pre-construction and during construction</p>	Contractor	PIU (NBS)	Publication of pre-vegetation clearance plans	<p>Publication of the final Project Tree Clearance Register</p> <p>Written approval by the DoFPS (i.e. permit issuance)</p> <p>Compliance with national legislation</p>	Before any vegetation is removed	PMU	

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		<p>Clearance Register. The details will inform the nationally required compensation payment values (see below).</p> <p>Complete all pre-construction works (above actions) alongside representatives from the DoFPS, local community heads, and other relevant stakeholders.</p> <p>Commit to no vegetation removal until all above actions have been completed.</p>							
		Realign the pylon locations, access road routes or design alternative construction methods if trees that are of value to vulnerable bird species (listed in D1 below) are within the right of way (RoW) (as informed by the pre-construction bird survey).		Contractor	PIU	Ensure bird data is used to inform final design and pre-clearance wildlife checks are completed.	Approval of design by NBS.	Before any vegetation is removed	PMU
		<p>Where practical Contractors to use drone technology to undertake the stringing of the wires and avoid felling trees unnecessarily.</p> <p>Where possible raise the height of the project's towers lowest structure to ensure trees 20m in height or shorter will be retained</p>		Contactors	PIU	Finalized design detailing use of drone technology showing retention of trees where possible, and showing height of towers.	Approval of design by NBS	During works site clearance throughout construction.	PMU
		Avoid impacts to IUCN Endangered or Vulnerable tree species: <i>Taxus wallichiana</i> , <i>Acer sterculiaceum</i> , <i>Picea brachytyla</i> and <i>Populus rotundifolia</i> .		Contractors	PIU	Finalised design reflecting results of pre-construction tree surveys and showing limited	Publication of pre-vegetation clearance plans highlighting	Pre-clearance  During Construction	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		Survey the RoW and physically mark the trees of conservation concern, take GPS coordinates and ensure their presence is included in the vegetation clearance plans. Trim/pollard these species rather than fell where impacts are not completely unavoidable.				impacts to threatened species.	location of key tree species. No damage to any target trees		
C2	Minimize impact of felling and clearance of trees Minimize impact of felling and clearance of trees	Protect all retained trees, including those beyond the RoW limits and their root systems throughout the construction period by using tree tags, barrier tape, spray paint, temporary fencing and ecological supervision when clearance being undertaken. The location of protective measures will be confirmed in the pre-vegetation clearance plans. Deliver ecological toolbox talks to the vegetation clearance team at the beginning of works, whenever new staff begin on the project, and undertake monthly updates. Ensure that only the vegetation pre-approved for clearance is removed and no more.	Pre-construction and during construction	Contractor	PIU (NBS)	Continual and daily site inspection by NBS. Monthly photographs of tree protection measures at each construction site for towers/access. Review of signatory list showing presence of workers at talk	No recorded loss or damage to retained trees at each works site More than 90% worker attendance at each talk/presentation	Quarterly inspection reports	PMU
		All vegetation clearance must be phased, that is all trees and scrub must be removed in one direction either along the length of the alignment or within the 27m wide RoW from the center point,		Contractor	PIU (NBS)	Continual and daily site inspection by NBS.	Dead or injured wildlife	Quarterly inspection reports	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring				
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible	
		outwards towards the retained vegetation. This will permit all wildlife to naturally move off-site into the retained vegetation.								
		<p>Undertake a pre-removal checks for wildlife. All vegetation must be physically inspected for active birds nests, mammals, reptiles etc within 24 hours of it being removed. The checks should be repeated if there are delays in the planned clearance of more than 12 hours.</p> <p>Delay works if any rare or notable species are discovered during the pre-works check. NBS to provide support during clearance if wildlife is recorded.</p> <p>Undertake soft felling of trees, with PIU in attendance if the pre-works checks cannot confirm absence of wildlife. Soft felling of large trees involves the cutting of individual branches and slowly lowering to the ground.</p>		Contractor	PIU (NBA)	Logbook of site works at each location will include written confirmation of pre-work checks, any findings and actions taken. PMU to review and confirm satisfaction with a sample of the documentation.	No reported loss or harm of notable or rare species / dissemination findings and required amendments to contractor BMPs within the project.	Timing of site checks TBC by works site program. PMU checks and communication every 2 weeks or as needed.	PMU	
		Manually clear trees, using methods that cause minimal disturbance to the surrounding vegetation (i.e. avoiding large mechanical clearance machinery). Specific methods and techniques must be specified and approved by NBS.	During construction	Contractor	PIU (NBS)	Continual and daily site inspection by NBS. Monthly log, evidenced by photographs, confirming clearance methods used.	No unnecessary or avoidable damage to trees.	Monthly	PMU	

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		Fell and give any felled trees, dead wood and non-timber forest products (NTFP) of value to the CFMG in accordance with agreements reached during consultation with affected stakeholders.	Construction and post-construction	Contractor	PIU (NBS)	Logbook of recovered felled trees confirming handover of material by contractors to CFMGs, verified by both parties.	Published CFMG satisfaction . DoFPS approval.	Quarterly	PMU
		Collaborate with the DoFPS, Forest Offices and CFMGs, ensuring their involvement in the tree felling process.	Pre-construction	Contractor	PIU (NBS)	Consultation and written records of meetings with the Forest Offices or CFMG.	Published consultation records	Process confirmed before works start	PMU
		Reinstate all temporary works areas to their original condition, with revegetation of disturbed areas using plant species native to the area and approved by DoFPS.	Post-construction	Contractor	PIU (NBS)	Prepare generic and work site specific vegetation restoration plans, with DoFPS. Replant post-construction.	Approval of restoration plans and post-implementation report by NBS	Visual inspection of restoration sites weekly	PMU
C3	Minimize impacts to forest resources	Use non-timber sources of energy (e.g., kerosene/LPG, which will be stored in safe conditions) for cooking and heating within all construction and accommodation camps.  Prohibit construction workers entering forest area/habitat outside of their working hours, and purchase, sale, and use of firewood, timber and NTFPs, hunting and poaching of fauna by workers.	During Construction	Contractor	PIU (NBS)	Set standards for the workers with which the contractor must comply to minimize potential for unauthorized use and unintended damage of forest resources. Carry out inspections to ensure	Zero extraction of vegetation off-site without approval. Zero fires. Signatures from all works confirming 90%	Workforce training, once per person, renewed annually.	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		Conduct training sessions with workers to raise awareness of the potential impacts of worker camps on forest ecosystems.				compliance and report on findings.	attendance of awareness programs		
		<p>Remove topsoil from all project footprint areas and temporarily store in designated areas the edge of the works, away from watercourses.</p> <p>Protect the topsoil and do not mix with any other material.</p> <p>Re-deposit topsoil as soon as possible once works are completed in any area.</p> <p>Restore the original contours of the land as closely as possible.</p> <p>Regularly maintain and monitor rehabilitated areas monthly to maintain a high vegetation cover and limit soil erosion due to water runoff and wind.</p>	During construction and post-construction	Contractor	PIU (NBS)	<p>Logbook of daily activities including the dates of removal and redeposit, location of storage areas of topsoil, including photographic evidence</p> <p>Report of maintenance and monitoring of rehabilitated areas</p>	Approval of report of rehabilitated areas All topsoil replaced in-situ	Monthly	PMU
C4	Reforestation and Afforestation	<p>BPC shall formally agree and secure funding for compensatory reforestation through a Memorandum of Understanding (MoU) with the Department of Forests and Park Services (DoFPS).</p> <p>The MoU shall confirm the commitment to compensate for the clearance of 50.2 ha of forest through the establishment of at least 100.4 ha of new forest, or an</p>	Before and during Construction	PMU	BPC	<p>Consultation with DoFPS.</p> <p>Publication of pre-vegetation clearance reports with details of all trees and vegetation being removed..</p> <p>Includes photographs of</p>	Signed MoU	Once, during Construction	BPC

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		<p>equivalent area of enhanced degraded forest, in accordance with national requirements.</p> <p>BPC shall also confirm arrangements with the three affected CFMGs for the restoration and enhancement of approximately 9 ha of degraded community forest areas, including roles, responsibilities, and benefit-sharing arrangements.</p>				restoration measures.			
		<p>Prior to any vegetation clearance, the Contractor, under the supervision of BPC and DoFPS, shall:</p> <p>Count, tag, and geo-reference every tree approved for felling.</p> <p>Record species, diameter at breast height (DBH), height, and general health condition.</p> <p>Complete and maintain a Tree Clearance Register.</p> <p>The verified data shall be submitted to DoFPS and used to finalise compensatory planting requirements, fees, and payments, in accordance with national forest valuation procedures.</p>		Contractor	PIU (NBS)	<p>Comprehensive and complete field surveys.</p> <p>Pre-vegetation clearance plans for the entire RoW</p>	DoFPS approval	Before vegetation starting	PMU
		<p>In collaboration with DoFPS, local Forest Offices, and affected communities, BPC shall:</p> <p>Confirm and finalise compensatory afforestation and reforestation</p>		PIU	PIAC	<p>Comprehensive pre-clearance vegetation surveys.</p> <p>Continual</p>	DoFPS approval	Before vegetation starting	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		<p>sites, building on those identified in the ESIA.</p> <p>Ensure that selected sites are legally available, ecologically suitable, and consistent with district and national forest management plans.</p> <p>Obtain all required approvals and permits from DoFPS prior to site preparation.</p> <p>Meaningful consultation with CFMGs and local stakeholders shall be undertaken to confirm access, management arrangements, and livelihood considerations.</p>				compliance with national legislation.			
		<p>Write one or more DoFPS-approved Afforestation/Reforestation Plans covering a minimum of 100.4 ha. Each plan will include, as a minimum:</p> <ul style="list-style-type: none"> <li>- Target area and mapped planting locations</li> <li>- Number of seedlings and planting density</li> <li>- Species composition (native species only, reflecting local forest types)</li> <li>- Minimum seedling size and quality standards</li> <li>- Planting methods, timing, and site preparation requirements</li> </ul>		Contractor	PIU/PIAC	Continual consultation with the DoFPS. IBS review of the Plans against the Tree Clearance Register. Detailed development of the plans in accordance with national requirements.	Published Afforestation/Reforestation Plans. Approval and permits from DoFPS	Before the end of construction	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring				
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible	
		<ul style="list-style-type: none"> <li>- Inclusion of suitable non-timber forest product (NTFP) species where appropriate to support community benefits</li> <li>- Management, protection, and maintenance measures</li> <li>- Monitoring indicators, reporting requirements, and success criteria</li> <li>- Roles and responsibilities of BPC, the Contractor, DoFPS, Forest Offices, and local user groups</li> <li>- Detailed cost estimates and funding arrangements.</li> </ul>								
		<p>All ground preparation, planting, and initial maintenance will be implemented by the Contractor, or delegated parties, strictly in accordance with:</p> <ul style="list-style-type: none"> <li>- The DoFPS-approved Afforestation/Reforestation Plan</li> <li>- Applicable national forestry legislation, rules, and technical guidelines.</li> </ul> <p>Local communities will be engaged in planting and early management wherever feasible, to build ownership and support long-term sustainability.</p>		PIU	PIAC	Complete all planting in accordance with the DoFPS and national legislation	100.4 ha of planted new forest	Before the end of construction	PMU	
		The health and survival of planted trees will be monitored for a		To be confirmed	DoFPS	Report of health and survival	At least 80% of tree	Monthly	BPC	

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		<p>minimum period of five years following planting.</p> <p>Monitoring will include survival rates, growth performance, and evidence of grazing, fire, or pest impacts.</p> <p>BPC may formally delegate day-to-day management of plantation areas to local Forest Offices or CFMGs, subject to written agreements and continued technical and financial support from the Project for the agreed monitoring period. Training must be provided to all managing and monitoring the trees.</p> <p>Corrective actions, including infill planting, shall be implemented where survival rates fall below DoFPS-defined thresholds.</p>				status of newly planted trees	survival during construction. At least 60% tree survival at within five years.		
		<p>Periodic progress and monitoring reports will be written and issued to DoFPS and PMU confirming compliance with approved plans, legal requirements, and BMP commitments.</p> <p>Successful completion of compensatory reforestation obligations will be formally approved by DoFPS.</p>		PIU	PMU	Site visits, quantitative monitoring all sites (including sport checks and quadrats) and use of a DoFPS and PMU approved report template.	Published quarterly reports	Quarterly	PMU
C5	Avoidance and control of forest fires.	No Contractors or Project staff will take wood off site or start any fires.	Pre-construction	Contractor	PIU (NBS)	Plan showing location and	Approval of firebreak and worksite	Once in advance of construction	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		Construct and maintain firebreaks in strategic locations to help prevent the spread of fires throughout construction period. Do not use fire as a land clearance method. Store fuel outside and in fuel bunds. Refuel outside of the forest area/habitat to minimize the risk of forest fire. Provide fire-fighting equipment and ensure adequate water supply.	and during construction			specification for firebreaks Logbook of firebreak and equipment inspections Production of works site management plans	management plans No incidents reported	Site and equipment inspections, logbook review: 2 x month	
		Appoint and train fire marshals. Educate the workforce through providing compulsory basic fire training to all workers and toolbox talks. Undertake training drills in preparation for forest fire. Install informative signages throughout the project area, including an emphasis on preventing fires, to improve awareness of forest fires.	Pre-construction and during construction	Contractor	PIU (NBS)	Production and approval of training material and signage Record of training events and attendance Photographs of installation and maintenance of signage	No incidents reported	Completion of drills: every 4 months.	PMU
<b>D: BIRDS</b>									
D1	Reduce risk of bird collision of with transmission infrastructure	Continue Vantage Point (VP) surveys and studies for collision sensitive species Himalyan Griffon ( <i>Gyps himalayensis</i> ), Mountain Hawk Eagle ( <i>Nisaetus nipalensis</i> ), Black-necked Crane ( <i>Grus nigricollis</i> ) already carried out for	Pre-construction	NBS	IBS/PMU	Completion of report detailing results of vantage point surveys	Written acceptance of the report by IES	One off report	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		the ESIA and for at three further years. Use the results of the surveys and studies to confirm areas with unacceptably high collision risk as the basis for designing avoidance and mitigation measures.							
		<i>Finalize the BAP Continue Bird Vantage Point surveys to confirm the species present, their abundance and behavior near the Project area, particularly the population of Himalyan Griffon, Mountain Hawk Eagle, Black-necked Crane for at least three years – details are included in the BAP.</i>	<i>Pre-construction</i>	<i>PIAC (IBS)</i>	<i>PMU</i>	<i>Complete survey methods in accordance with best practice, completion of a compliant set of surveys over the required period.</i>	<i>Approval of the final survey report by IBS.</i>	<i>Monthly, throughout construction</i>	<i>BPC</i>
		Continually use the survey data to review the identify areas along the Project alignment used more frequently by birds at higher risk to collision with the pylon wires (e.g. birds with poor forward-facing eyesight or poor maneuverability). Potential refinement of the pylon tower locations to reduce collision risk.	During construction	PIU (NBS)	PIAC (IBS)	Quarterly review of the VP data. Revised layout including any amendments to reduce collision	Quarterly report. Confirmation of opportunities to reduce impacts to birds.	Quarterly	PMU
		Purchase and install bird diverters along the entire route alignment. Bird diverters must be purchased from a professional and reputable company approved by the IBS (cheaper alternatives must not be used and can be dangerous). Bird	During construction	Contractor	PIU (NBS)	Site audit to confirm the correct installation of bird diverters every 10 m	Quarterly report with photographic evidence.	Ongoing	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		diverters must be purchased from Powerline Sentry (or a similar company). Diverters must be installed every 10m for the entire route. A reduction in the frequency of bird diverts may only be permitted if the data (from the bird VP surveys) provides strong justification that the risk to the rare bird species is very, very low and will continue to be.							
		Install insulation materials on all energized and exposed part of the pylon tower infrastructure to reduce the risk of electrocuting birds. Insulators may include arcing horns or surge arrestors to safeguard against insulator damage during lightning strikes.	During construction	Contractor	PIU (NBS)	Site audit to confirm the correct installation of bird diverters every 10 m	Quarterly report with photographic evidence.	Ongoing	PMU
D2	Avoid disturbance to breeding / nesting birds	In areas where suitable nesting or bird foraging habitat exists, complete surveys to confirm existing breeding and roosting locations for species of conservation significance / legally protected, including but not limited to: Himalayan griffon, Satyr tragopan, Himalayan monal, Mountain hawk-eagle and River lapwing. Restrict high-disturbance activities (tree felling, blasting, tower erection) if nesting or roosting is confirmed or suspected stop all	During construction	Contractor	PIU (NBS)	Report of survey including dates, species found, location, and a map of construction exclusion zone around nests/roosts approved by IBS.	Measures implemented to protected breeding birds and nest habitats in accordance with site works plans and programs.	Ongoing in accordance with construction program	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring				
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible	
		works within 500m of the nest sites until the young birds have fledged. If not practical contact the IBS for advice.								
		<p>Schedule vegetation clearance outside the nesting bird season (July-September), where practical</p> <p>Undertake a pre-clearance nesting bird check of the vegetation to be cleared within 24 hours of works commencing, where avoidance of the breeding season is not practical.</p> <p>Delay clearance of trees supporting nesting birds, wherever possible. This applies both to low vegetation and larger shrubs and trees. Active nests for any protected species or IUNC Red listed Species (Vulnerable, Endangered or Critically Endangered) must be delayed until after the works have been completed.</p>	During construction	Contractor	PIU (NBS)	Report of pre-clearance nesting bird checks including dates, species found, location, and whether the area is approved for clearance or not. Plans of trees to be retained, photographs of trees post construction.	Quarterly report with photographic evidence.	Ongoing	BPC	
<b>E: MAMMALS</b>										
E1	Minimize habitat loss and disturbance in areas known or likely to support vulnerable or	As far as possible, minimize loss and disturbance (for example for tower installation, workers camps, stock piles etc.) of suitable habitat in areas where IUCN Vulnerable, Endangered or Critically Endangered mammals, including but not limited Asiatic black bear, Asiatic golden cat, Common	Pre and during construction	Contractor	PIU (NBS)	Plans demonstrating any necessary and possible amendments to temporary construction areas to limit impacts on	Quarterly report with photographic evidence.	Monthly inspections	PMU	

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring				
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible	
	endangered mammals	leopard, Himalayan serow, Sambar, Wild dog are present recorded in surveys for the ESIA. Fence/physically mark the vegetation surrounding the construction area to protect surrounding vegetation. Minimize work noise and light disturbances where practical.				mammals. Working hours restricted during dusk and nighttime. Works site inspections				
E2	Avoid loss of fauna due to poaching	Conduct a toolbox talk before construction, with a reminder session every month during construction and whenever new staff are inducted into the project, to raise awareness of the threatened species present and the potential risks to them. This will include: <ul style="list-style-type: none"> <li>- roles and responsibilities</li> <li>- information on all endangered, and protected species wildlife species using photographs and of national regulatory requirements</li> <li>- required behaviors including bans on hunting, foraging, and trapping</li> </ul> Obtain signatures for all site workers and contractors to confirm attendance talks/inductions.		Contractor	PIU (NBS)	Review of signatory list showing presence of workers at talk	More than 90% worker attendance at toolbox talk	Monthly and annual	PMU	
		Commit to zero poaching. Enforce a hunting ban for all workers, with anti-poaching clauses included		Contractor	PIU (NBS)	Contracts to include commitment to	Compliant contractual document	Monthly	PMU	

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring				
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible	
		within all contractual agreements. No potential hunting equipment will be allowed in the project area including traps and firearms. Prohibit dogs on site.				zero poaching. Inspections to demonstrate no evidence of poaching				
<b>F: OTHER/GENERAL WILDLIFE</b>										
F1	Avoid and minimize disturbance to fauna	Undertake pre-clearance site checks before any vegetation clearance or construction to confirm that no animals are present. Robustly fence or cover excavated pits at the end of each working day to prevent fauna accidentally falling in, or install escape ramps to allow their escape. Check all open foundations and trenches daily and move animals present to safety. Install a temporary fence around compounds and worksites at the end of each working day if required, to prevent entry of mammals during the night.	During construction	Contractor	PIU (NBS)	NBS to be present during site works to help check and implement the BMP requirements.	Quarterly report with photographic evidence.	Monthly compliance checks	PMU	
		Actively minimise light use, particularly where it is not necessary or can be avoided. Where lighting is required, use directional lighting to avoid light spill into retained, adjacent habitat.		Contractor	PIU (NBS)	Compliance with specification confirmed through worksite inspections (see above)	Quarterly report	Monthly	PMU	
		Restrict or reduce work from 1 hour before sunset to 1 hour after sunrise, where practical, to avoid		Contractor	PIU (NBS)	Review of log of daily working hours	Quarterly report	Monthly	PMU	

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring				
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible	
		disturbance to the fauna in (a) forest areas/habitat, and (b) within 10km of a protected area.								
		Limit unnecessary noise during all construction by scheduling loud works during the day, using hand tools instead of large machinery, where practical and using low speeds when travelling, all in accordance the EMP).		Contractor	PIU (NBS)	Implementation of construction in line with the EMP	Quarterly report	Monthly	PMU	
		Minimise emission of dust throughout works by using dust suppression techniques as applicable to location and nature of work.		Contractor	PIU (NBS)	Implementation of construction in line with the EMP	Quarterly report	Monthly	PMU	
F2	Avoid and minimize killing and injury of fauna	Install anti-climbing devices on the transmission towers upon completion of each tower to prevent wildlife such as monkeys climbing the towers. Anti-climbing devices can include physical barriers such as spikes or mesh covers. Monitor anti-climbing devices monthly to ensure they remain functional.	During construction	Contractor	PIU (NBS)	Design showing anti-climbing devices and report of installation including photographs Report of inspections of anti-climb devices	Approval of design by IBS Quarterly report with photographs confirming installation	Monthly	PMU	
		Maintain a minimum vertical clearance of 7 m between the conductor and tree canopy ground along the RoW. This gap ensures a safe passage for fauna by minimizing the risk of wildlife collisions or obstructions caused by the project infrastructure.		Contractor	PIU (NBS)	Site inspections	Quarterly report	Monthly	PMU	

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
F3	Avoid loss of fauna and flora due to poaching	The measures described for endangered and protected mammals (E2) above must apply to all fauna and flora at risk of degradation from poaching.	Durning construction	Contractor	PIU (NBS)	Review of signatory list showing presence of workers at talk	More than 90% worker attendance at toolbox talk	Monthly and annual	PMU
<b>G: INVASIVE AND NON-NATIVE SPECIES, AND SPREAD OF PLANT DISEASES</b>									
G1	Avoid the introduction of non-native species	No planting of non-native species will occur and species selection for all reforestation and afforestation will follow DoFPS and the National Plant Protection Centre under the Ministry of Agriculture and Livestock's specifications. Where re-planting of native trees occurs, only topsoil taken from that local area will be used.	During construction	Contractor	PIU (NBS)	Written plans for all habitat rehabilitation and forest planting.	No invasive species recorded in restored areas	Monthly	PMU
		Complete pre-vegetation clearance checks to identify and remove all invasive species from the proposed worksites (or to inform when work sites should be moved). If invasive species are recorded, the NBS must approve the clearance and disposal methods and monitor the works on site.  Disposal of invasive species will be carried out responsibly e.g. moved as a covered load to a suitable site for burning or deep burial, with thorough inspection and cleaning of vehicle before leaving the disposal site.		Contractor	PIU (NBS)	Completion of pre-clearance checks and the NBS present on site.	No evidence of spreading invasive species	Monthly	PMU
		All invasive species survey methods (for all recorded and		Contractor	PIU (NBS)	Written methods for the cleaning of	Published Invasive	Once pre-construction.	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		potentially present specie), all species-specific disposal and treatment methods (i.e. specific methods for each invasive species) and long-term monitoring methods will be documented in an Invasive Species Management Plan. It must be written by, or consistent with, the National Plant Protection Centre guidelines. It will be published before any vegetation clearance starts. The methods will apply Good Industry Practice (GIP) (e.g. cleaning of equipment before transport to site) throughout all works to prevent accidental introduction or spread of non-native species.				all equipment and machinery. Methods approved by the IBS and the DoFPS. Worksite inspections to record compliance.	Species Plan. DoFPS approval. IBS approval.  No evidence of spreading invasive species	Monthly	
G2	Avoid spreading plant pathogens	Pine trees must be inspected before felling for signs of the pine wilt disease, which is present throughout the area, and the presence of the longhorn beetle that causes its spread.  The felling of infected or potentially infected trees must only take place in accordance with the approved methods provided to the Project in writing by the DoFPS or another regulatory body responsible for Bhutan's domestic phytosanitary, which may include restrictions on the movement and use of infected timber.		Contractor	PIU (NBS)	Completion of a comprehensive pre-vegetation clearance checks. Receipt of approved removal or treatment methods.  Record of management of potentially infected material and worksite inspections to record compliance.	No evidence of spreading pine wilt disease	Monthly	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring				
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible	
<b>H: ECOSYSTEM SERVICES</b>										
H1	Avoid loss and degradation of ecosystem services	Temporary and permanent clearance of natural forest habitat must not result in loss or degradation of provisioning and regulating ecosystem services in the project area. This can be achieved through actions listed above in this BMP that relate to forest clearance and replanting, principally: Compensate for the permanent and temporary loss of forest and scrub habitat from the WCNP Avoid impacts of habitat loss to forest/habitats Minimize impact of felling and clearance of trees Reforestation and revegetation	During construction	Contractor	PIU (NBS)	See previous actions	See previous actions	See previous actions	PMU	
<b>H: OTHER ENVIRONMENTAL MANAGEMENT PRACTICES THAT ARE RELEVANT TO BIODIVERSITY</b>										
H1	N/A	<i>Refer to the EMP for details on the management and monitoring requirements for chemical use, waste management, dust suppression, noise and light disturbance, water management and working near water, and pollutant and contamination control.</i>	<i>Pre and during construction</i>	<i>Contractor</i>	<i>PIU</i>	<i>Various</i>	<i>Various</i>	<i>Continual</i>	<i>BPC</i>	

## E. Initial Framework Biodiversity Action Plan

### Summary

622. The Asian Development Bank (ADB) is considering the provision of loan financing to the Royal Government of Bhutan for the proposed 132 kV TL in Bumthang Dzongkhag, associated with the 120 MWp Wobthang Solar Farm. Bhutan Power Corporation (BPC) is the Project proponent and executing agency.

623. The ADB ESF requires that projects affecting Natural Habitat and PBFs are designed and implemented to achieve at least NNL of biodiversity, and where feasible to deliver Net Gain. The majority of Project-related biodiversity impacts are addressed through the application of the mitigation hierarchy, as defined in the EIA and its associated EMP and BMP, and are expected to achieve NNL.

624. The ESIA concluded, however, that NNL cannot be robustly demonstrated for all biodiversity receptors through standard mitigation measures alone. Additional, targeted conservation actions are therefore required, specifically in relation to WCNP, Natural Forest habitat, and the local bird assemblage, with particular emphasis on larger bird species that are susceptible to collision with overhead TLs during the operational phase of the Project.

625. This document constitutes an initial, framework BAP. It establishes a clear commitment by BPC, as the executing and accountable agency, to secure and implement the additional biodiversity actions necessary to achieve NNL and, where feasible, Net Gain. At this stage, the full scale and extent of residual impacts have not yet been quantified. These will be determined through further analysis of residual impacts against the established baseline conditions for the identified biodiversity receptors.

626. The detailed BAP with full and comprehensive actions will subsequently be developed by BPC once this quantification is complete. The actions will be documented in the Project's final BAP. Which will be informed by engagement with relevant national authorities, protected area management, and local stakeholders. This initial framework BAP therefore commits BPC to the timely provision of financial resources, institutional capacity, and implementation arrangements required to develop and subsequently deliver the finalized actions within an agreed timeframe, providing assurance to lenders and stakeholders that biodiversity outcomes will be achieved.

627. Indicative and illustrative biodiversity commitments, and the corresponding strategic focus of the BAP, are presented in Table IX-4.

**Table IX-4: BAP Actions Summary**

BAP Action Summary	Responsibility	Indicative Budget (\$)
<b>Wangchuck Centennial National Park &amp; Natural Forest Habitat</b> BPC commits, in collaboration with the Department of Forests and Park Services (DoFPS), to implement targeted conservation actions that compensate for the permanent loss of c.0.5 ha and the temporary disturbance of c.50 ha of habitat, supplementing the creation of 100.4 ha of forest as set out in the BMP. Actions will be jointly designed to support	BPC ADB (lender)	75,000

<b>BAP Action Summary</b>	<b>Responsibility</b>	<b>Indicative Budget (\$)</b>
National Park conservation objectives and wider forest <sup>32</sup> management priorities, including risk reduction (e.g. forest fire management) and enhancement of ecological value and connectivity, with measures integrated where possible to maximise biodiversity benefits across receptors.		
<b>Large Bird Species</b> BPC commits, in collaboration with the Royal Society for Protection of Nature (RSPN), to retrospectively insulate and otherwise safeguard the highest-risk live distribution lines associated with the Solar Farm and TL, and selected existing lines near sensitive bird areas, including the Bumthang Wetlands, to reduce collision and electrocution risk.	BPC ADB (lender)	75,000
<b>Bird Monitoring</b> BPC commits, in collaboration with RSPN, to implement a structured bird monitoring programme for a minimum of three years to verify that population numbers, distribution, and behaviour do not decline or change materially as a result of the Project.	BPC ADB (lender)	48,000
<b>Monitoring and Adaptive Management</b> (i.e. contingency) BPC commits to maintaining a dedicated contingency budget to enable timely adaptive management should monitoring results or external factors (e.g. extreme weather or natural disasters) indicate material adverse deviations from baseline conditions, with funds deployed only where justified by evidence.	BPC ADB (lender)	150,000
<b>Total Indicative Cost</b>		348,000

### **Biodiversity Action Plan Introduction**

628. The Asian Development Bank (ADB) is considering the provision of loan financing to the Royal Government of Bhutan for the proposed 132 kV TL in Bumthang Dzongkhag, associated with the 120 MWp Wobthang Solar Farm. Bhutan Power Corporation (BPC) is the Project proponent and the executing agency responsible for implementation of this BAP.

629. The ADB ESF requires that projects affecting Natural Habitat and PBFs are designed and implemented to achieve at least>NNL of biodiversity, and where feasible to deliver Net Gain. Most Project-related biodiversity impacts are addressed through application of the mitigation hierarchy, as documented in the ESIA and the BMP, and are expected to achieve>NNL. The ESIA concluded, however, that this outcome cannot be secured for all biodiversity receptors through standard mitigation measures alone.

630. Additional, targeted conservation actions are therefore required, particularly in relation to WCNP, natural forest habitat, and the local bird assemblage. This framework BAP outlines the additional actions and conservation objectives and commits BPC to their timely development and implementation, in order to avoid residual adverse effects and ensure full compliance with the ADB ESF.

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<sup>32</sup> See para. 645.

631. The purpose of this BAP is therefore to define and secure the additional conservation actions required to address residual biodiversity impacts that cannot be fully mitigated through standard measures alone. It provides a clear framework through which Bhutan Power Corporation commits meaningfully to achieving at least NNL of biodiversity, and where feasible Net Gain, in line with the ADB ESF.

632. The objectives of the BAP are to compensate for residual impacts on priority biodiversity receptors, support the conservation objectives of WCNP and surrounding natural forests, reduce risks to vulnerable bird species, and establish robust monitoring and adaptive management mechanisms to ensure that biodiversity outcomes are achieved and maintained over the life of the Project.

### **Scope of the Biodiversity Action Plan**

633. The ADB ESF, 2025, and specifically ESS6, requires that projects affecting biodiversity are designed and implemented to avoid adverse impacts on Natural Habitat and PBFs, achieve at least NNL, and where feasible deliver Net Gain.

634. In accordance with ESS6, where residual adverse impacts remain after application of the mitigation hierarchy, additional measures are required. These comprise Additional Conservation Actions (see Box 1 below), which are intended to strengthen the conservation status of biodiversity receptors through protection, restoration, or enhancement.

635. This BAP sets out the requirements for the Project to achieve compliance with ESS6 by addressing residual impacts and delivering measurable biodiversity outcomes. The BAP includes both Additional Conservation Actions and applies to biodiversity receptors of national and international importance.

636. The scope of the BAP is informed by the findings of the Environmental and Social Impact Assessment (ESIA) and the Critical Habitat Assessment (CHA). These assessments identified WCNP, natural forest habitats, and the local bird assemblage as priority biodiversity receptors requiring targeted actions beyond standard mitigation measures.

637. The ESIA concluded that the Project will result in permanent and temporary losses of natural forest habitat and a low residual risk to large bird species associated with collision with overhead power lines. Accordingly, this BAP defines actions to compensate for forest habitat losses, support conservation objectives within and adjacent to WCNP, and reduce risks to birds through targeted mitigation, monitoring, and adaptive management.

638. Through implementation of this BAP, the Project commits to achieving at least NNL of biodiversity for the identified receptors, and where feasible Net Gain, in line with ESS6 and Bhutan's national conservation priorities.

#### **BOX 1: The Mitigation Hierarchy**

The mitigation hierarchy is a set of industry-recognised principles used in the ESIA process. The hierarchy supports the assessment, and ideally the subsequent reduction of biodiversity impacts from a project. For the protection and conservation of biodiversity, the mitigation hierarchy includes the following steps:

1. **Avoidance:** as a matter of priority, the client should seek to avoid impacts on biodiversity and ecosystem services.

2. **Minimisation:** when avoidance of impacts is not possible, measures to minimise impacts to biodiversity and ecosystem services should be implemented.
3. **Restoration:** when avoidance and minimisation of impacts is not possible, measures to restore biodiversity and ecosystem services should be implemented.
4. **Offset:** biodiversity offsets may be considered only after appropriate avoidance, minimisation and restoration measures have been applied and where there is a significant adverse residual impact. A biodiversity offset should be designed and implemented to achieve measurable conservation outcomes that can reasonably be expected to result in NNL or Net Gain of biodiversity, dependent on the requirements of the standards being applied.
5. **Additional Conservation Actions:** additional conservation outcomes are those actions that further contribute to the achievement of NNL or Net Gain and help the improvement of the overall conservation efforts, often in addition to a measurable biodiversity offset

639. This BAP presents a series of actions for each protected area, habitat, species, or species group that are subject to significant adverse residual effects in the ESIA. Each action will be designed to achieve NNL for each receptor and where possible a Net Gain. Each action will comprise a succinct plan detailing what must be done, when, by whom and how to ensure that the conservation status of the target species or habitat(s) is improved.

640. The BAP includes an adaptive management section that sets out how it will be continually monitored and assessed to maximize the likelihood of it achieving NNL or a net gain in the conservation status of the target species. Adaptive management is required to ensure there is sufficient flexibility within the BAP for BPC, the contracted BAP Implementing Partners and ADB to change the objectives or resource allocations during the implementation phase to address unknown, future challenges and changes and therefore increase the likelihood of NNL, or Net Gains being achieved.

641. The Additional Conservation Actions presented in this BAP build on, but do not duplicate, the on-site biodiversity mitigation and compensation measures included in the Project ESIA and the associated Environmental and Social Management Plan and BMP. This BAP is a live document that should be updated as the Project develops over time, both in the construction and operational phases, and as the conservation context of the targeted biodiversity receptors are better understood.

## **Stakeholder Consultation**

642. Stakeholder consultation will form a core component of the BAP development and implementation process, in accordance with the requirements of the ADB ESF and ESS6. The effectiveness of the BAP will depend on clear ownership and accountability by the executing agency, BPC, and on the early and meaningful involvement of potential implementing partners and trusted stakeholders.

643. BPC will undertake structured, multi-stakeholder consultation during the detailed development of the BAP actions to obtain relevant data, refine proposed measures, confirm implementation roles, and agree realistic budgets and delivery mechanisms. Engagement will include relevant government departments, protected area authorities, national and local non-government organisations, affected communities, and biodiversity specialists and academic institutions with expertise relevant to national parks, forest ecosystems, and bird conservation.

644. Community engagement will be integrated with, and build upon, the consultation processes established under the Environmental and Social Impact Assessment. This engagement will be used to incorporate local knowledge, cultural considerations, and sustainability priorities into the final design and implementation of BAP actions, and to identify and manage potential risks or conflicts. Where implementing partners have existing community participation programmes, these will be utilized to ensure ongoing engagement, transparency, and local involvement throughout BAP implementation.

### **BAP Roles and Responsibilities**

645. The BAP is intended to deliver effective and durable biodiversity outcomes while meeting the expectations of key stakeholders. Its successful implementation will depend on clear ownership, well-defined roles, and sustained coordination across multiple parties and project phases, including implementation, monitoring, reporting, and adaptive management.

- a) **The Asian Development Bank (ADB)**, as the lender, will require assurance that the BAP will achieve its stated conservation objectives and that risks arising from uncertainty or change over time will be proactively managed. To provide this confidence, the BAP defines achievable actions developed with technically competent national partners, commits adequate financial resources, and clearly assigns accountability to the Executing Agency.
- b) **The Executing Agency, BPC**, is ultimately accountable and responsible for all aspects of the BAP throughout its lifetime. BPC will provide overall leadership and oversight, ensure that sufficient funds are allocated, and confirm that all actions are legally compliant and aligned with national policies and international standards. BPC will be responsible for contracting suitable Implementing Partners, providing access to appropriate technical and administrative support, monitoring performance against defined objectives, verifying outcomes, and applying adaptive management where actions deviate from the approved plan or where monitoring indicates the need for adjustment. Accountability for delivery of the BAP will remain with BPC as a condition of the loan agreement.
- c) **Implementing Partners** will be engaged by BPC through a Memorandum of Understanding followed by formal contractual arrangements. They will be responsible for the day-to-day delivery of assigned BAP actions in accordance with agreed objectives, methods, timelines, and budgets. Implementing Partners will be expected to apply their technical expertise and local knowledge to improve outcomes where appropriate, while operating within the agreed scope. Their performance will be subject to defined monitoring, reporting, and verification requirements.

646. While implementation responsibilities may be delegated, BPC will retain full accountability for the effectiveness, timeliness, and success of all BAP actions and for ensuring that the Plan achieves its intended biodiversity outcomes.

### **Biodiversity Context**

647. The ESIA confirms that the northern extent of the Project overlaps with, and is immediately adjacent to, WCNP, a nationally protected area of high biodiversity value. This section of the alignment is characterised by extensive, largely intact forest ecosystems that form part of a wider protected and connected landscape. The Project construction footprint is dominated by forest habitat, with approximately 90% of the affected area comprising blue pine and mixed conifer forest, resulting in both permanent and temporary habitat loss and disturbance within a sensitive ecological context.

648. The ESIA also identifies the Project area as supporting a diverse bird assemblage, including large-bodied species that are more vulnerable to collision with overhead power lines. While overall residual impacts to birds are assessed as low following application of standard mitigation measures, some risk remains, particularly in areas close to wetlands, forest edges, and movement corridors. These factors, taken together, underpin the need for targeted biodiversity actions focused on forest compensation, protected area conservation objectives, and the reduction and monitoring of risks to bird populations.

### **Action Plans**

649. The final BAP will comprise three discrete actions, each designed to address specific biodiversity objectives relevant to the Project. For each action, the BAP will define the intended outcome, the rationale for the action, the proposed implementation approach, monitoring and reporting requirements, roles and responsibilities, and an indicative budget. This structure will provide a clear and consistent framework for delivery, oversight, and accountability.

650. Collectively, the BAP actions will address the residual biodiversity impacts, strengthen conservation outcomes for priority receptors, and establish a foundation for longer-term biodiversity resilience. Through their implementation, the Project commits to achieving at least NNL of biodiversity, and where feasible Net Gain, in line with ADB requirements.

651. The overview presented in this initial framework BAP are intended to provide sufficient assurance to the ADB and other stakeholders that objectives can be achieved within agreed timeframes and committed budgets. BPC, as the executing agency, will be responsible for formally appointing and contracting suitable Implementing Partners for each action. While Implementing Partners will be expected to refine methods at inception to reflect current risks and opportunities, BPC will retain overall accountability for delivery and performance of all BAP actions. The proposed actions are summarised below:

### **Wangchuck Centennial National Park and Natural Forest Habitat**

652. BPC commits, in collaboration with the Department of Forests and Park Services (DoFPS), to deliver additional conservation actions to compensate for the permanent loss of approximately 0.5 ha of natural habitat and the temporary disturbance of approximately 50 ha, in addition to the compensatory creation of 100.4 ha of forest as defined in the BMP. These actions will be designed to support the conservation objectives of WCNP and to strengthen the condition, resilience, and ecological value of surrounding natural forest habitats.

653. BPC will first quantify the residual impacts on forest habitat and ecological function, using the ESIA baseline and post-mitigation footprint, to define the scale and focus of the required actions. BPC will then consult with DoFPS and relevant protected area authorities to identify priority conservation needs, including risk reduction measures (such as forest fire prevention and management), enhancement of habitat quality, and improvement of ecological connectivity. Where appropriate, actions for the National Park and adjacent forests will be combined to maximise biodiversity benefits and delivery efficiency.

654. BPC commits to engaging suitably qualified national and, where necessary, international forest and conservation specialists to support this process and to develop a detailed, time-bound, and costed action plan. The final actions will be clearly defined as commitments, with clear

objectives, implementation methods, performance indicators, monitoring requirements, and responsibilities, and will be implemented in accordance with agreed timelines.

### **Proposed Indicative Budget 75,000 (USD)**

#### **Large Bird Species**

655. BPC commits, in collaboration with the Royal Society for Protection of Nature (RSPN), to reduce risks to large bird species through targeted retrofitting of high-risk live distribution lines with bird-safety insulators. This will include lines associated with the Solar Farm and TL, as well as selected existing lines located near sensitive bird habitats, including the Bumthang Wetlands

656. As a first step, BPC will support the identification and prioritisation of distribution line sections that present the greatest collision or electrocution risk, informed by existing data, expert judgement, and site reconnaissance. BPC will then work with RSPN and qualified technical specialists to define the most appropriate insulation and safeguarding measures, quantify the extent of works required, and develop a detailed implementation plan with clear timelines and budgets.

657. BPC commits to ensuring that these measures are designed, implemented, and verified in a manner that delivers measurable and lasting risk reduction for vulnerable bird species.

### **Proposed Indicative Budget 75,000 (USD)**

#### **Bird Monitoring**

658. BPC commits, in collaboration with RSPN, to implement a structured bird monitoring programme for a minimum period of three years following construction. The surveys will comprise Vantage Point bird surveys at locations used by high number of birds or target, vulnerable species. The purpose of this monitoring will be to verify that bird abundance, distribution, and behaviour do not decline or change materially as a result of the Project.

659. BPC will support the development of a scientifically robust monitoring design, including definition of baseline reference conditions, survey methods, frequency, and statistically meaningful indicators and thresholds. Qualified ornithological specialists will be engaged to design and implement the programme and to analyse and report results on a regular basis.

660. Monitoring outcomes will be used to inform adaptive management. Where monitoring indicates adverse trends or exceedance of agreed thresholds, BPC commits to reviewing and strengthening mitigation or offset measures in consultation with RSPN and relevant authorities.

### **Proposed Indicative Budget 48,000 (USD)**

#### **Adaptive Management**

661. Ecological systems are dynamic, and uncertainties remain regarding the scale and response of biodiversity receptors to the Project. Adaptive management is therefore a core requirement of this BAP and will be applied throughout its implementation to ensure that at least>NNL, and where feasible Net Gain, is achieved.

662. Adaptive management will be based on regular monitoring, review, and evidence-based decision-making. Monitoring results will be assessed annually against defined conservation

objectives, indicators, and agreed thresholds for each BAP receptor. Where monitoring identifies material deviation from baseline conditions, under-performance against agreed indicators, or emerging external pressures, BPC will revise actions, re-prioritise resources, or implement additional measures as necessary.

663. Thresholds for adaptive management will be defined for each BAP component. Threshold's help decision makers, managers and stakeholders understand when change is required. Thresholds in the final BAP will comprise:

- **Wangchuck Centennial National Park and forest habitat**, thresholds will relate to the successful and quantified establishment and condition of compensatory and enhancement measures, and the persistence of forest extent, connectivity, and risk levels (e.g. fire).
- **Large bird species**, thresholds will relate to evidence of collision or electrocution risk, changes in mortality rates, or observable changes in use of key habitats.
- **Bird monitoring**, thresholds will relate to statistically or ecologically significant declines in abundance, distribution, or behaviour relative to the baseline.

664. If any threshold is exceeded, BPC commits to initiating corrective action without delay. This may include modification of methods, expansion of existing actions, implementation of additional mitigation or offset measures, or reallocation of the contingency budget. Where monitoring confirms that thresholds are not exceeded, no change will be required.

665. BPC will remain fully accountable for adaptive management throughout the life of the BAP. Implementing Partners, technical specialists, and monitoring teams will be required to report concerns promptly and propose improvements where better conservation outcomes can be achieved. A dedicated contingency budget will be maintained to enable timely and effective response to monitoring results or external events, including extreme weather or natural disturbances.

666. BPV commits to maintaining a dedicated contingency budget to support adaptive management under this BAP. An indicative total allocation of USD 150,000 will be reserved, assumed for planning purposes to comprise approximately USD 75,000 for forest and protected area related actions and USD 75,000 for bird-related actions, although this allocation may be flexibly adjusted in response to monitoring results and emerging risks. The contingency budget will be used only where evidence demonstrates the need for additional or modified measures to address unforeseen impacts, under-performance against agreed thresholds, or external pressures, ensuring that biodiversity objectives continue to be met.

667. This structured and responsive approach, adaptive management will ensure that the BAP remains effective, proportionate, and capable of achieving its biodiversity objectives despite uncertainty and change.

## **F. Institutional Arrangements**

### **Project Management Unit**

The PMU will maintain ultimate accountability for the implementation of the Environmental Management Plan (EMP) and ensure the project adheres to the National legislation, rules,

regulations and standards, 2020, as well as the ADB Safeguard Policy Statement (SPS, 2009) and the loan covenant. The Environment, GIS & Survey Section under the PMU will provide centralized oversight for all biodiversity components. In detail, the PMU will be responsible for the following:

- Project oversight, approvals, clearances and reporting to ADB
- PMU will provide overall leadership and oversight, and accountability for the EMP. It will ensure that all actions are legally compliant and aligned with national policies, international standards and loan covenants.
- Maintain clear communication channels between BPC, PIAC, Contractor, communities and other stakeholders.
- Ensure adequate budget, institutional/management support, and staff resources are allocated to implement, supervise, and monitor the EMP throughout the Project cycle.
- Secure all relevant permits and clearances for the project.
- Ensure that bidding and contract documents for civil works include all environmental safeguards requirements in line with the ESIA/EMP and ensure that the environmental management costs are reflected in the BOQ.
- Organize and conduct pre-bid meeting with contractors to brief on safeguard requirements.
- Review and approve the contractors' CEMP prior to commencement of civil works.
- Coordinate and implement the Resettlement Action Plan and the Gender Action Plan
- The PMU will provide guidance to the PIU to ensure the implementation of the RAP, EMP, GRM and SEP and review concerns from the community and work with PIU to address relevant concerns.
- Notify ADB of changes in project scope / location that may result in any unanticipated environmental impacts, update the ESIA/EMP/BMP/BAP and/or conduct additional environmental assessment as/when required.
- Coordinate additional studies as agreed under the loan agreement.
- Update assessment documents if unanticipated environmental impacts become apparent.
- monitor performance against defined objectives, verifying outcomes, and applying adaptive management where actions deviate from the approved plan or where monitoring indicates the need for adjustment.
- Based on the results of environmental monitoring (air, noise, water), evaluate the effectiveness with which the CEMPs are implemented, and identify environmental corrective actions
- Prepare EMRs (within 30 days after completion of the monitoring period) and submit to ADB for disclosure, starting after the Project becomes effective.
- Report in a timely manner to ADB of any non-compliance or breach of ADB safeguard requirements.
- Review and approve the need for corrective actions, repair of any property damage and financial compensation (insurance) for any H&S incidents and ensure that information on these is submitted to ADB in the EMR.
- In case of any accident related to occupational and community H&S, report to ADB within 72 hours, and prepare and submit an incident report with action plan within 7 days of the occurrence.
- Prepare the project's environmental compliance performance report (within three months after completion of all civil works) and submit to ADB for disclosure with the support of

PIAC.

- Prepare project completion report. Report on EMP and BMP implementation during operation, including to ADB for at least the first year of operation until ADB's PCR is issued (usually 1-2 years after financial close) or longer period if required.

### **Consultant recruitment and contacting implementing partners**

- Maintain ultimate accountability for the implementation of the Environmental Management Plan (EMP) and ensure the project adheres to the National Environment Commission (NEC, 2020) requirements and the ADB Safeguard Policy Statement (SPS, 2009).
- Provide technical guidance and expert advice to the PIU and EPC contractors on complex environmental and social (E&S) issues, including high-altitude engineering constraints and biodiversity mitigation strategies.
- Review and clear the contractors' Construction Environmental Management Plan (CEMP) and update the ESIA/EMP/BMP/BAP if project scope changes lead to unanticipated impacts.
- Establish and maintain formal communication protocols between the PMU, PIU, Project Implementation Advisory Consultant (PIAC), and the EPC contractor to ensure seamless information flow regarding safeguard performance and incident reporting.
- Serve as the primary point of contact for inter-agency coordination with national stakeholders, including the Department of Forests and Park Services (DoFPS), the Department of Environment and Climate Change (DECC), and relevant Dzongkhag administrations.
- The Project Management Unit (PMU) will prepare terms of reference for the PIAC and recruit all required consultants for the Project Implementation Assistance Consultant (PIAC) team. The preferred candidates must be approved by both the PMU and ADB competent authorized person(s).
- PMU will also work with PIAC to plan and implement EMP/BMP/BAP, conduct training and fulfill reporting requirements to ADB
- PMU will be responsible for contracting suitable Implementing Partners and providing access to appropriate technical and administrative support,

### **Implementation of the BAP and BMP**

- The PMU will provide centralized oversight and ultimate accountability for the implementation of the BMP and BAP.
- The PMU will facilitate the Technical Working Group and ensure the successful implementation of the BAP and BMP, by ensuring proper budget allocation and fund utilization. PMU will be responsible for compiling reports on actions implemented from DoFPS and other implementing partners for inclusion in the EMR.

### **Capacity building and Grievance Redress Mechanism**

- The PMU will prioritize, update, plan and coordinate all trainings as identified in the ESIA. Additional trainings as per project requirements maybe identified and coordinated with ADB and PIAC and the contractor.
- Determine the training needs of the EPC contractors' staff, and, in coordination with the PIAC and the EPC contractor, develop training materials for preparation and effective implementation of the CEMPs during construction.

- Facilitate the provision of training with ADB and ensure that relevant staff (+ contractors staff) attend all capacity development and training activities provided. BPC and ABD may wish to invite participants from other agencies (e.g. DoFPS, DECC, Dzongkhags)
- Set-up and disclose the project's GRM to affected communities in coordination with the PIAC and the EPC contractor. Monitor and keep relevant records of any complaints, and ensure their effective, timely, and adequate resolution.
- Coordinate with BPC's Safety and Quality Unit (SQU) to integrate the project into BPC's annual ISO 14001 (EMS) and ISO 45001 (OHSMS) auditing cycles.

668. Especially during the O&M and decommissioning stages, the PMU will

- Develop an O&M Plan reflecting O&M-related measures to be followed
- Undertake environmental monitoring during O&M and decommissioning and document monitoring results.
- Report on EMP implementation during operation, including to ADB for at least the first year of operation up until ADB's PCR is issued (usually 1-2 years after financial close) or longer period if required
- Upon handover, update the community liaison/consultation plan and continue ongoing consultation by informing affected communities of the change in management team, all ongoing consultation, such as, minutes of the meetings will be documented in the SAEMRs submitted to ADB.
- Upon any decommissioning, develop a Decommissioning EMP reflecting construction-related measures in relation to the dismantling of equipment and restoration of the sites and other specific activities like transport and disposal of used TL components, footings, and electrical equipment.
- Supervise and monitor any contractors hired for major maintenance works on decommissioning of the solar power plant, with their roles and responsibilities the same as those of the contractors for construction.

### **Project Implementation Unit (PIU)**

BPC will establish a PIU Office in Bumthang. The Office will comprise one full-time National Environment and Social (**E&S**) Officer for 18 months. The Officer will be guided by the PMU to supervise contractors, implement EMP activities, and address grievances. Specifically, the PIU will be responsible for the following:

- Ensure compliance with government and ADB requirements on environmental and social safeguards. Verify that all statutory clearances and permits (environmental, forestry, road/transport, water abstraction, blasting, etc.) are obtained before works commence.
- Ensure that necessary pre-construction studies are carried out such as documentation of road conditions and cultural practices.
- Conduct site visits to monitor implementation of the contractor's environmental management plan, CEMP and subplans, BMP, or other necessary plans.
- Function as the community liaison officer for the PMU. Assist in implementation of the RAP, Gender Action Plan and Stakeholder Engagement Plans.
- Plan and coordinate community consultations on behalf of the project (or as required) and document and report community concerns to the PMU. Maintain continuous dialogue with the residents of the affected communities as required.

- Meaningfully disclose the project's GRM to affected communities and monitor and keep relevant records of any complaints, and ensure their effective, timely, and adequate resolution. Act as the first point of contact for any local grievances.
- Responsible for maintaining the Grievance Register and facilitating resolutions within 5 days for field-level issues (e.g., dust, noise, or minor property damage).
- Review monthly reports from contractors, especially keeping track of worker numbers and their occupational health and safety reports.
- Coordinate with contractors to manage labor influx risks, community health and safety, and culturally sensitive practices.
- Ensure cultural heritage protection, chance-find procedures, and coordination with religious authorities and DoCDD.
- Prepare quarterly reports on all aspects concerning environmental assessment, management, and monitoring and submit to PMU.
- Directly supervise implementation of the BMP
- Oversee surveying, recording, marking and felling of trees within the 132kV RoW and access road footprints.
- Coordinate with DoFPS on the compensatory plantation activities following tower footing construction.
- Conduct regular inspections of worker camps to ensure they meet ADB and National labor standards for hygiene, living space and amenities.
- Enforce specialized EHS protocols for high-altitude work, including mandatory briefings on Altitude Mountain Sickness (AMS), cold-weather exposure, and emergency evacuation procedures.
- Verify that contractors conduct daily safety briefings, toolbox talks, and that all personnel including sub-contractors are equipped with, and correctly using, Personal Protective Equipment (PPE).
- In the event of any EHS incident, the PIU will perform the initial site investigation and ensure the PMU is notified within 24 hours to meet the ADB's 72-hour reporting threshold.
- Conduct verification of work and camp sites upon completion of work to ensure that these sites are cleaned up and restored and that no waste is left at the sites.

### **Project Implementation Assistance Consultant (PIAC)**

669. The PIAC will use dedicated experts to manage environmental and social safeguards, who will be responsible exclusively for the Project.

- **1X International Biodiversity Consultant with specialization in Ornithology (international, intermittent)** 10+ years of experience in energy projects/linear infrastructure projects and experience of internationally funded project and associated standards and requirements. A master's degree in ecology/wildlife management or equivalent. Their role is to ensure continued compliance with ADB's Standards and continually refine, adapt and improve the BMP and BAP. The international ecologist will be assisted on site by a national ecologist who will be based full-time at site. Required inputs are shown in section XC.

- **1 X International EHS Expert (international, intermittent)** having 10+ years of experience in energy projects funded by international funding agencies and at least a master's degree in environmental science/ environmental management t/environmental engineering. The international EHS expert will be adequately supported by a national EHS expert. Required inputs are shown in section XC.
- **1 X National Biodiversity Consultant (national, fulltime) and 1 X National EHS Expert (national, fulltime)** based at the project site. The biodiversity consultant shall implement and monitor the BMP and BAP actions, supervise the Contractors work and liaise directly with the Contractors management team (and biodiversity specialist during the construction period.
- **1 X Social, Gender and GRM focal (national, fulltime)** during construction to focus on RP and Gender Action Plan implementation. Required inputs are shown in section XC.

670. The PIAC will support PMU by undertaking the following activities (not an exclusive list):

- Review the ESIA and supplementary documents to understand the Project's environmental safeguards requirement and assist BPC in updating the relevant documents in case of unanticipated impacts.
- Ensure that BPC secures the Environmental Clearance of the Project prior to contract award.
- Review the contractor CEMP and sub plans and advise PMU on alterations, gaps, and enhancements necessary.
- Assist BPC in managing and implementing the project and ensuring compliance with ADB SPS (2009) requirements on environmental safeguards, and the ESIA and the EMP of the project.
- Conduct ongoing biodiversity/ bird surveys and reporting, and manage and monitor the Contractor's work, specifically the Contractor's biodiversity specialist/manager.
- Document the project's compliance monitoring system in an environmental supervision procedures manual so that all parties have a clear understanding of their roles including regular monitoring tasks to be undertaken, checklists to be used and procedures to be followed. This would include roles and responsibilities of various parties, lines of communication, checklists to be used, and procedures to be followed including how and when noncompliance is communicated to the contractor and corrective actions initiated, tracked, and resolved. The manual should also describe regular recording and reporting requirements of these activities, including information to be provided in monthly progress reports.
- Conduct training, workshops, and other knowledge sharing sessions on requirements, lessons and good practices on safeguards, occupational and community H&S, etc. to BPC staff and EPC contractors' staff and build capacity of relevant staff to undertake their tasks in EMP implementation and monitoring. One of the training courses should be conducted prior to the start of construction to develop the knowledge and understanding of the environmental, occupational and community H&S aspects of the project (including risk of workers and community interactions).
- Provide guidance to contractors on the development of the CEMP and assist BPC in reviewing the CEMP prepared by the EPC contractor and provide approval.

- Ensure that contractors (and their subcontractors, if any) comply with the relevant measures and requirements set forth in the ESIA, the EMP, and any corrective or preventative actions set out in the EMR.
- Assist BPC in supervising and monitoring EMP/CEMPs and sub-plan implementation and in preparation of SAEMR for further submission to ADB.
- Following the formal systems and templates developed for supervision and monitoring, undertake day-to-day supervision to ensure that EPC contractor adheres to all the provisions in the EMP as well as their CEMPs and sub-plans as approved by PMU.
- Keep daily records and photo logs of site observations to inform the preparation of the EMRs.
- Report any grievances or violations of the EMP and assist in implementing solutions and remedial measures.
- Assist BPC in preparing summaries for disclosure and undertake ongoing meaningful consultation with affected communities to keep them informed of progress and local disclosure of the findings of the ESIA and EMRs etc.
- Coordinate the implementation of the GRM and assist PMU to resolve ongoing issues related to environmental and social safeguards during pre-construction and construction.
- Upon completion of the civil works, prepare a report on the project's environmental compliance performance; including lessons learned that may help BPC in their environmental monitoring of future projects. This report will be part of the input to the overall PCR.

## **Contractor**

671. The contractor is to employ the following suitably qualified and experienced personnel to manage environmental safeguards.

- ✓ **1 X EHS Expert (fulltime)** 5+ years' experience working across energy projects, experience of working in internationally funded and governed projects, required on site for the entire construction period and first year of operation. Degree in environmental science/environmental management/environmental engineering/safety or equivalent are required. This officer shall be supported by EHS on-site supervisors. Required inputs are shown in section XC.
- ✓ **1 X National Biodiversity specialist (national, fulltime)** 5+ years of experience in energy projects/linear infrastructure projects, experience of working in internationally funded and governed projects, required on site for the entire construction period and first year of operation. Experience in ecology, forestry and preferably ornithology. Required inputs are shown in section XC. Their primary role will be to implement all biodiversity relevant mitigation and BMP actions on behalf of the Contractor.
- ✓ **1 X National EHS on-site supervisor (national, fulltime)** will provide adequate H&S supervision at active construction sites to safeguard all workers and local communities. Under the guidance of the EHS Expert, the supervisor will apply their NEBOSH/IOSH (or similar) qualifications on-site for the duration of works under the contract package, to monitor and supervise the health and safety aspects of the contractor's EMP implementation. Report at least monthly to BPC including information to inputs into the quarterly progress reports and semi-annual EMRs for the duration of the contract. The contractor's environment safeguards team will also act as a GRM Focal for each contract

package/lot to deal with any grievances at the project site level. Required inputs are shown in section XC.

672. The contractor will be required to comply with the EMP and BMP during the pre-construction and construction phases, relevant provisions of contract on RP and closely supervised and monitored by BPC. The contractor will be delegated, through the contract, to undertake relevant mitigation and monitoring actions as set out in this EMP at the construction site for the solar power plant as well as at any temporary workers camps/overnight accommodation provided by them, and to assist with operation of the GRM.

673. The contractor must ensure that EMP and BMP requirements are cascaded to all sub-contractors engaged in project works. The contractor is expected to maintain a corporate EHS policy and, preferably, hold environmental management certification such as ISO 14001 (or equivalent) and occupational health and safety certification such as ISO 45001 (or equivalent).

674. During project implementation, the Contractor is responsible for the following activities (not an exclusive list):

- Comply with any corrective action plan (CAP) required and cover the costs where corrective action is required due to non-compliance on behalf of the contractor, its subcontractor or third parties.
- Ensure all their subcontractors and third parties, irrespective of being formally or informally employed by them, also comply with the final EMP/BAP and any updates to it, as well as their own CEMP and that this responsibility is cascaded down any chain involved.
- Not engage in any activities described on the ADB Prohibited Investment Activities List in Appendix 5 of ADB SPS
- Coordinate with affected community and households prior to start of any construction activities.
- Put in place appropriate incentives and/or penalties for non-compliance by workers related to use of PPE, prohibit on firewood and NTFPs collection and fishing, hunting, or poaching by workers.
- Implementing all actions and responsibilities allocated to the contractor under the EMP for the full duration of the contractor's involvement in the project and relevant provisions and section of contract on RP.
- Ensuring adherence to all applicable Royal Government of Bhutan environment, health, safety, and labour laws and regulations in force at the time.
- Ensuring adherence to ADB's SPS, 2009 and the related IFC Environment, Health, and Safety (EHS) general guidelines.
- Ensuring adequate budget and staff resources are allocated to comply with and implement the contractor's responsibilities under the EMP and to supervise and monitor the active construction site to protect the environment and ensure the health and safety of all workers and affected communities.
- Preparing a Construction Environment Management Plan (CEMP) with all other subplans as specified in the EMP and BMP for review and approval by BPC prior to the commencement of works.
- Ensuring that all construction workers, including all formal and informal employees and subcontractors, understand their responsibilities to implement the EMP and mitigate environmental impacts associated with pre-construction and construction activities

- Providing and ensuring attendance at EHS training for formal and informal construction workers and other personnel as required.
- Adopting a zero-tolerance approach to OHS on the project, enforce all workers to comply with the OHS requirements of the EMP including the wearing of appropriate PPE on the construction site.
- Supporting EA's in undertaking ongoing public consultation and implementing the site-level GRM; in particular, the contractor's GRM focal shall thoroughly document details of complaints and make its best efforts to resolve the complaints at project site level; all this information is to be included in the contractor's monthly reports to BPC.
- Submitting monthly environmental management reports to BPC (these reports will be included as part of the contractor's monthly progress reports), relating the work undertaken over the reporting period and documenting the environmental measures including monitoring activities that have been carried out, problems encountered, record data including near misses and accidents, grievances received, and follow-up actions that were taken (or will be taken) to correct the problems.
- Informing BPC immediately in case of any approved detailed design changes or unanticipated environmental impacts occurring during the project implementation stage, and as required, provide any information needed to the EA's to enable them to promptly update the ESIA/EMP for clearance by ADB before any changes are implemented.
- Informing BPC within 24 hours in case of chance find or accident on site and within 48 hours provide an incident report with corrective actions detailing how reoccurrence will be prevented.

### **Contractors Environmental Management Plan (CEMP)**

675. A Contractors' Environmental Management Plan (CEMP) including the following will be prepared by the Contractor and approved by BPC prior to any works commencing on site. The CEMP will provide details on how the contractors plan to implement the EMP and relevant parts of the IFC EHS Guidelines on Construction and Demolition. The CEMP will be updated as required (including when the construction methods or site conditions change, or in response to an accident, incident, near miss etc.) and re-approved by BPC.

676. The CEMP will include a Construction Method Statement identifying all construction activities, schedule, off- and on-site access routes, anticipated traffic volumes, and construction methods to be used as well as temporary construction facilities needed and their location e.g., laydown areas, stores, construction workers rest areas, toilets/washrooms, temporary workers' camps/overnight accommodation etc.

677. The CEMP will include the following sub-plans in Table IX-5.

**Table IX-5: Description of CEMP subplans**

No.	Plan	Description
1	<b>Health and Safety Management Plan (HSMP)</b>	The plan will document outlining the Projects systematic approach to preventing workplace injuries, illnesses, and incidents by identifying hazards, assessing risks, implementing controls (elimination, substitution, PPE), ensuring legal compliance, and providing training, all driven by visible leadership and worker involvement. It details responsibilities, emergency procedures, and performance monitoring to create a proactive safety culture, moving beyond reactive fixes to protect workers and meet regulatory duties.
2	<b>Pollution Prevention Plan</b>	Designed to eliminate or reduce waste and pollutants at the source before they are created, treated, or disposed of. It identifies, evaluates, and implements methods—such as using greener materials, improving efficiency, and changing processes—to save money, enhance safety, and ensure compliance with environmental regulations
3	<b>Blasting Management Plan (if necessary)</b>	Detail how blasting activities will be planned and executed, how explosives will be stored and used on-site in accordance with the Bhutanese Explosive Rules and how occupational and community H&S risks will be managed
4	<b>Site Restoration Plan</b>	To be developed to ensure all work sites will be cleaned, rehabilitated and restored to an acceptable condition after work is completed
5	<b>Air Quality, Noise and Vibration Management Plan</b>	Detail construction noise from all sources will be controlled and monitored to prevent disturbance to nearby residents, institutions/schools, health clinics and religious sites
6	<b>Solid and Hazardous Waste management plan</b>	To cover solid and hazardous wastes generated to be managed in an environmentally sound and safe manner, per national regulations and the IFC EHS General Guidelines section on Waste Management
7	<b>Traffic Management Plan</b>	A comprehensive document outlining strategies to manage vehicles, pedestrians, and cyclists safely around construction sites, events, or road works. Its primary purpose is to eliminate or reduce risks by controlling traffic, ensuring safety, and minimizing disruption. Key elements include site maps, hazard identification, traffic control measures, and designated routes.
8	<b>Emergency Preparedness and Response Plan</b>	To include communication systems and protocols to report an emergency e.g., health emergency, work-related accident, traffic accident, accident involving the community, natural disaster including landslide, fire especially forest fire, virus outbreak etc.
9	<b>Labour Management Plan</b>	To outline policies, procedures, and resources to manage labor risks, ensure compliance with national labor laws and ADB SPS (2009) requirements, and promote fair, safe working conditions
10	<b>Invasive Species Management Plan</b>	Identification of target species, clear objective setting, implementation of integrated control methods (physical, chemical, biological), and long-term monitoring. Key components include early detection and rapid response (EDRR), mapping infestations, stakeholder collaboration, and habitat restoration to prevent re-establishment. (#G1 of Table IX-3)
11	<b>Worker Accommodation Plan</b>	A strategic document ensuring that staff housing meets health, safety, and hygiene standards. Key requirements include, but are not limited to, providing adequate space per person, separate single-sex rooms, proper ventilation, sanitary facilities, fire safety, and adequate recreation areas.
12	<b>Community Engagement Plan</b>	A document outlining how a project will identify, analyze, and communicate with individuals or groups (stakeholders) affected by or influential to its success, detailing <i>who, what, when, and how</i> to engage them through clear communication, feedback, and involvement to build trust, manage expectations, and achieve project goals. Key components include, communication methods, engagement frequency, responsibilities, and

No.	Plan	Description
		feedback mechanisms, ensuring transparency and alignment throughout the project lifecycle
13	<b>Sediment and Erosion Control Plan</b>	A document for construction projects that details strategies to manage soil erosion and runoff, protecting local waterways from pollution. It is a “living” document to guide upon most appropriate an management practices such as installing silt fences, sediment basins, and stabilized site entrances.

## **X. MONITORING AND REPORTING**

### **A. Monitoring and Reporting**

678. Bhutan Power Corporation (BPC) will designate a dedicated environmental officer to carry out regular site inspections and supervision. The responsibilities of the designated officer will include:

- Assessing compliance with the approved Environmental Management Plan (EMP);
- Identifying and documenting any environmental or social non-compliance or emerging risks;
- Providing guidance to the Contractor and requiring the preparation and implementation of corrective action plans, where necessary; and
- Ensuring compliance with government approvals, permit conditions, and ADB safeguard requirements.

679. BPC, through its Environmental and Gender, Safety and Social (EGSS) Unit, will coordinate with the Contractor and relevant stakeholders to monitor project activities and ensure timely and effective implementation of the EMP. Monitoring and reporting will be carried out throughout project implementation to verify that mitigation measures are properly applied and to identify any need for corrective actions or adjustments to improve EMP effectiveness. Environmental monitoring reports will summarize project progress during the reporting period, document any changes in design, construction methods, or site conditions, and describe the status of environmental and social safeguards compliance.

680. The Contractor will prepare and submit monthly environmental monitoring reports, which will include compiled monitoring checklists and records completed daily and duly signed by the Contractor's Environment, Health and Safety (EHS) Supervisor or equivalent designated personnel.

681. The BPC EGSS staff at site will consolidate the Contractor's monitoring information and submit quarterly environmental monitoring reports to BPC Head Office. These reports will include a summary of the Contractor's monitoring activities, findings from site inspections, and the results of any independent monitoring undertaken by BPC's environmental officers. BPC will then prepare and submit the consolidated quarterly Environmental Monitoring Reports (EMRs) to senior management for onward submission to ADB for review and disclosure on the ADB website.

**Table X-1: Environmental Monitoring Plan (EMoP)**

	Activity	Indicators	Frequency	Monitoring	
				Implementing Agency	Supervising Agency
<b>Pre-Construction Phase</b>					
1	Residual impacts on WCNP MUZ	<ul style="list-style-type: none"> <li>Signed MoU between BPC and DoFPS</li> <li>BMP implementation report</li> </ul>	One time	PIU	PMU
	Avoidable loss of natural habitat and fragmentation - Loss of forest cover and tree removal - impact on carbon sequestration.	<ul style="list-style-type: none"> <li>Approved final alignment map;</li> <li>reduced number of trees marked</li> </ul>	One time	PIU	PMU
		<ul style="list-style-type: none"> <li>Signed MoU with DoFPS</li> <li>Commitment for budget for Afforestation funding proof</li> <li>Afforestation Plan report</li> </ul>	One time	PIU	PMU
	Impact on IUCN Red List Species	EMR will report upon wildlife encounters, injury, or mortality	One time	PIU	PMU
2	Change in land use	<ul style="list-style-type: none"> <li>Detail road design</li> <li>Site inspection records of contractor facilities</li> <li>Restoration report</li> </ul>	One time	PIU	PMU
3	community forest compensation Restoration Mapping of NWFP areas	<ul style="list-style-type: none"> <li>Compensation payment receipts</li> <li>Engagement of community forest members in tree removal</li> <li>Receipt of trees felled by community forest</li> <li>Map of NWFP areas</li> <li>Degraded areas in community forest included under compensatory afforestation plan</li> </ul>	One time	PIU	PMU
4	Bird surveys	<ul style="list-style-type: none"> <li>Bird Vantage Point survey reports</li> <li>Worker briefing reports by contractor</li> </ul>	One time	PIU	PMU
5	Bird diverters	<ul style="list-style-type: none"> <li>Purchase of professional grade diverters</li> </ul>	One time	PIU	PMU
6	Natural hazard and disasters	<ul style="list-style-type: none"> <li>Briefing on natural hazards and disasters Design standards</li> </ul>	One time	PIU	PMU
7	Clearance and bidding process	<ul style="list-style-type: none"> <li>Clearances (Forestry, Environmental Clearance, Clearance from DoST)</li> <li>Bidding documents containing EMP, GRM, and loan covenants</li> </ul>	One time	PIU	PMU
<b>Construction Phase</b>					

	Activity	Indicators	Frequency	Monitoring	
				Implementing Agency	Supervising Agency
8	Labour Management	<ul style="list-style-type: none"> <li>• Approved Labour Management Plan (LMP)</li> <li>• Worker recruitment records and Worker contracts</li> <li>• Records of worker (Log)</li> <li>• Recorder induction and training</li> <li>• Functional Worker Grievance Redress Mechanism and worker grievance logs</li> <li>• Site inspection reports on labor conditions and worker welfare</li> </ul>	One time	Contractor	PIU
9	Health and Safety	<ul style="list-style-type: none"> <li>• Approved Health and Safety Management Plan (HSMP) and Construction Emergency Preparedness and Response Plan (CEPRP)</li> <li>• Records of worker induction and refresher trainings</li> <li>• Site inspection reports</li> <li>• Incidents and accidents reporting</li> <li>• Vehicle inspection logs</li> <li>• PPE inventory and issuance</li> <li>• Qualified first aider(s) and trained fire marshal(s) on site</li> <li>• Displays/signage/barricades</li> <li>• Occupational injury and illness register, including reporting and compensation record</li> </ul>	Monthly or as necessary	Contractor	PIU
10	Water sourcing for domestic and construction purposes	<ul style="list-style-type: none"> <li>• Water abstraction clearance</li> <li>• Grievance logs regarding water</li> </ul>	As required	Contractor	PIU
11	Waste management	<ul style="list-style-type: none"> <li>• Waste Management Sub-Plan</li> <li>• No. and types of waste storage facility (bags/drums)</li> <li>• Types of waste segregated and reused</li> <li>• Ocular inspection of camps and construction site</li> <li>• Segregation, storage of hazardous waste</li> <li>• Log of waste disposed and Waste disposal documentation</li> </ul>	Monthly	Contractor	PIU
12	Vegetation clearance	<ul style="list-style-type: none"> <li>• Tree felling records</li> <li>• Training records</li> </ul>	Monthly	Contractor	PIU

	Activity	Indicators	Frequency	Monitoring	
				Implementing Agency	Supervising Agency
		<ul style="list-style-type: none"> <li>• Illegal Incidents reported</li> <li>• Site restoration photos</li> </ul>			
12	Invasive species management	<ul style="list-style-type: none"> <li>• Training records on invasive species identification and prevention</li> <li>• Site inspection reports confirming absence of exotic species use</li> <li>• Records of invasive species sightings and removal actions</li> </ul>	Quarterly or as required	Contractor	PIU
14	Sediment management	<ul style="list-style-type: none"> <li>• Sediment Management Plan</li> <li>• Water quality test results (turbidity, TSS)</li> </ul>	Quarterly	Contractor	PIU
15	Air quality	<ul style="list-style-type: none"> <li>• Ambient air quality sampling measurement</li> </ul>	Monthly or as necessary (ocular)	Third Party	PIU
16	Noise management	<ul style="list-style-type: none"> <li>• Ambient noise level measurement</li> <li>• No. of complaints received from neighboring residents/community</li> </ul>	Monthly or as necessary (ocular)	Contractor	PIU
<b>Operation Phase</b>					
17	Maintenance of RoW	Maintenance reports	Quarterly	BPC Team	O&M BPC PMU
18	Repair and Maintenance of TL	<ul style="list-style-type: none"> <li>• Visual inspection of towers</li> <li>• Safety audit reports</li> <li>• Maintenance logs</li> <li>• Worker briefing reports</li> </ul>	Quarterly	BPC Team	O&M BPC PMU
19	Safety of Repair and Maintenance Team	<ul style="list-style-type: none"> <li>• SOP for Repair and Maintenance</li> <li>• PPE issue</li> <li>• Repair and maintenance report</li> </ul>	Quarterly	BPC Team	O&M BPC PMU
20	Community safety risks from live conductors	<ul style="list-style-type: none"> <li>• Warning signs installed and maintained (</li> <li>• site inspection records</li> <li>• awareness programs participant list/attendance sheet</li> <li>• Safety related incidents</li> <li>• Record of corrective actions</li> </ul>	Quarterly	BPC Team	O&M BPC PMU
21	Closure of temporary roads	<ul style="list-style-type: none"> <li>• road closure notification</li> <li>• briefing/meeting attendance list</li> <li>• inspection and monitoring reports Number of temporary access roads physically closed and rehabilitated</li> <li>• reports of illegal activities</li> <li>• meeting records</li> </ul>	Quarterly	BPC Team	O&M BPC PMU

## **B. Institutional Arrangements**

682. BPC as the Implementing Agency will work closely with other stakeholders. The main parties that will be involved in environmental management and monitoring activities for this project are:

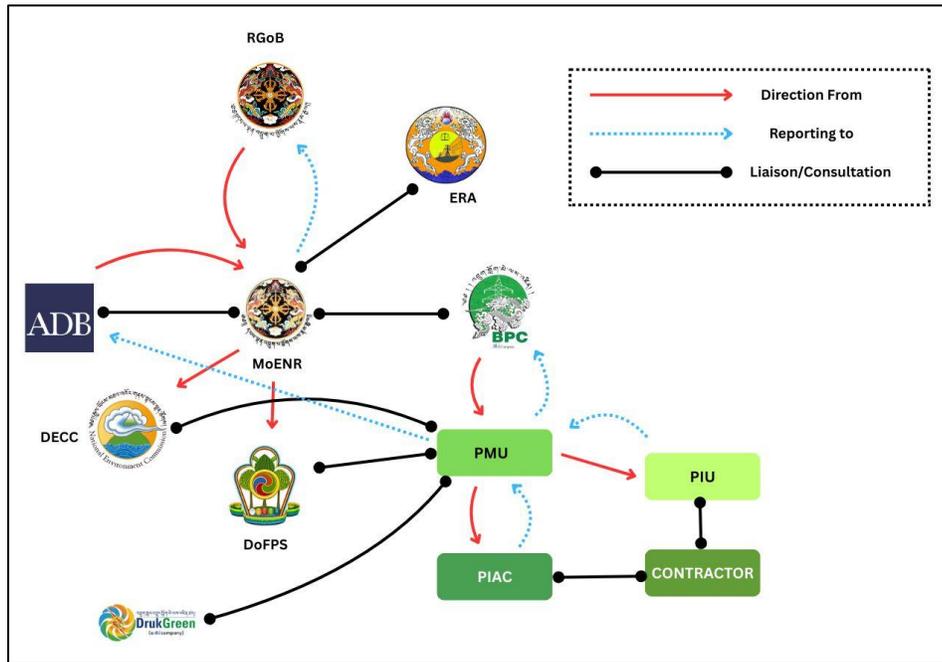
- DECC- enforcing national environmental clearances required for the solar power plant.
- DOFPS - Issuance of Forestry clearance based on the site-specific information/enumeration and application from DGPC and BPC.
- CFMG - Issuance of clearance for land use and tree felling in community forest area.
- DoST - Issuance of clearance take off for new roads construction for access to site from the nearest existing road.
- DoE - Review and vetting of the project design.
- Local community - Issuance of public clearance
- Gewog Administration- Issuance of administrative clearance
- Dzongkha Administration: Processing Land Transfers and supporting Gewogs
- NLCS: Issuance of LUC and lease agreement.
- DoL: Issuance of labor permits and inspection for compliance to labor and OHS requirements for foreign workers.
- ERA: Issuance of power evacuation clearance
- DoAT: Issuance of aviation clearance.
- Project Financers – Asian Development Bank (ADB).

683. Of the stakeholders, the DECC and DoFPS are the agencies who will be responsible for issuance of clearances, prioritization of BMP and BAP activities. The institutional arrangement is shown in Figure X-1 for Pre-construction and Construction stage and Figure X-2 for Operation and Decommissioning Stage.

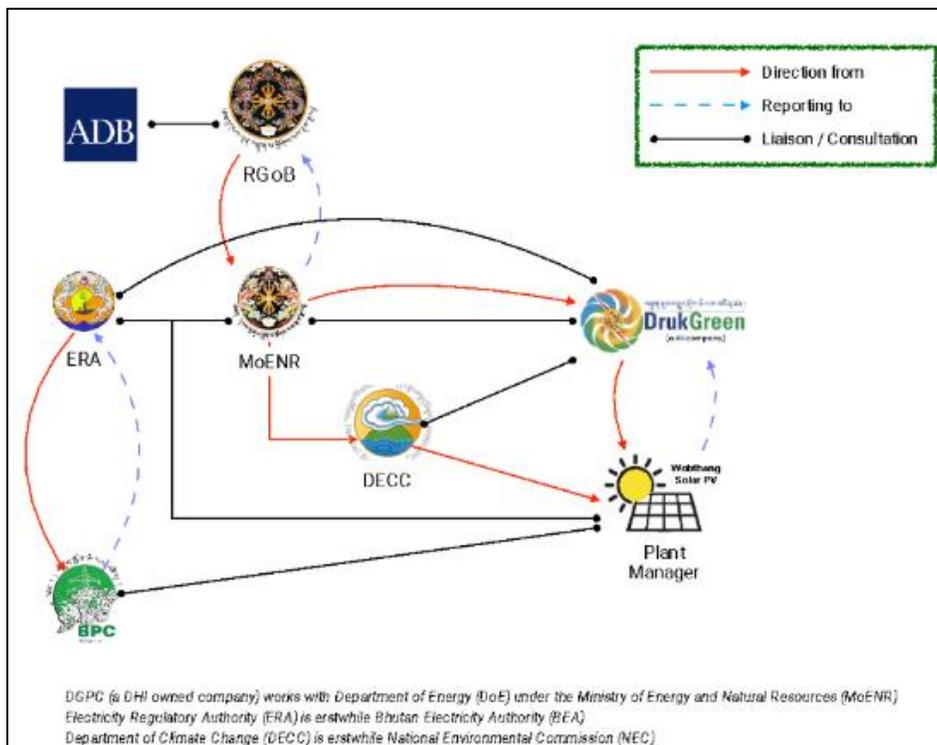
684. Bhutan Power Corporation Ltd (BPC) will be implementing agency and overall responsible for TL, and associated components, impact assessments, safeguards planning and implementation. BPC has four Departments: Construction and Procurement, ii) Distribution, iii) Transmission and iv) Corporate services.

685. The Environment, GIS & Survey Section (EGSS) under the Construction Division, BPC will be responsible for all environmental and social safeguards aspects of the ATS for each subproject. The Section will support the Construction Project Offices to maintain compliance with national statutory requirements, ADB's SPS 2009 requirements, loan covenants, the ESARF and the EMP for the ATS projects. Environment Officers from the EGSS will be attached with each CPO to look after the environment, social and health and safety issues. The officers will be available for the entire project duration and will be responsible for assisting ADB with important inputs for its project completion

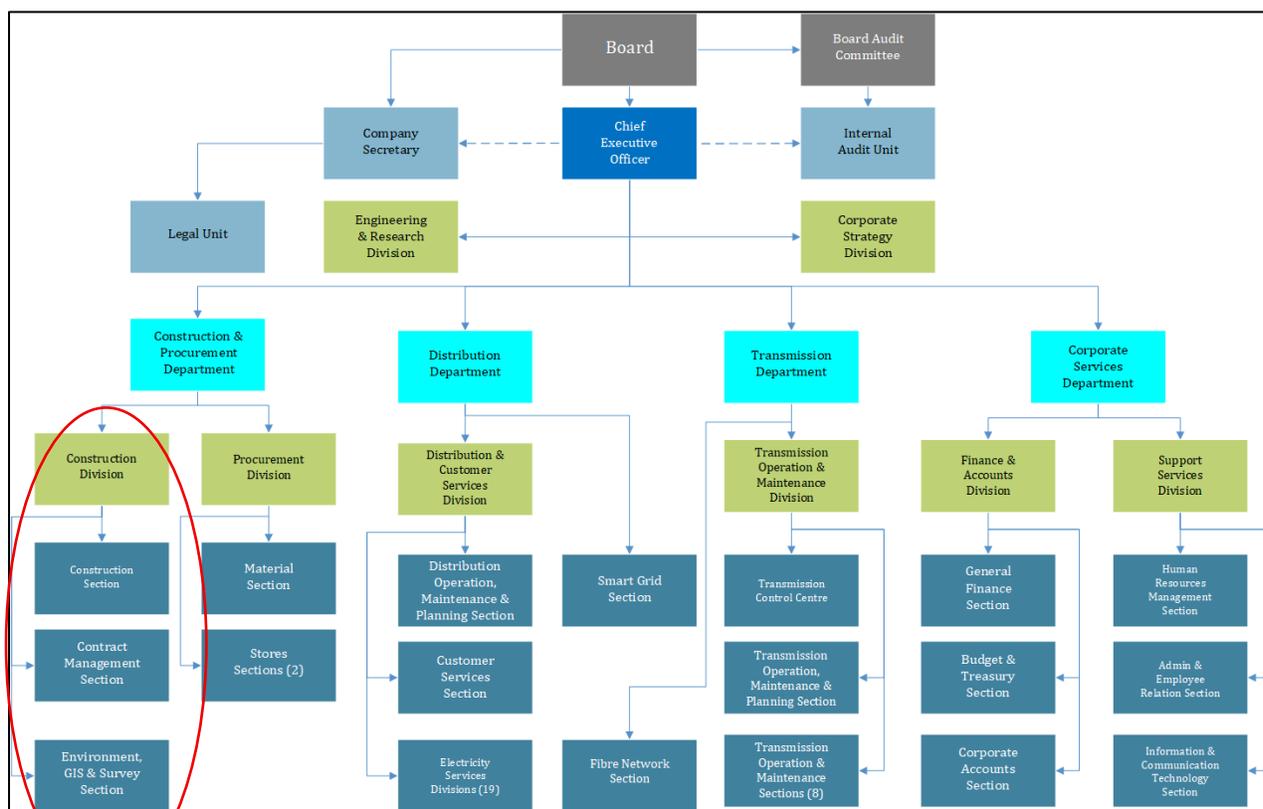
**Figure X-1: Institutional Arrangement for Solar Power Plant Implementation (Pre-construction and Construction Stages)**



**Figure X-2: Institutional Arrangement for Solar Power Plant Implementation (O&M and Decommissioning Stages)**



**Figure X-3: BPC Organogram**



### Gaps and Constraints

686. Currently, The Environment, GIS, and Survey Section (EG&SS) of BPC is responsible for managing environmental and social safeguards compliance across multiple projects. The EG&SS team consists of seven environment officers, all with national-level qualifications (Degree).

687. Based on the discussions with BPC, the following gaps have been identified with the EGSS;

- Aside from the Manager, only one officer has background in GIS and has +3 years of experience, while four are staff have just completed the probation period. BPC like other offices also faces staff attrition, with environment officers leaving quite frequently.
- Not all officers are proficient in national environmental regulations; many have little or no exposure to ADB's safeguard requirements. Only 30% of BPC staff have exposure to international finance institution requirements.
- Training provided by BPC is limited and is dependent on annual budget allocation
- A key challenge is that the environment officers also take on the additional responsibilities of social safeguards, an area where their background is less specialized, as their training is primarily environmental.
- Staff are not experienced in conducting public consultations and dealing with and grievances, especially regarding compensations based on the rules and regulations,
- There is a lack of experience and capacity to review ESIA and IEEs as per ADB standards, or implement EMPs and monitor the implementation of mitigation measures

688. The EGSS currently lacks a dedicated budget for Environmental and Social (E&S) management. Budget allocation for Training Needs Assessment (TNA) is prioritized by the company based on the needs of the different sections and requires endorsement by the board

689. Given that EG&SS staff are mainly trained in environmental aspects, there is a recognized need for further capacity development in socially leaning areas such as social safeguard policies, consultations, grievance redress mechanisms. Table X-2 is a list of capacity building needs for the PMU and PIU based on the discussions as well as needs of the EMP.

**Table X-2: Capacity building needs**

	Topic	Duration	Period	Participants	Trainer
1	Introduction and Sensitization to Environmental Issues ) - ADB Safeguards Policy Statement and ADB ESF - Incorporation of EMP into the project design and contracts - Monitoring, reporting and corrective action planning	1 day	Once during Pre-construction	PMU, PIU staff,	International EHS consultant
2	Preparation of CEMP and sub plans	1 day	Once during Pre-construction	PMU, PIU and contactor	International EHS consultant
3	Stakeholder Engagement, conducting meaningful community consultation and Grievance Redress Mechanism	Half day	Once during Pre-construction and during construction	PMU, PIU	International EHS consultant
4	Occupational Health and Safety and Community health and safety	Half day	Once during Pre-construction and during construction	PMU, PIU	International EHS consultant
5	Compliance monitoring, documentation and preparation of monitoring reports	Half day	Once during Pre-construction and during construction	PMU, PIU	International PIAC consultant
6	RAP implementation and Gender Action Plan,	Half day	Once during Pre-construction and during construction	PMU, PIU	International Social Consultant
7	Critical Habitat Assessment, Natural Habitats, Modified Habitats, Biodiversity surveys, Vantage Point Surveys, Implementation of BMP	Half day	Once during Pre-construction and during construction	PMU, PIU	International Biodiversity Consultant

690. Wherever required, resources persons will be identified by ADB and BPC and arranged. The capacity building trainings may also include participants from other stakeholders wherever relevant.

### C. Cost of EMP Implementation and Monitoring

691. BPC as the implementing agency and overall responsible for ensuring implementation of the EMP, BAP, capacity building, monitoring and reporting. The total cost of EMP measures is reflected Table X-3, while Table X-4 Table X-5 and Table X-6 detail the individual costs

**Table X-3: Summary of Overall Mitigation Costs**

	<b>Particulars</b>	<b>Amount (\$USD)</b>
1	PMU, PIU, BMP, BAP, SEP, GRM and Training Costs	1,501,006.50
2	PIAC Cost	575,820.00
3	Contractors Cost	402,874.50
	Total Cost	<b>2,479,701.00</b>
	Miscellaneous, Provisional Sum and Contingency @ 5% of the Total	123,985.05
	<b>Grand Total</b>	<b>2,603,686.05</b>

**Table X-4: BPC Budget for EMP Implementation**

	<b>Particulars</b>	<b>Quantity</b>	<b>Amount (\$USD)</b>
A	Project Management Unit The Environment, GIS & Survey Section under the PMU will provide centralized oversight of biodiversity and ecology components. The PMU will maintain ultimate accountability for the implementation of the Environmental Management Plan (EMP) and ensure the project adheres to National legislation, rules, regulations and standards, 2020, as well as the ADB Safeguard Policy Statement (SPS, 2009) and the loan covenant. Responsibilities of the PIU are detailed under Institutional arrangements.	NA	Cost of PIU staffing will be internalized/borne by BPC
B	Project Implementation Unit BPC will establish a PIU Office in Bumthang. The Office will comprise one full time National Environment and Social <b>(E&amp;S)</b> Officer for 18 months. Responsibilities of the PIU are detailed under Institutional arrangements.	NA	Cost of PIU staffing will be internalized/borne by BPC
C	<b>Biodiversity Management Plan</b>	lumpsum	
1	Forest clearance - Royalty payments for tree marking/forest clearance and DoFPS fees	lumpsum	3,000.00
2	Compensation for Community Forest impacts	lumpsum	160,000.00
3	Compensatory Afforestation (@\$2000/hectare, inclusive of plantation, and @\$1000/hectare for maintenance (5 years monitoring)	lumpsum	742,000.00
4	Design and purchase of signage	lumpsum	5,000.00
5	Survey and monitoring equipment	lumpsum	10,000.00
6	Bird Diverters (includes 50% contingency for installation costs and unknowns) for entire line	lumpsum	74,100.00
7	Development of an invasive species methods and management plan & training	lumpsum	20,000.00
8	Creating an operational habitat management plan for the RoW and access roads	lumpsum	15,000.00
	<b>Subtotal</b>		<b>1,029,100.00</b>

<b>D</b>	<b>Biodiversity Action Plan</b>		
1	Bumthang Forest Division Natural Forest & WCNP enhancements and compensation	lumpsum	25,000.00
2	Retrofitting the 33kV Garpang Line	lumpsum	73,590.00
3	Bird Monitoring (three years post-construction)	lumpsum	48,840.00
4	Forest - enhancing forest with NTFP to create incentive for communities to manage	lumpsum	15,000.00
5	Forest - Labor and Equip' to improve fire breaks	lumpsum	15,000.00
6	Forest - Provision of fire-fighting and survey equipment	lumpsum	20,000.00
7	Contingency budget for BAP	lumpsum	150,000.00
		<b>Subtotal</b>	<b>347,430.00</b>
<b>E</b>	<b>Others</b>	lumpsum	
1	Capacity building	lumpsum	30,000.00
2	SEP & GRM cost	lumpsum	20,000.00
3	Clearances and Permits	lumpsum	3,000.00
		<b>Subtotal</b>	<b>53,000.00</b>
	<b>Total A+B+C+D+E</b>		<b>1,429,530.00</b>
	Miscellaneous, Provisional Sum and Contingency @ 5% of the Total		71,475.50
		<b>Grand Total</b>	<b>1,501,006.50</b>

**Table X-5: Contractor Budget for EMP Implementation**

#	Particulars	Quantity	Unit Cost	Amount (\$USD)
<b>A.</b>	<b>Mitigation Measures</b>			
1	Provision of training		lumpsum	2,000.00
2	General EMP implementation including Occupational Health and Safety measures for workers (PPE, first aid, periodic medical checks for workers, worker compensation, emergency transportation etc. )		lumpsum	262,700.00
3	Provision of fully functional worker camps		lumpsum	30,000.00
4	Restoration of work sites, camps with native species		lumpsum	5,000.00
5	Waste disposal transportation cost		lumpsum	5,000.00
			<b>Subtotal</b>	<b>304,690.00</b>
<b>B</b>	<b>Human Resource Requirements</b>			
1	1x EHS Expert (fulltime) during construction and defect liability period	18 months	\$2000/month	36,000.00
2	1x Ecologist (National) full time during construction period	14 months	\$1000/month	14,000.00
3	1 x EHS on-site supervisor (national, fulltime) during construction	14 months	\$1000/month	14,000.00
			<b>Subtotal</b>	<b>64,000.00</b>
<b>C</b>	<b>Monitoring Measures</b>			
	Monitoring parameters including air quality, noise levels, surface water quality and drinking water quality		lumpsum	15,000.00
			<b>Subtotal</b>	<b>15,000.00</b>
			<b>Total (A+B+C)</b>	<b>383,690.00</b>

Miscellaneous, Provisional Sum and Contingency (5% of total)		lumpsum	19,184.50
<b>Grand Total</b>			<b>402,874.50</b>

*Note: While the estimates are for full 14-18 months, the total number of input months and days will be finalized during bid preparation and finalization of construction period, given the cold climatic conditions and heavy monsoon which could results in non-work periods.*

**Table X-6: PIAC Budget for EMP Implementation**

#	Particulars	Quantity	Unit Cost	Amount (\$USD)
<b>B</b>	<b>Human Resource Requirements</b>			
1	1x International Ecologist with specialization in Ornithology (International, 1 month full time, then 14 days x each quarter (six total) during construction and 7 days/month for 3 months during the operation phase	18 months	\$26000/month includes travel cost <sup>33</sup>	169,200.00
2	1x International EHS Expert with experience in health and safety (International, intermittent: 1 month, then 14 days x each quarter (seven in total) during construction)	18 months	\$26000/month includes travel cost <sup>34</sup>	169,200.00
3	1 x EHS on-site supervisors (national, fulltime) during construction	14 months	\$5000/month	70,000.00
4	1x Full Time National Ecologist based at the project site to focus on EMP and BMP supervision, monitoring and implementation during the construction period.	14 months	\$5000month	70,000.00
5	1x Full Time National Social, Gender and GRM focal	14 months	\$5000month	70,000.00
<b>Subtotal</b>				<b>584,400.00</b>
Miscellaneous, Provisional Sum and Contingency (5% of total)				27,400.00
<b>Grand Total</b>				<b>575,820.00</b>

*Note: While the estimates are for full 14-18 months, the total number of input months and days will be finalized during bid preparation and finalization of construction period, given the cold climatic conditions and heavy monsoon which could results in non-work periods.*

<sup>33</sup> Lumpsum cost estimated to include remuneration, travel cost and per diem for the consultant. The input of the consultant is 127 days.

<sup>34</sup> Lumpsum cost estimated to include remuneration, travel cost and per diem for the consultant. The input of the consultant is 141 days.

## XI. CONCLUSION AND RECOMMENDATION

692. The EIA presents environmental and social safeguards assessment and specific arrangements for management of the identified environmental impacts and risks (both negative and positive) including supervision, monitoring and reporting for the project. There will be adverse impacts as a result of the project but implementation of the EMP, BMP and BAP will ensure such risks and impacts are adequately managed to avoid, minimize and mitigate impacts to the extent possible. Satisfactory EMP, BMP and BAP implementation will be assured by a program of environmental supervision and monitoring to be conducted by PMU, PIU, PIAC and contractor staff during construction and operation stages. The detailed design must ensure inclusion of any such environmental impacts that could not be specified or identified at this feasibility stage assessment are taken into account and mitigated where necessary.

693. Initial impacts upon a small and modified section of the WCNP and anticipated impacts upon approximately 50.2 hectares of state forest (84% Natural Habitat) is unavoidable even after an alternative analysis was conducted for five potential alignment options. Government preference for alignment options included the avoidance of settlements, private land, community forests, whilst also factoring TL engineering design standards for alignment and stringing. The assessment demonstrates how successful implementation and management of the BMP and BAP can reduce Project impacts to acceptable levels and that reforestation programs by the DoFPS have revealed a ratio of 2:1 can be achieved. However, close coordination and monitoring between key Project stakeholders to adequately implement the BMP and the BAP will be crucial to its success. A technical working group has been created to provide necessary technical inputs and guidance to design, manage, and budget the BAP. The finalized BAP will be included in the final draft of the ESIA.

694. While field surveys confirmed the existence of common and threatened mammals (such as leopard, sambar, serow, and Asiatic black bear) and one bird with a restricted range (Bhutan Laughingthrush), their populations or densities did not meet the critical habitat thresholds defined by ESS6. As such, the assessment concluded that no threatened or geographically restricted ecosystems occur within the project area, no species meets population or range-based thresholds, and the site does not function as a migratory, congregatory, connectivity, or evolutionary key area. Accordingly, the project is not considered to be located within Critical Habitat.

695. Aside from the key impact habitat and biodiversity impacts described above, construction impacts for the 14-month construction period will be limited to access roads, TL RoW and tower foundation, all predominantly located away from settlement areas. Potential risks and impacts to be mitigated and managed include OHS, community health and safety, localized reduced air quality, noise and disturbance, and an increase in traffic. Potential social risks relate to labor recruitment and management, occupational health and safety hazards, labor influx, and potential grievances between workers and local communities. Natural hazards such as landslides and extreme weather events may also pose risks to construction activities and community safety if not adequately assessed during pre-construction.

696. To mitigate and manage the above risks and impacts the EMP includes the need for the Contractor to prepare a CEMP and 13 management subplans. The EMP will serve as the primary instrument for avoiding, minimizing, and managing environmental and social impacts, and its provisions must be implemented in full. BPC, as the implementing and executing agency, guided and assisted by the PIAC, will be responsible for ensuring compliance with the EMP throughout the pre-construction, construction, and operation phase. Potential environmental impacts of the

project are well understood and can be mitigated through adherence to national requirements and international good practice measures and standards as set out in the IFC General and Electric Power Transmission and Distribution Environment, Health and Safety Guidelines and the ILO Code of Practice on Safety and Health in Construction. Mitigation measures have been developed for all predicted adverse risks and impacts.

697. BPC will ensure that adequate institutional capacity is in place for environmental and social safeguards implementation, including designation of trained personnel, delivery of safeguard briefings to contractors, and timely disclosure of ESIA documents and environmental monitoring reports in accordance with ADB requirements. Information on project activities and the Grievance Redress Mechanism (GRM) will be disseminated to affected communities in an accessible manner.

698. It is expected that the Project will make a positive contribution to Bhutan's renewable energy transition, climate resilience, and sustainable development objectives.

## **Recommendations**

699. The EMP of the ESIA document, including mitigation and monitoring programs, will be included in the bid documents of the civil works for all project components along with suitable experience, staffing and BOQ requirements and eventually become part of the civil works contract(s) – the definitive version of the EMP to be followed by contractors will be that disclosed on the ADB website.

700. Bid documents will state that the EPC Contractor will be responsible for the implementation of the requirements of the EMP allocated to them (including specific design phase actions) through their own CEMP and management sub-plans which will adopt all the conditions of the EMP and add site specific elements not currently known, such as the EPC Contractor's laydown and camp locations. This will ensure that all potential bidders are aware of the environmental requirements of the Project and its associated environmental costs. The EMP and all its requirements will then be added to the EPC Contractor's Contract, thereby making implementation of the EMP a legal requirement according to the Contract.

701. This ESIA report, including EMP, BMP and a finalized BAP is considered sufficient to meet national requirements and ADB's Safeguard Policy Statement (2009) and ESS6 requirements for the Category A project. In case of any scope, sites or routing change, and/or unanticipated impact during project implementation, the ESIA and associated assessment documents will be updated as required by BPC for review and clearance (as required by law) and ADB (as per ADB Safeguard Policy Statement (2009) requirements) before any related works commence or are allowed to continue. The EPC contractors will prepare their detailed designs, CEMP, and management plans to be approved and monitored by PMU, PIU and the PIAC.

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